

TECHNICAL MANUAL

CORROSION PREVENTION AND CONTROL, CLEANING, PAINTING, AND MARKING OF USAF SUPPORT EQUIPMENT (SE)

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INTRODUCTION

1 PURPOSE.

The purpose of this manual is to provide information necessary to prevent or minimize the impact of corrosion on Support Equipment (SE). This manual is designed to provide basic corrosion principal, theory, identification, prevention and control information to enable SE technicians to differentiate between the different types of corrosion in order to identify the appropriate temporary repair materials and processes. This technical order is specific to SE; however, for areas not covered in this manual, or expanded information on a particular material or process, technicians or contractors should refer to Technical Order (TO) 1-1-691. For additional guidance, refer to TO 1-1-8, and TO 1-1-689.

2 SCOPE.

This manual consist of the following chapters:

Chapter 1	Corrosion Theory, Identification, Causes and Effects
Chapter 2	Cleaning
Chapter 3	Painting, Sealing, Corrosion Preventive Compound Application
Chapter 4	Marking of Support Equipment
Chapter 5	Corrosion Prevention and Control of Hush Houses
Chapter 6	Corrosion Prevention and Control of Noise Suppressor Systems (NSS)
Chapter 7	Southwest Asia Operations and Environments
Chapter 8	Indo-Pacific (INDOPACOM) Operations and Environments

3 ABBREVIATIONS.

All abbreviations used in this manual are shown in the list of abbreviations below. Standard abbreviations are in accordance with ASME Y14.38, Abbreviations and Acronyms for Use in Product Definition and Related Documents.

°C	degrees Celsius
°F	degrees Fahrenheit
AF	Air Force
AFCPCO	Air Force Corrosion Prevention and Control Office
AFI	Air Force Instructions
AFOSH	Air Force Office of Safety and Health
AFTO	Air Force Technical Order
AGE	Aerospace Ground Equipment
AISI	American Iron and Steel Institute
AOR	Area of Responsibility
ASM	Aircraft Structural Maintenance
BEF	Bioenvironmental Engineering Flight
BX	Box
CAGE	Commercial and Government Entity
CARC	Chemical Agent Resistant Coating
CA	Cartridge
CBRN	Chemical, Biological, Radiological, Nuclear
CFM	Cubic Feet Per Minute
CN	Can
COTS	Commercial Off the Shelf
CPC	Corrosion Preventive Compound
CRES	Corrosion Resistant Steel
CS	Case

DAFI	Department of the Air Force Instruction
DAFMAN	Department of the Air Force Manual
DC	Direct Current
DFT	Dry Film Thickness
DLA	Defense Logistics Agency
DO	Dissolved Oxygen
DoD	Department of Defense
DoW	Department of War
DR	Drum
DZ	Dozen
ELMS	Enterprise Logistics Management System
ESDS	Electrostatic Discharge Sensitive
ESOH	Environmental Safety and Occupational Health
GL	Gallon
HAZMAT	Hazardous Materials
HCI	Hardness Critical Item
HHL	Handheld Laser
Hp	Horsepower
HPW	High-Pressure Water
ILSO	Installation Laser Safety Officer
INDOPACOM	Indo-Pacific Command
KT	Kit
mL	milliliters
mm	milimeters
mg/L	milligrams per Liter
MAJCOM	Major Command
MTBF	Mean Time Between Failure
M&U	Maintenance & Utilization
MWAS	Metal Wire Arc Spray
NSL	Not Stock Listed
NSN	National Stock Number
NSS	Noise Suppressor System
OSHA	Occupational Safety and Health Administration
PG	Package
pH	Potential of Hydrogen
PM	Preventive Maintenance
PN	Part Number
PO	Program Office
PPE	Personal Protective Equipment
PSIG	Pound Per Square Inch Gauge
PT	Pint
QPL	Qualified Products List
QPD	Qualified Products Database
QT	Quart
RECC	Rare Earth Conversion Coating
RH	Relative Humidity
RL	Roll
RPM	Revolutions Per Minute
RTV	Room Temperature Vulcanizing
SCC	Stress Corrosion Cracking

SDS	Safety Data Sheet
SE	Support Equipment
SWA	Southwest Asia
TCTO	Time Compliance Technical Order
TO	Technical Order
TU	Tube
USAF	United States Air Force
WCM	Wing Corrosion Mangers
WRM	War Reserve Material

4 RELATED PUBLICATIONS.

NOTE

When searching Technical Order (TO) numbers in the Enhanced Technical Information Management System (ETIMS) catalog, please use the wildcard (*) after typing in the TO number. Many TOs are not available in paper format, (i.e., digital (WA-1) or (CD-1)). This ensures TOs in all media formats will populate the search.

The following publications contain information in support of this technical manual.

List of Related Publications

Number	Title
ASME Y14.38	Abbreviations and Acronyms for Use in Product Definition and Related Documents.
DAFI 10-2503	Chemical, Biological, Radiological, Nuclear (CBRN) Defense Program
DAFI 21-101	Aircraft and Equipment Maintenance Management
DAFMAN 91-203	Air Force Occupational Safety, Fire, and Health Standards
DoDI 5330.03	Single Manager of DoD Document Services
ESD TR20.20	Handbook for the Development of an Electrostatic Discharge Control Program for the Protection of Electronic Parts, Assemblies and Equipment
MIL-HDBK-263	Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts, Assemblies and Equipment
MIL-HDBK-529	Use of Handheld Lasers to Remove Coatings and Corrosion from Aerospace Ground Equipment
OSHA 1910.107	Spray Finishing using Flammable and Combustible Materials
TO 00-5-1	Air Force Technical Order System
TO 00-25-195	Source, Maintenance, and Recoverability Coding of Air Force Weapons, Systems, and Equipment
TO 00-25-234	General Shop Practice Requirements for the Repair, Maintenance, and Test of Electrical Equipment
TO 00-35D-54	USAF Deficiency Reporting, Investigation, and Resolution
TO 00-110A-1	Guidelines for Identification and Handling of Aircraft and Materiel Contaminated with Radioactive Debris (Fallout)
TO 1-1-8	Application and Removal of Organic Coatings, Aerospace and Non-Aerospace Equipment
TO 1-1-689-1	Cleaning and Corrosion Control: Volume 1, Corrosion Program and Corrosion Theory
TO 1-1-689-3	Cleaning and Corrosion Control: Volume 3, Avionics and Electronics
TO 1-1-691	Aircraft Weapons Systems-Cleaning and Corrosion Control and Prevention Aerospace and Non-Aerospace Equipment
TO 35-1-18	Marking of USAF General Support Equipment (SE)
TO 42B-1-23	Management of Recoverable and Waste Liquid Petroleum Products

5 RECORD OF APPLICABLE TIME COMPLIANCE TECHNICAL ORDERS (TCTOS).

List of Time Compliance Technical Orders

TCTO Number	TCTO Title	TCTO Date
None		

6 HCI HARDNESS CRITICAL ITEMS (HCI).



The HCI symbol (HCI) establishes special requirements limiting changes and substitutions and that the specific parts listed must be used to ensure hardness is not degraded. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

If included, items with nuclear survivability requirements are marked with the HCI symbol (HCI). All changes to, or proposed substitutions of, HCIs must be approved by the acquiring activity.

7 ELECTROSTATIC DISCHARGE SENSITIVE (ESDS) ITEMS.



All ESDS parts shall be handled in accordance with the ESDS device handling procedures in TO 00-25-234. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

If included, items containing ESDS parts are marked with the ESDS symbol ().

8 IMPROVEMENT REPORTS.

Recommended changes to this manual shall be submitted in accordance with TO 00-5-1.

SAFETY SUMMARY

9 GENERAL SAFETY INSTRUCTIONS.

This manual describes physical and/or chemical processes which may cause injury or death to personnel, or damage to equipment, if not properly followed. This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment. Prior to performing any specific task, the WARNINGS, CAUTIONS, and NOTES included in that task shall be reviewed and understood. The safety precautions in Air Force Instructions (AFI) 91-203 and Occupational Safety and Health Administration (OSHA) Standard 1910.107 are applicable to the operation of paint shops and spray-painting equipment and shall be followed during cleaning and repainting of SE.

10 WARNINGS, CAUTIONS, AND NOTES.

WARNINGS and CAUTIONS are used in this manual to highlight operating or maintenance procedures, practices, conditions, or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). WARNINGS and CAUTIONS immediately precede the step or procedure to which they apply. WARNINGS and CAUTIONS consist of four parts: heading (WARNING, CAUTION, or icon), a statement of the hazard, minimum precautions, and possible results if disregarded. NOTES are used in this manual to highlight operating or maintenance procedures, practices, conditions, or statements which are not essential to protection of personnel or equipment. NOTES may precede or follow the step or procedure, depending upon the information to be highlighted. The headings used and their definitions are as follows:

WARNING

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards. Failure to comply could result in injury to, or death of, personnel or long term health hazards.

CAUTION

Highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in damage to, or destruction of, equipment or loss of mission effectiveness. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

Highlights an essential operating or maintenance procedure, condition, or statement.

11 HAZARDOUS MATERIALS (HAZMAT) WARNINGS.

HAZMAT Warnings are provided through use of the following Hazard Symbols. Consult the HAZMAT DESCRIPTION or Safety Data Sheet (SDS) (formerly MSDS) (OSHA Form 20 or equivalent) for specific information on hazards, effects, and protective equipment requirements. If you do not have an SDS for the material involved, contact your supervisor, or the base Safety or Bioenvironmental Engineering Offices.

11.1 HAZMAT Icons. The following icons are used throughout this Air Force (AF) technical manual to indicate the use of HAZMATs:



The abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to your life or health.



The symbol of a human figure in a cloud shows that the material gives off vapors that are a danger to life or health.



The symbol of drops of liquid onto a hand shows that the material will cause burns or irritation of skin and tissue.



The symbol of a hand in a block of ice shows a material is so cold it will burn your skin on contact.



The rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition or high pressure.



The symbol of a person wearing goggles shows that the material will injure eyes.



The symbol of a flame shows that the material can ignite and burn.



The symbol of a skull and crossbones shows that the material is poisonous or a danger to life.



The symbol of a liquid entering the mouth shows that eating or drinking this material can cause a health hazard.



The symbol of an O with a flame shows a material that is a fire hazard when near flammable or organic materials.



The symbol of three circular wedges shows that radioactive energy is emitted which can injure tissue and organs.



The hand symbol shows a material that can irritate the skin or enter the body through the skin and cause a health hazard.

11.2 HAZMATs Description. The following detailed HAZMAT warnings pertain to materials or substances used in connection with procedures called out or described in this technical manual. Use these advisory warnings and their associated precautions in conjunction with the current SDS for each material or substance. If there is conflict between this safety summary and the SDS, the SDS takes precedence.



ADHESIVE-SEALANTS, SILICONE, RTV, NON-CORROSIVE, MIL-A-46146

1

MIL-A-46146 is an eye, skin and respiratory irritant. Use in a well-ventilated area. Appropriate skin and eye protection must be worn. Do not ingest. Keep container tightly closed when not in use. Store in a cool, dry, ventilated area, away from incompatible substances.



CLEANER, LUBRICANT, AND PRESERVATIVE FOR WEAPONS AND WEAPON SYSTEMS, MIL-PRF-63460

2

Cleaning Lubricant, MIL-PRF-63460 is toxic to skin, eyes, and respiratory tract. Use only with adequate ventilation. Avoid breathing of vapor or spray mist. Avoid prolonged or repeated contact with skin. Wear goggles or face shield, gloves, apron, and footwear impervious to material.



CLEANER, NON-AQUEOUS, LOW-VOC, HAP-FREE, MIL-PRF-32295

3

Non-Aqueous Cleaner is a combustible liquid. Suspected of damaging fertility or the unborn child. May cause breathing problems, eye damage, skin irritation and may be harmful if swallowed. Use only with adequate ventilation. Keep away from heat/sparks/open flames/hot surfaces. Avoid formation of aerosol. No smoking. Wear protective gloves/protective clothing/eye protection/face protection. Store in a well-ventilated place. Keep cool.



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

4

MIL-PRF-87937 is an eye, skin and respiratory irritant. Ingestion may cause digestive tract irritation. Do not ingest. Appropriate skin and eye protection must be worn.



CLEANING COMPOUND, AIRCRAFT EXTERIOR, MIL-PRF-85570

5

Cleaning Compound is irritating to the skin and eyes. Vapor/aerosol concentrations above recommended exposure levels are irritating to the eyes and respiratory tract, and may cause headaches, dizziness, drowsiness, unconsciousness and other central nervous system effects. Do not breathe fumes, vapors or mists if inhalable mists occur during use. Use only outdoors or in a well-ventilated area. Wear protective gloves, eye protection, and face protection. Wash hands and exposed skin thoroughly after handling. Do not eat, drink or smoke when using this product.



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

6

Corrosion Preventive Compound may contain: Petroleum Asphalt and Hydrogen Sulfide which produces inhalation and contact hazards. It also affects the central nervous system and respiratory system. May cause apnea, coma, convulsions, and dizziness. May be carcinogenic. May be harmful if ingested. Avoid contact with skin and eyes. Appropriate skin and eye protection must be worn with adequate ventilation. Respiratory protection may be required.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

7

MIL-PRF-81309 is a combustible liquid that may be fatal if inhaled or swallowed. Causes eye and skin irritation. If swallowed, do not induce vomiting and seek medical attention. Avoid contact with skin and eyes. Appropriate skin and eye protection must be worn. Rinse eyes for several minutes. Wash skin with soap and water. Respiratory protection may be required.



DEGREASING SOLVENT, MIL-PRF-680

8

Degreasing Solvent is flammable and may contain the following hazardous chemicals: Naphtha (petroleum), Alkanes and/or C9 -C12 hydrocarbons which are skin and eye irritants and respiratory depressants. Exposure can occur through inhalation, ingestion, or skin and eye contact. May be fatal if swallowed. Avoid repeated and prolonged contact. Use with adequate ventilation. Do not ingest. Appropriate skin and eye protection must be worn.



ISOPROPYL ALCOHOL, TT-I-735

9

Isopropyl Alcohol is flammable, and an eye, skin and respiratory irritant. It may be harmful if swallowed. Avoid contact with skin and eyes and avoid breathing vapors. Do not ingest. Keep away from heat, sparks and flame. Appropriate skin and eye protection must be worn. Use in a well-ventilated area. Half mask respirator required in poorly ventilated areas.



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10

MIL-DTL-87177 is toxic to skin, eyes, and respiratory tract. Use only with adequate ventilation. Avoid breathing of vapor or spray mist. Avoid prolonged or repeated contact with skin. Wear goggles or face shield, gloves, apron, and footwear impervious to material.



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

11

MIL-DTL-53022 is an extremely flammable aerosol. Contains gas under pressure; may explode if heated. May cause an allergic skin reaction. Causes serious eye irritation. May cause respiratory irritation. May cause drowsiness or dizziness. May cause cancer. May damage fertility or the unborn child. Causes damage to organs (lungs) through prolonged or repeated exposure. Wear protective gloves, protective clothing and eye or face protection. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Do not spray on an open flame or other ignition source. Use only outdoors or in a well-ventilated area. Do not breathe dust or mist. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Contaminated work clothing must not be allowed out of the workplace. Pressurized container: Do not pierce or burn, even after use.



PRIMER, EPOXY, HIGH SOLIDS, CORROSION INHIBITING, CHROME FREE, 02GN093

12

02GN093 is highly flammable liquid and vapor. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye damage. May cause respiratory irritation. May cause cancer. May damage fertility or the unborn child. May cause damage to organs (kidneys) through prolonged or repeated exposure. Put on appropriate personal protective equipment. Avoid exposure during pregnancy. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical equipment. Use only non-sparking tools.



PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377

13

MIL-PRF-23377 is a highly flammable liquid and vapor. May cause serious eye damage. May cause respiratory and skin irritation. May cause cancer. May cause burns to mouth, throat, and stomach if ingested. Avoid repeated and prolonged Exposure. Use with adequate ventilation. Appropriate skin and eye protection must be worn. Do not ingest. Keep away from heat, spark, and flames.



PRIMER, METAL-RICH, MIL-PRF-32550

14

MIL-PRF-32550 causes skin irritation. Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause an allergic skin reaction. May cause genetic defects. May cause cancer. May cause damage to organs through prolonged or repeated exposure. Highly flammable liquid and vapor. Contaminated work clothing should not be allowed out of the workplace. Do not breathe dust, fume, gas, mist, vapors or spray. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Keep container tightly closed. Ground container and receiving equipment. Use explosion-proof electrical/ventilating/lighting/equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection.



SEALING COMPOUND, POLYSULFIDE, NON-CHROMATED, LOW ADHESION, PR-1773

15

PR-1773 is harmful if swallowed or inhaled. Suspected of causing cancer. Suspected of damaging fertility or the unborn child. May cause damage to organs (brain) through prolonged or repeated exposure. Wear protective gloves, protective clothing and eye or face protection. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.



SEALING COMPOUND, FUEL-RESISTANT, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, SAE AMS-S-8802

16

SAE AMS-S-8802 is toxic and flammable. It may be fatal if swallowed. Avoid contact with skin, eyes, and avoid breathing vapors. Keep away from heat, sparks and flame. Store in a cool, well-ventilated area away from ignition sources and oxidizing agents. Keep container tightly closed when not in use. Protection: butyl gloves and chemical goggles, face shield and clothing required when splashing is possible or expected. Use in a well-ventilated area. Half mask respirator with organic vapor cartridge required in poorly ventilated areas.



TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285

17

MIL-PRF-85285 is flammable and may irritate skin and respiratory tract. Can cause serious eye damage. Exposure to high vapor concentrations may cause central nervous system depression. Aspiration of liquid may cause pneumonitis, pulmonary edema, and hemorrhaging. Do not take internally. Use only in well-ventilated areas. Avoid breathing dust, fumes, gas, mist vapors, and spray. Appropriate skin and eye protection must be worn. Wash thoroughly after handling.



PETROLATUM, TECHNICAL VV-P-236

18

Petrolatum may cause mild skin irritation after prolonged or repeated exposure. Mist may irritate the eyes. Appropriate skin and eye protection must be worn. Wash hands thoroughly after use.



CLEANING AND CLEANING-LUBRICATING COMPOUNDS, ELECTRICAL CONTACT, MIL-PRF-29608

19

MIL-PRF-29608 is a highly flammable liquid and vapor. Contains gas under pressure and is harmful if swallowed or inhaled. Can cause serious eye and skin irritation. Wear protective gloves, clothing and eye/face protection. Wear respirator if insufficient ventilation. Do not eat, drink or smoke when using this product. Wash hands after handling product.



ACETONE, ASTM-D329

20

Acetone is extremely flammable and an eye, skin, and respiratory irritant. Harmful if swallowed. Avoid contact with skin and eyes and avoid breathing vapors. Do not ingest. Keep away from heat, sparks and flame. Protection: butyl gloves and chemical goggles. Face shield is required when splashing is possible or expected. Use in a well-ventilated area. Half mask respirator required in poorly ventilated areas. Keep container tightly closed when not in use. Store in a cool, dry, ventilated area, away from incompatible substances.



ADHESION PROMOTER, COATINGS, AEROSOL, SUR-PREP™ AP-1

21

Sur-Prep™ AP-1 is a highly flammable liquid and vapor. Causes serious eye irritation. May cause drowsiness or dizziness. Keep away from heat/sparks/open flames/hot surfaces. -No smoking. Use only non-sparking tools. Keep container tightly closed. Use explosion-proof electrical/ventilating/lighting equipment. Avoid breathing dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves and eye/face protection. Wash thoroughly after handling.



COATING, WALKWAY COMPOUND, NON-SLIP, A-A-59166

22

A-A-59166 is a highly flammable liquid and vapor. May cause an allergic skin reaction. May cause genetic defects. May cause cancer. Keep away from heat, sparks, open flames, or hot surfaces. No smoking. Use explosion-proof electrical, ventilating, lights, equipment. Use only non-sparking tools. Avoid breathing dust, fumes, gas, mist, vapors, or spray. Wear protective gloves, protective clothing, eye protection, face protection. IF exposed or concerned: Get medical advice, attention. Store in a well-ventilated place. Keep cool.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, TRANSPARENT, MIL-DTL-85054

23

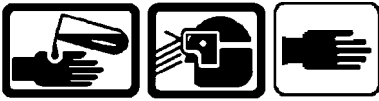
MIL-DTL-85054 is toxic to skin, eyes, and respiratory tract. Use only with adequate ventilation. Avoid breathing of vapor or spray mist. Avoid prolonged or repeated contact with skin. Wear goggles or face shield, gloves, apron, and footwear impervious to material.



CHEMICAL CONVERSION MATERIALS FOR COATING ALUMINUM AND ALUMINUM ALLOYS, MIL-DTL-81706

24

MIL-DTL-81706 is an oxidizer and harmful if swallowed. May cause severe burns to the eyes, skins, and respiratory tract. May cause cancer. Do not get this material in your eyes, on your skin, or on your clothing. Do not inhale vapor or mist of this product. Wash thoroughly after handling. Clothing or other materials wet with this product and allowed to dry may become flammable. Use in a well-ventilated area. Appropriate skin, body, and eye protection must be worn. If ventilation is not sufficient to effectively prevent buildup of dust, appropriate NIOSH/MSHA respiratory protection must be provided. Do not store with incompatible materials.



PRIMER, EPOXY, WATER BASED, LEAD AND CHROMATE FREE, MIL-DTL-53030

25

MIL-DTL-53030 is toxic to skin, eyes, and respiratory track. Use only with adequate ventilation. Avoid breathing of vapor or spray mist. Respirator is required if in an enclosed area with no ventilation. Avoid prolonged or repeated contact with skin. Wear goggles or face shield, gloves, apron, and footwear impervious to material.



PRIMER, EPOXY, NON-CHROMATED, AEROGLAZE™

26

Aeroglaze™ is a highly flammable liquid and vapor. Harmful if inhaled. Causes skin irritation. Causes serious eye irritation. May cause an allergic skin reaction. May cause damage to organs (Lungs). May cause drowsiness or dizziness. May cause respiratory irritation. Causes damage to organs (Central nervous system). May be fatal if swallowed and enters airways. Keep away from heat/sparks/open flames/hot surfaces. No smoking. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Wear protective gloves/protective clothing/eye protection/face protection. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Contaminated work clothing should not be allowed out of the workplace. Avoid release to the environment.



THINNER, AIRCRAFT COATING, MIL-DTL-81772

27

MIL-DTL-81772 is a highly flammable liquid and vapor and can cause serious eye damage. Is a skin, eye, and respiratory irritant. Is suspected of causing cancer. May damage unborn children. Prolonged or repeated exposure may cause organ damage. Avoid contact with skin and eyes and avoid breathing vapors. Do not ingest. Keep away from sources of ignition. Appropriate skin and eye protection must be worn. Use in a well-ventilated area.



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

28

MIL-PRF-81733 is flammable and can cause moderate eye and skin irritation. Breathing of vapors can cause dizziness and nausea. Concentrated vapors are explosive. Maintain standard hygiene for chemical handling. Use grounding and bonding procedures when transferring. No cutting or welding on empty containers. Use in ventilated area. Keep containers closed. Use air respirator or air mask suitable for organic vapors. Appropriate skin and eye protection must be worn.



SEALING COMPOUND, LOW ADHESION, CORROSION INHIBITING, FOR REMOVABLE PANELS AND FUEL TANK INSPECTION PLATES, SAE AMS3267

29

SAE AMS3267 is a highly flammable liquid and vapor. May be fatal if swallowed. Causes serious eye and skin irritation. May cause respiratory irritation if inhaled. May cause cancer. May damage fertility or the unborn child. Keep away from heat, flames and sources of ignition. Do not breathe fumes, vapors or mists. Use outdoors or in well-ventilated area. Wear respiratory protection. Wear protective gloves, clothing, eye and face protection. If swallowed, do NOT induce vomiting. If on skin, remove all contaminated clothing and wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



LUBRICANT, SOLID FILM, AIR-CURED, CORROSION INHIBITING, MIL-L-23398

30

MIL-L-23398 has extremely flammable vapors. Hot surfaces can cause it to ignite. May explode when mixed with air. May be harmful if swallowed. Causes skin, eye, and respiratory irritation. Use only in a well-ventilated area or in a hood where no flame or other ignition sources are present. Keep container closed when not in use and protect it from extremes in temperature. Do not use product in food processing areas or near food handling equipment or surfaces. Do not eat, drink or smoke when using this product. Appropriate skin and eye protection needs to be worn when using this product. Avoid breathing of vapor or mist by using in a well-ventilated area. Wash thoroughly after handling this lubricant.



LUBRICANT, SOLID FILM, AIR CURED, CORROSION INHIBITING, MIL-PRF-46147

31

MIL-PRF-46147 has extremely flammable vapors. Hot surfaces can cause it to ignite. May explode when mixed with air. May be harmful if swallowed. Causes skin, eye, and respiratory irritation. Use only in a well-ventilated area or in a hood where no flame or other ignition sources are present. Keep container closed when not in use and protect it from extremes in temperature. Do not use product in food processing areas or near food handling equipment or surfaces. Do not eat, drink or smoke when using this product. Appropriate skin and eye protection needs to be worn when using this product. Avoid breathing of vapor or mist by using in a well-ventilated area. Wash thoroughly after handling this lubricant.



ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOY, MIL-PRF-8625

32

MIL-PRF-8625 is a severe eye, skin and respiratory irritant, and may be toxic if ingested. Avoid repeated or prolonged exposure. Keep off of skin, out of eyes and avoid breathing vapors. Appropriate skin and eye protection must be worn. Do not eat, drink or smoke when using this product. Wash exposed areas thoroughly with soap and water.



SEALER, THERMAL SPRAY SURFACES, METCOSEAL SA

33

Metcoseal SA is a highly flammable liquid and vapor. Causes skin and serious eye irritation. May cause genetic defects and cancer. Suspected of damaging fertility or unborn child. Wear protective gloves, clothing, eye and/or face protection. Keep away from heat, open flames and other ignition sources. No smoking. Wash thoroughly after handling. If on skin, wash with plenty of water. If in eyes, rinse cautiously with water for several minutes. Seek medical attention if irritation persists.



CORROSION PREVENTIVE COMPOUND, COLD APPLICATION, A-A-59295

34

CID A-A-59295 may cause eye and skin irritation. It is also flammable. Keep away from open flames or other sources of ignition. Wear personal protective equipment including goggles and gloves when handling.



REMOVER, RUST, LOCTITE NAVAL JELLY

35

Loctite Naval Jelly contains phosphoric and sulfuric acid. Extremely corrosive and causes skin and eye burns. Wear protective gloves, clothing, eye and/or face protection. Use with adequate ventilation. Consult with local Bioenvironmental Flight (BEF) for approved personal protective equipment. In the event of skin or eye contact, flush immediately with plenty of water.



COATING KIT, EPOXY, FOR INTERIOR OF STEEL FUEL TANKS, MIL-PRF-23236

36

MIL-PRF-23236 is a flammable liquid and vapor. Harmful if swallowed. Causes serious eye damage. Causes skin irritation. May cause an allergic skin reaction. Suspected of causing cancer. May cause respiratory irritation. May cause drowsiness or dizziness. May cause damage to organs through prolonged or repeated exposure. Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.



CLEANING COMPOUNDS, AIRCRAFT SURFACE, A-A-59921

37

A-A-59921 is toxic. May be fatal if swallowed and enters airways. Causes skin irritation. Suspected of damaging fertility or the unborn child. May cause damage to organs (Central nervous system, Peripheral nervous system) through prolonged or repeated exposure. Do not eat, drink or smoke when using this product. Wear protective gloves, protective clothing, eye protection, face protection. Use personal protective equipment as required. Wash thoroughly after handling. Do not breathe mist, vapors, spray. Avoid release to the environment. If swallowed, do NOT induce vomiting and seek medical help. If on skin, wash with soap and water. If in eyes, rinse cautiously for several minutes.



TOPCOAT, SILICONE, HIGH TEMPERATURE, THURMALOX 270-18

38

Thurmalox 270-18 is a flammable liquid and vapor. Harmful if inhaled or swallowed. Causes eye and skin irritation. Use appropriate cartridge type respirator during and after application. In confined spaces, use positive pressure supplied respirator. Wear protective gloves, chemical safety goggles and impervious protective clothing. Only use around explosive proof lights and equipment. Use only non-sparking tools and equipment and footwear.



CONVERTER, RUST, RUST TRAP™

39

Rust Trap™ is a flammable liquid and vapor. May be fatal if swallowed and enters airways. Causes skin, eye and respiratory irritation. May cause cancer, genetic defects and damage to organs through prolonged or repeated exposure. Keep away from heat, sparks, open flames, hot surfaces and no smoking. Use explosion proof tools and equipment. Use only outdoors or in well-ventilated areas. Do not breathe fumes, vapors or mists. Wear protective gloves, clothing, eye and face protection. Wear respirator when using. If swallowed, do NOT induce vomiting. If on skin or eyes rinse with water for several minutes. Contaminated clothes must not be allowed out of work area.



CONVERTER, RUST, RUST REFORMER

40

Rust Reformer is an extremely flammable aerosol. Causes skin, eye and respiratory irritation. May cause cancer. Keep away from heat, sparks, open flames, hot surfaces and no smoking. Use only outdoors or in well-ventilated areas. Do not breathe fumes, vapors, sprays or mists. Wear protective gloves, clothing, eye and face protection. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air. Contaminated clothes must not be allowed out of work area.



CONVERTER, RUST, LOCTITE® EXTEND RUST NEUTRALIZER

41

Loctite® Extend Rust Neutralizer causes skin, eye and respiratory irritation. Harmful if swallowed. May cause cancer and Reproductive harm. Do not breathe fumes, vapors or mists. Wear protective gloves, clothing, eye and face protection. If swallowed, do NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



CONVERTER, RUST, LOCTITE® SF 754

42

Loctite® SF 754 is a flammable liquid. Causes skin, eye and respiratory irritation. Harmful if swallowed. May cause cancer and Reproductive harm. Keep away from heat, flames and sources of ignition. Do not breathe fumes, vapors or mists. Ensure adequate ventilation. Wear protective gloves, clothing, eye and face protection. If swallowed, do NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



CONVERTER, RUST, VPCI CORRVERTER® RUST PRIMER

43

VPCI CorrVerter® Rust Primer is a flammable liquid. Causes skin, eye and respiratory irritation. Harmful if swallowed. Keep away from heat, flames and sources of ignition. Do not breathe fumes, vapors or mists. Ensure adequate ventilation. Wear protective gloves, clothing, eye and face protection. Wear respirator when insufficient ventilation. If swallowed, do NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



CONVERTER, RUST, NEUTRARUST® 661

44

Neutrast® 661 causes skin, eye and respiratory irritation. Harmful if swallowed. Do not breathe fumes, vapors or mists. Ensure adequate ventilation. Wear protective gloves, clothing, eye and face protection. If swallowed, wash out mouth with water. Do NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



SOLVENT, ECO-FRIENDLY, ACRASTRIP 600

45

Acrastrip 600 causes skin, eye and respiratory irritation. Harmful if swallowed. Do not breathe fumes, vapors or mists. Ensure adequate ventilation. Wear protective gloves, clothing, eye and face protection. Wear respirator when insufficient ventilation. If swallowed, give two glasses of milk at once. Do NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



SOLVENT, ECO-FRIENDLY, SKYKLEEN® 1000

46

SkyKleen® 1000 causes skin, eye and respiratory irritation. Harmful if swallowed. Do not breathe fumes, vapors or mists. Ensure adequate ventilation. Wear protective gloves, clothing, eye and face protection. Wear respirator when insufficient ventilation. If swallowed, seek medical advice. If on skin wash with plenty of soap and water. If in eyes rinse with water for several minutes. If inhaled remove person to fresh air.



CHEMICAL CONVERSION COATINGS AND PRETREATMENTS FOR METALLIC SUBSTRATES, TT-C-490

47

TT-C-490 is a flammable liquid and vapor. May cause eye, skin, and respiratory tract irritation. May cause asphyxiation or brain, lung, or other organ injury if inhaled, swallowed, or absorbed by the skin. Use only in well-ventilated areas. Do not ingest. Appropriate skin and eye protection must be worn, and respiratory protection may also be needed. Contact lenses should not be worn. Keep away from heat, spark, and flames.



REMOVER, CARBON, SAE AMS-C-19853

48

SAE AMS-C-19853 is fatal if inhaled. Harmful if swallowed. Causes severe skin burns and eye damage. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause genetic defects. May cause cancer. May damage fertility or the unborn child. May cause damage to organs through prolonged or repeated exposure. Wear protective gloves. Wear eye or face protection. Wear protective clothing. Wear respiratory protection. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling. If swallowed DO NOT induce vomiting. If on skin wash with plenty of soap and water. If in eyes rinse with water for 15 minutes. If inhaled remove person to fresh air.

12 MATERIALS HANDLING.

12.1 Personnel Hazards. Many of the materials and procedures outlined in this technical order are potentially hazardous to personnel, if used improperly. When using chemicals such as paint strippers, cleaning compounds, conversion coatings, and solvents, follow the correct procedures and wear appropriate protective gear to prevent injury to personnel. Read the appropriate Safety Data Sheet (SDS), manufacturer's instructions and be familiar with related warnings and cautions in this technical order prior to using any material. Misuse of certain materials can also damage parts or cause corrosion. Refer to DoD 6050.5-LR, Hazardous Material Information System, FED STD 313, Material Safety Data, Transportation Data, and Disposal Data for Hazardous Material Furnished to Government Activities, or the appropriate systems command documents for the handling, storage, and disposal of hazardous materials. When in doubt, contact the local safety office, base bioenvironmental office, or regional medical center for guidance.

12.2 Environmental Hazards. Many of the materials and procedures outlined in this technical order are also potentially hazardous to the environment. Wherever possible, methods for preventing pollution, minimizing waste, and using less toxic materials are given. Consult the base bioenvironmental office for information about the handling, storage, and disposal of hazardous waste.

13 GENERAL PRECAUTIONS.

The following general safety precautions are not related to any specific procedure and therefore do not appear elsewhere in this technical manual. These are general safety precautions and instructions people must understand and apply during many phases of operation and maintenance to ensure personal safety and health and the protection of Air Force property.

13.1 Live Circuits. Operating personnel must observe all safety requirements at all times. Do not replace components or make adjustments inside equipment with the electrical supply turned on. Under certain conditions, danger may exist even when the power control is in the off position due to charges retained by capacitors. To avoid injuries, always remove power, discharge, and ground a circuit before touching it. Adhere to all lock out/tag out requirements.

13.2 Resuscitation. Personnel working with or near dangerous voltage shall be trained in modern methods of resuscitation. Information and training sources may be obtained from the Director of Base Medical Services.

13.3 Finger Rings/Jewelry. Finger rings have caused many serious injuries. Remove rings, watches and other metallic objects that may cause shock or burn hazards. Unless specifically allowed by shop safety procedures, remove finger rings during all maintenance activity.

13.4 Compressed Air. Use of compressed air can create an environment of propelled particles. Do not direct air streams towards yourself or other personnel. Air pressure shall be reduced to less than 30 Pound Per Square Inch, Gauge (PSIG) and used with effective chip guarding and personal protective equipment.

13.5 Dangerous Pressures. Care must be taken during testing to ensure that all test connections are proper and tight. All system components must be compatible with applied pressure. Personnel must be protected by a safety shield or located at a distance sufficient to prevent injury.

14 PERSONAL PROTECTIVE EQUIPMENT (PPE).

If unique local conditions make compliance with the protective clothing or other occupational health requirements specified in this manual unnecessary or impractical, obtain an evaluation of the operation from the BEF. The BEF or Wing Safety Office will determine the required precautions and approved PPE.

15 CLEANERS/CHEMICALS/PAINTS/PRIMERS.

Some cleaners, chemicals, paints, and primers have adverse effects on skin, eyes, and the respiratory tract. Observe manufacturer's warning labels, SDS and other instructions for proper handling, storage, and disposal; and current safety directives. Use only in authorized areas.

16 ELECTROSTATIC DISCHARGE.

Certain circuit card assemblies and their components will be damaged by seemingly undetectable electrostatic discharge. Care must be exercised during handling/repair of those items. Use electrostatic discharge precautionary procedures outlined in TO 00-25-234 and ESD TR20.20.

17 CHEMICAL, BIOLOGICAL AND/OR RADIOLOGICAL CONTAMINATED ASSETS.

Any asset that has been contaminated or potentially contaminated must be identified, marked and decontaminated in accordance with DAFI 10-2503 and TO 00-110A-1.

CHAPTER 1

CORROSION THEORY, IDENTIFICATION, CAUSES AND EFFECTS

1.1 PURPOSE.

The purpose of this chapter is to provide Support Equipment (SE) and Aircraft Structural Maintenance (ASM) personnel with the basic knowledge necessary to understand the causes of corrosion, identify the different types of corrosion that will in-turn help minimize corrosion damage through prevention and early detection and treatment. To help prevent corrosion, SE technicians must first need to understand corrosion causes and effects and be able to recognize there are several types of corrosion with different preventive measures. This chapter is an introduction to corrosion theory, the causes of corrosion and the factors that influence its development. The various forms of corrosion and the effect of corrosive environments normally on SE are also described in this chapter.

1.2 DEFINITION OF CORROSION.

Corrosion is the electrochemical deterioration of a metal due to its chemical reaction with the surrounding environment. This reaction occurs due to the tendency of metals to return to their naturally occurring states, usually oxide or sulfide ores. For example, iron in the presence of moisture and air will return to its natural state, iron oxide or rust. Aluminum and magnesium form corrosion products that are white oxides or hydroxides. When corrosion occurs, water is usually present in some form (e.g., humidity, moisture, condensation, rain, salt spray, etc.), acting as an electrolyte and reacting chemically with metal surfaces.

1.3 CHEMICAL DEFINITIONS.

1.3.1 Atom. The smallest unit of an element. There are more than 100 elements, including metals (such as aluminum, magnesium, iron, nickel, titanium, cadmium, chromium, copper, and carbon) and non-metals (such as hydrogen, oxygen, sulfur, and chlorine).

1.3.2 Electron. A negatively charged particle much smaller than an atom. An electrical current occurs when electrons are forced to move through metal conductors. Electrons also flow through water solutions, but only in the presence of ions.

1.3.3 Ions. Atoms or groups of atoms bound together that is either positively or negatively charged. An electrical current occurs when ions are forced to move through water solutions. Ions cannot move through metal conductors.

1.3.4 Electrolyte. A liquid solution (usually water) containing ions. Salt water is an electrolyte, an aqueous (i.e., water) solution of sodium ions and chloride ions.

1.4 THEORY OF CORROSION.

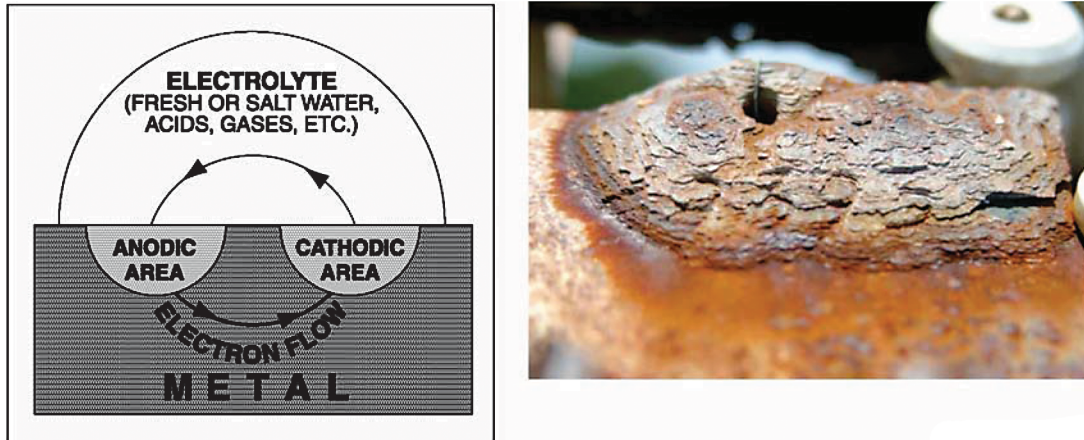
A corrosion cell is much like a battery. When a metal corrodes, the metal atoms lose electrons and become metal ions in an electrolyte solution. The positively charged metal ions can combine with negatively charged ions to form corrosion products, such as metallic chlorides, oxides, hydroxides, and sulfides. Four conditions must exist before this type of corrosion can occur.

1.4.1 Anode. A metal must be present that has a tendency to corrode. The corroding metal is known as the anode.

1.4.2 Cathode. A dissimilar conductive material (the cathode) that has less of a tendency to corrode than the anode must be present. Examples include a different metal, a protected part of the same metal, or conductive plastics/composite.

1.4.3 Electrolyte. A conductive liquid (electrolyte) must connect the anode and cathode so that ions can carry electrical current between them.

1.4.4 Electrical Path. Electrical contact between the anode and cathode (usually in the form of metal-to-metal contact) must exist so that electrons can move from the anode, where they are released, to the cathode. Eliminating any one of these four conditions, illustrated in [Figure 1-1](#), will stop corrosion. For example, a coating film on a metal surface will prevent the conducting liquid (electrolyte) from connecting the anode and cathode, thereby stopping the electric current. Another example is when two connected dissimilar metal parts placed in pure water corrode very slowly due to the lack of ions to conduct the electric current. In seawater, the corrosion reaction is accelerated by a factor of 1,000 or more.



TO-35-1-3-001

Figure 1-1. Diagram of a Simplified Corrosion Cell and an Example of Raised Corrosion Product

1.5 DEVELOPMENT OF CORROSION.

1.5.1 Corrosion Origination Locations. All corrosive attacks begin on the surface of metals whether it is the inside of a bolt hole, border of a metal crystal, handrail interior or bottom of a frame. If allowed to progress, corrosion can penetrate into and through the metal. When corrosion products form, they often precipitate onto the corroding surface as a powdery or scaled deposit. Other evidence of corrosion is the bulging/blistering of the metal surfaces. Thin film corrosion forms on electrical contact points and pins may appear as a tarnish, or powdery deposit on the metal surface.

1.5.2 Corrosion Under Painted Surfaces. Coatings can mask the initial stages of corrosion. Because corrosion products occupy more volume than the original metal, frequently inspect surfaces for irregularities such as blisters, flakes, chips, and lumps.

ANODIC (HIGH CORROSION POTENTIAL)
 MAGNESIUM ALLOYS
 ZINC (PLATE)
 BERYLLIUM
 BERYLLIUM (PLATE)
 URANIUM (DEPLETED)
 ALUMINUM ALLOYS
 INDIUM
 TIN (PLATE)
 STAINLESS STEEL 430 (ACTIVE)
 LEAD
 1010 STEEL
 CAST IRON
 STAINLESS STEEL 410 (ACTIVE)
 COPPER (PLATE)
 NICKEL (PLATE)
 AM 350 (ACTIVE)
 CHROMIUM (PLATE)
 STAINLESS STEELS 350, 310, 301, 304 (ACTIVE)
 STAINLESS STEELS 430, 410 (PASSIVE)
 STAINLESS STEELS 13-8, 17-7 PH (ACTIVE)
 BRASS, YELLOW, NAVAL
 STAINLESS STEEL 316L (ACTIVE)
 BRONZE 220
 COPPER
 STAINLESS STEEL 347 (ACTIVE)
 COPPER-NICKEL 715
 STAINLESS STEEL 202 (ACTIVE)
 MONEL 400
 STAINLESS STEEL 201 (ACTIVE)
 STAINLESS STEEL 321, 316 (ACTIVE)
 STAINLESS STEEL 309, 13-8, 17-7 PH (PASSIVE)
 STAINLESS STEEL 304, 301, 321 (PASSIVE)
 STAINLESS STEEL 201, 316L (PASSIVE)
 STAINLESS STEEL 286 (ACTIVE)
 AM355 (ACTIVE)
 STAINLESS STEEL 202 (PASSIVE)
 CARPENTER 20 (PASSIVE)
 AM355 (PASSIVE)
 TITANIUM ALLOYS
 SILVER
 PALLADIUM
 GOLD
 RHODIUM
 PLATINUM
 CARBON/GRAPHITE
 CATHODIC (LOW CORROSION POTENTIAL)

TO-35-1-3-002

Figure 1-2. Galvanic Series of Metals and Alloys

1.6 FACTORS INFLUENCING CORROSION.

Both natural and man-made environments cause corrosion of SE. Natural conditions that affect the corrosion process are moisture, temperature, salt atmospheres, ozone, sand, dust, solar radiation, insects and birds, and micro-organisms. Man-made conditions that affect the corrosion process are industrial pollution, manufacturing operations, storage conditions, and shipment. By understanding these conditions, maintenance personnel will be better able to prevent SE damage. Factors that influence metal corrosion and the rate at which it occurs are outlined in [Figure 1-2](#).

1.6.1 Type of Metal. The metals most commonly used in SE construction are aluminum, steel, and to some extent magnesium. Cadmium, nickel, chromium, and silver are sometimes used as protective plating. Metals have a wide range of corrosion resistance. The most active metals (i.e., those that tend to lose electrons easily), such as magnesium and aluminum, corrode easily and are listed at the top of [Figure 1-2](#). The most noble metals (i.e., those that do not lose electrons easily), such as gold and silver, do not corrode easily and are listed at the bottom of [Figure 1-2](#).

1.6.2 Dissimilar Metal Coupling (Galvanic Corrosion). When two dissimilar metals make electrical contact in the presence of an electrolyte, the rate at which corrosion occurs depends on the difference in their location on the galvanic scale (see [Figure 1-2](#)). The greater the distance between the metals on the galvanic scale, the faster corrosion occurs. For example, magnesium corrodes very quickly when coupled with gold in a humid atmosphere. However, pure aluminum corrodes very slowly, if at all, when in contact with cadmium. It is essential in the repair of SE that compatible metals and metal fasteners, washers, etc., be selected for repair and refurbishment processes. If dissimilar metal coupling must occur due to the equipment design or configuration, contact the appropriate system equipment specialist for the appropriate processes and materials to insulate the incompatible metals.

1.6.2.1 Graphite or carbon fiber composites are materials which consist of reinforcing fibers in a matrix made of organic resin, usually epoxy. They are an important class of SE construction materials due to their high strength-to-weight ratios and high stiffness. Although graphite or carbon/carbon composites appear as a plastic, the graphite material is considered a metal. Care should be exercised when attaching fasteners through the fibers. Use the appropriate sealant to insulate the composite from the metal parts.

1.6.2.2 Since carbon is the least active metal in the galvanic series, it will accelerate the corrosion of any metal to which it is coupled. Insulation, with sealant or other nonconductive coatings, between graphite or carbon epoxy composites and other metals surfaces or fasteners is necessary to prevent dissimilar metal attack on the attached part.

1.6.3 Anode and Cathode Surface Area. The rate of galvanic corrosion also depends on the size of the parts in contact. If the surface area of the corroding metal (the anode) is smaller than the surface area of the less active metal (the cathode), corrosion will be rapid and severe. However, if the corroding metal is larger than the less active metal, corrosion will be slow and superficial. For example, an aluminum fastener in contact with a relatively nonreactive Monel® structure may corrode severely, while a Monel® bracket secured to a large aluminum member would result in a relatively superficial attack on the aluminum.

1.6.4 Climate. Warm, moist air, typically found in tropical climates, tends to accelerate corrosion due to the higher concentration of water vapor in the air. Additionally, high temperature environments tend to produce more rapid corrosion due to accelerated chemical reactions. Conversely, cold dry air, typically found in colder regions of the world, tends to slow corrosion rates due to less water vapor in the air. Corrosion does not occur in very dry conditions. For this reason, desiccants or dehumidification systems are placed in, or connected to, shipping or storage containers to create very dry local environments. The equipment's proposed operational environments and established corrosion prevention and control optimal design parameters should be considered in SE design and procurement.

1.6.4.1 Desert. Hot, wind-swept deserts create a severe maintenance problem allowing powdery dust to penetrate even assumedly sealed components. Typically, desert conditions are thought to have low humidity and rainfall. However, there are areas of the world considered as desert with high daytime temperatures, moderate to low nighttime temperatures, high humidity (in areas such as the Persian Gulf), ultraviolet radiation, and fine dust. These conditions pose the most serious, destructive elements of the desert climate due to the wide range of conditions experienced daily (See [Chapter 7](#).)

1.6.4.2 Temperate Zones. The temperate or intermediate climate zone encompasses most of the North American and European continents. These areas at various times of the year may approximate the extremes of polar, desert, or tropical temperatures and humidity. The temperate zone temperatures range from -25 to +59 degrees Fahrenheit (°F) (-32 to +15 degrees Celsius (°C)) in the winter and from 59 to 125 °F (15 to 52 °C) in the summer. The Relative Humidity (RH) also fluctuates between 5 and 100 percent. The most critical areas are coastal locations, during the warm periods of the year in which the relative humidity approaches 100 percent RH at night and the air has high concentrations of salt. Moisture from this salt laden air can condense on equipment during early evening and morning hours, thereby causing serious corrosion. Because of its relatively mild temperatures, the temperate zone is also the most heavily populated. Consequently, the smoke, smog, ozone, and corrosive fumes associated with heavy industry are also found there.

1.6.4.3 Tropics. One of the greatest challenges to SE manufacturing industries is to the design equipment that is protected from corrosion and deterioration in the continual heat and humidity of tropical climates. Even though they encompass only a small portion of the earth's land area, the tropics demand the greatest amount of consideration from the standpoint of corrosion control and treatment. Relative humidity of up to 100 percent RH at ambient air temperatures of 85 °F (29 °C) and above create a formidable threat of corrosion. When high humidity and temperature conditions are combined with salt laden air, the corrosive environment becomes extremely severe. The critical combination of high temperatures, condensation, high relative humidity, and contaminants such as salt and sand may cause premature structural failure of equipment due to corrosion. Deterioration of the materials used in electronic equipment may also be accelerated. Thin film corrosion on electrical contact points and pins act as insulators to electrical current adversely affecting the operations of SE. (See [Chapter 8](#).)

1.6.4.3.1 Factors of Influence in Tropical Environments. Tropical environments are noted for long periods of heavy rainfall, during which 100 inches or more of rain may fall. Extended periods of high heat and humidity contribute to rapid corrosion of metals, cracking and flaking of rubber and plastic materials, and deterioration of seals. Equipment, whether stored or in use, requires special protective containers/measures and frequent preventive maintenance. Micro-organisms multiply excessively in tropical environments and attack many nonmetallic materials. Many items become covered with fungi in a matter of hours. Electronic equipment requires special efforts for effective operation in the tropics. Intensive preventive maintenance and the best possible protective techniques are necessary for SE and their components in tropical environments.

1.6.5 Heat Treatment and Grain Direction. When heat-treated, heavy sections of metals do not cool uniformly due to the metallic grain/crystalline structures tend to vary in chemical composition from one part of the metal to another. This can cause galvanic corrosion if the metal crystals are more active than another or contain contaminates. Alloys that are fabricated by rolling, extruding, forging, or pressing have properties that depend highly on the metal grain/crystal direction (parallel to grain elongation vs. cross grain). For example, exposed end grain corrodes much more easily than flattened elongated surfaces in sheet stock. This explains why exfoliation occurs at the structural edges or next to countersunk fasteners on certain types of alloys.

1.6.6 Electrolytes. Electrically conductive solutions are easily formed on metallic surfaces when condensation, salt spray, rain, or rinse water accumulate. Dirt, salt, and carbon deposits from engine exhaust and engine exhaust gases can combine with water on wet surfaces thereby increasing the electrical conductivity of the electrolyte and the rate of corrosion. Improper dilution of cleaning chemicals, combining cleaning compounds together, or the use of unauthorized cleaning material can cause the cleaning solution to become an electrolyte.

1.6.6.1 Moisture is present in air as a gas (water vapor) or as finely divided droplets of liquid (mist or fog) and often contains contaminants (such as chlorides, sulfates, and nitrates) that increase its corrosive effects. Moisture will enter all areas of SE that air can enter. All enclosed areas, that are not hermetically sealed, will allow air to enter and leave as the difference in pressure between the inside and outside the equipment changes. These pressure differences occur when atmospheric pressure changes and when the air temperature inside an enclosed area changes. As the surrounding surfaces are heated, moisture-laden air is drawn into the enclosed area or absorbed in open cell foam. As the air around the equipment cools, moisture will condense in the enclosed areas and settle in the lowest area of the part. The enclosed areas are often hidden and/or inaccessible. Moisture is difficult to remove and the subsequent corrosion may be difficult to identify in the early stages.

1.6.6.2 Salt laden atmospheres pose a continual problem in locations operating near coastal environments. When dissolved in water, salt solutions form very effective electrolytes. The ocean, which is 3.5 percent to 3.9 percent salt, is the world's primary source of salt. Normal sea winds carry from 10 to 100 pounds of sea salt per cubic mile of air. Bases located close to marine environments are continually exposed to a salt laden atmosphere. Because dissolved salts are strong electrolytes, it is easy to understand why coastal environments are listed in the moderate to severe corrosion prone categories and require frequent rinsing and cleaning to remove salt deposits.



TO-35-1-3-003

Figure 1-3. Corrosion Accelerated by Condensed Moisture

1.6.6.3 Condensed moisture will usually evaporate as the surrounding air warms but will leave behind its contaminants (residues), including salts. This can result in the build-up of soils and salt contamination. Salt laden condensation may collect at the lowest surface of the equipment which are usually the last to dry. As the condensation continues to collect at the lowest surfaces the contaminates/electrolytes become more concentrated. Condensed moisture and its contaminants can also be trapped in close fitting, wettable joints such as faying surfaces. Some gasket and packing materials will absorb several times their weight in water and, when heated, can transmit this retained moisture into the sealed area. Moisture can accumulate in such areas through successive cycles of warming and cooling and cause corrosion on the interior of the part resulting in premature structural failure as shown in [Figure 1-3](#).



TO-35-1-3-004

Figure 1-4. Open Cell Foam and Resulting Corrosion

1.6.6.4 Open cell foam, (see [Figure 1-4](#)), is a sponge-like material used mainly for sound suppression and insulation. Humidity, condensation, rainfall, etc., is absorbed into the foam and ultimately migrates to the mating metal surface to which it is attached. The absorbed moisture is very slow in drying out and holds the moisture/electrolyte against the metal surfaces creating a corrosion cell. When possible, open cell foam should not be used. Closed cell types of foam may be suitable substitutes for this material and will not absorb moisture. If open cell foam is the only material suitable for your needs, prior to installation in the SE, seal all open cell surfaces and sides of any perforations in the foam with a corrosion inhibitive sealant such as MIL-PRF-81733. Sealing any tears in the foam, or any unsealed sides and edges of the foam, will preclude any fluid absorption by the foam.

1.6.6.5 Airborne industrial pollutants also contribute to the deterioration of nonmetallic materials and severe corrosion of metals. The most aggressive are: carbon (from internal combustion engine exhaust), nitrates (from agricultural fertilizers), ozone (from electrical motors and welding operations), sulfur dioxide (from engine exhaust and industrial and ship smoke stacks), and sulfates (from automobile exhaust).

1.6.6.6 Sand, dust, and volcanic ash are present in many areas, but particularly in industrial areas where they often contain a number of tar products, ashes, and soot. Dust is also found in tropical zones with plentiful rainfall and arid zones where there is little or no rainfall. Sand and dust are extreme problems in deserts as the wind carries dry, powdery sand and dust. During sandstorms, sand and dust can penetrate sealed equipment and many internal areas of SE. Sand, dust, and volcanic ash are hygroscopic and can absorb and hold moisture when present on internal or external surfaces of SE or electronic parts. Dust from volcanic areas contains chlorides and sulfates, dust from desert areas may contain chlorides, carbonates, and sulfates. These materials are extremely corrosive in the presence of moisture. Although small amounts of sand or dust may be unnoticed by operating personnel, they may be sufficient to initiate and accelerate corrosion.



TO-35-1-3-005

Figure 1-5. Results of Microbial Induced Corrosion

1.6.7 Microbial Induced/Influenced Corrosion. Although rarely seen on SE, microbial induced/influenced corrosion, as the term is used in this manual, includes the aggressive action of bacteria, fungi, or molds that can be found on SE. Micro-organisms are nearly everywhere and outnumber all other types of living organisms. Those organisms causing the greatest corrosion problems are bacteria and fungi. Damage resulting from microbial growth can result from: (1) the tendency of the growth to hold moisture which then causes corrosion; (2) digestion of the substrate as food for the microorganism; or (3) corrosion of the surface beneath the growth by secreted corrosive fluids of the action of bacteria, fungi, or molds on a metal surface. (See [Figure 1-5](#).)

1.6.7.1 Bacteria may be either aerobic or anaerobic. Aerobic bacteria require oxygen to live. They can accelerate corrosion by oxidizing sulfur to produce sulfuric acid or by oxidizing ammonia to produce nitric acid. Bacteria living adjacent to metals may promote corrosion by depleting the oxygen supply or by releasing metabolic products. Anaerobic bacteria, on the other hand, can survive only when free oxygen is not present. The metabolism of these bacteria requires they obtain food sources by oxidizing inorganic compounds such as iron, sulfur, hydrogen, and carbon monoxide. The resultant chemical reactions cause corrosion.

1.6.7.2 Microbial attack can be prevented by frequent and thorough cleaning of the affected areas and applying moisture proofing coatings to nutrient-rich materials or by removing moisture from the air inside compartments through the use of desiccants. However, some moisture-proofing coatings are attacked by micro-organisms, especially if they are used on already contaminated surfaces.

1.6.7.3 When dry, some micro-organisms can survive in spore form for long periods and can become active when moisture is available. When desiccants become saturated and unable to absorb the moisture passing into the affected area, micro-organisms can begin to grow. Dirt, dust, and other airborne contaminants are the least recognized contributors to microbial attack. Unnoticed, small amounts of airborne debris may be sufficient to promote fungal growth.

1.6.8 Mechanical Stress. Manufacturing processes such as machining, forming, welding, or heat treatment can leave stresses in SE parts. Almost all alloys in SE construction are sensitive to a form of corrosion known as Stress Corrosion Cracking (SCC). This residual stress allows corrosion to proceed more rapidly in structurally important regions of the part until failure occurs.

1.6.9 Time. As time goes on, metals naturally tend to corrode. In some cases, the corrosion process occurs at the same rate, no matter how long the metal has been exposed to the environment. In other cases, corrosion can decrease with time (due to the barrier formed by corrosion products) or increase (if a barrier to corrosion is being broken down).

1.6.10 Manufacturing. During the manufacture, assembly, or repair of SE, many factors can cause the introduction of corrosion. Use of unsuitable materials and improper materials processing can cause corrosion. Shearing or hole-punching operations on some metal alloys, especially on high-strength aluminum, may create stresses that will lead to corrosion or provide a raised lip to inhibit complete drainage of electrolytes from an area. Assembly of parts in areas contaminated by fumes or vapors from adjacent operations may entrap fumes in the equipment, which might lead to future corrosion. Areas without humidity control may be sources of condensed moisture. Inadequate or nonexistent sealant usage, improper material selection, use of open cell foam for sound suppression are other causes that contribute to premature structural failure of SE.

1.6.11 Storage. Even traces of corrosive vapor in sealed packages containing SE parts may result in serious corrosion. Moreover, the natural breathing of packages may introduce moisture into parts and equipment. Decomposed packing materials can emit corrosive vapors during prolonged storage, which can create serious corrosion of equipment, and the parts stored in these packages.

1.6.12 Degradation of Non-metals. Nonmetallic materials (plastics, elastomers, paints, and adhesives) are not subject to electrochemical corrosion as ions are not easily formed from nonmetallic elements and the electrical conductivity of nonmetals, is extremely low. The degradation of non-metals depends on the chemical make-up of the material and the nature of the environment. In general, nonmetallic materials used on equipment are selected for their performance properties (flexibility, transparency, strength, electrical resistance, etc.) and their resistance to heat, impact, abrasion, ultraviolet radiation, moisture, ozone and other detrimental gases, and operational fluids (such as hydraulic fluid, lube oil, cleaners, deicing fluids, etc.). However, the use of unauthorized chemicals and procedures can accelerate degradation and ultimately lead to material failure resulting in leakage, corrosion, electrical shorts, crazing, and/or mechanical failure.

1.6.13 Preventive Maintenance (PM). PM is probably one of the easiest, most effective, and least expensive means of preventing corrosion and is the process organization maintenance personnel can control. Each type of corrosion has its own peculiarities and will require special treatment. However, there is a common four-point approach in developing an effective corrosion prevention and control program. The four-point approach consists of (1) the early identification of corrosion, (2) the early and thorough removal of corrosion and proper treatment of the corroded area (3) the complete removal of electrolytes through frequent cleaning with approved, properly mixed cleaning compounds, (4) and the application and maintenance upkeep of effective protective coatings.

1.6.13.1 Corrosion can be minimized by frequent washing since the extent of corrosion depends on the length of time electrolytes are in contact with metals. When the mandated Qualified Product List/Qualified Products Database (QPL/QPD) approved cleaners and additives are used, frequently cleaning of equipment based or operating in a corrosive environment will reduce the likelihood and severity of corrosion.

1.6.13.2 Keeping chemical treatments and coatings in good condition will minimize corrosion. The degradation of nonmetallic materials can be minimized by avoiding the use of unauthorized maintenance chemicals, coatings, and procedures.

1.6.13.3 Dedication to proper preventive maintenance practices will maximize equipment reliability and availability.

1.6.13.4 A typical PM program should include personnel trained in corrosion identification, prevention, thorough corrosion removal, chemical treatment, coating removal, sealing, and repainting. An effective PM program also includes:

- Proper SE washing and cleaning cycle based on the corrosion severity zone the equipment operates in.
- Daily cleaning or wiping down of all exposed unpainted surfaces such as actuating rods of hydraulic cylinders.
- Keeping all drains and drain holes open, and low parts of the SE dry and free of salt deposits.
- Initial use, inspection, and reapplication of the appropriate Corrosion Preventive Compound (CPC) following SE washing, repairs, and component replacement.
- Early detection and thorough removal of corrosion, and replacement of the damaged protective coatings and sealants.
- Sealing gaps, seams, and holes to prevent moisture entry. This is especially important around spot-welded areas.
- Application/reapplication of sealants, where required, to insulated dissimilar metals or prevent water intrusion following SE repairs, and component replacements.
- Technician awareness of the importance of corrosion prevention during regular maintenance activities (while performing daily repairs and maintenance tasks, always look for signs of corrosion or corrosion damage).
- Track causes of initial corrosion to the source and eliminate the source.

1.7 TYPES OF CORROSION.

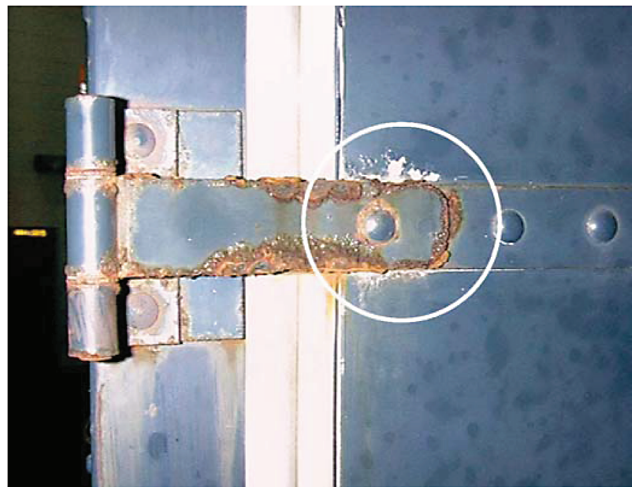
Corrosion is cataloged and classified in many ways. Occasionally, different names are used for the same type of corrosion. Common types of corrosion are described below.



TO-35-1-3-006

Figure 1-6. Example of Uniform Etch

1.7.1 Uniform Etch Corrosion. Uniform etch corrosion results from a direct chemical attack on a metal surface and involves only the metal surface. On a polished surface, this type of corrosion is first seen as a general dulling or etching of the surface, and, if the attack continues, the surface becomes rough and possibly frosted in appearance. This type of corrosion appears uniform and the anodes and cathodes are very small and constantly shift from one area of the surface to another. An example is the etching of metals by acids or by the use of unapproved or improperly mixed cleaning compounds. (See [Figure 1-6](#).) The discoloration or general dulling of metal created by exposure to elevated temperatures is not considered to be uniform etch corrosion.



TO-35-1-3-007

Figure 1-7. Example of Galvanic Corrosion-Steel Hinge Bolted to an Aluminum Door

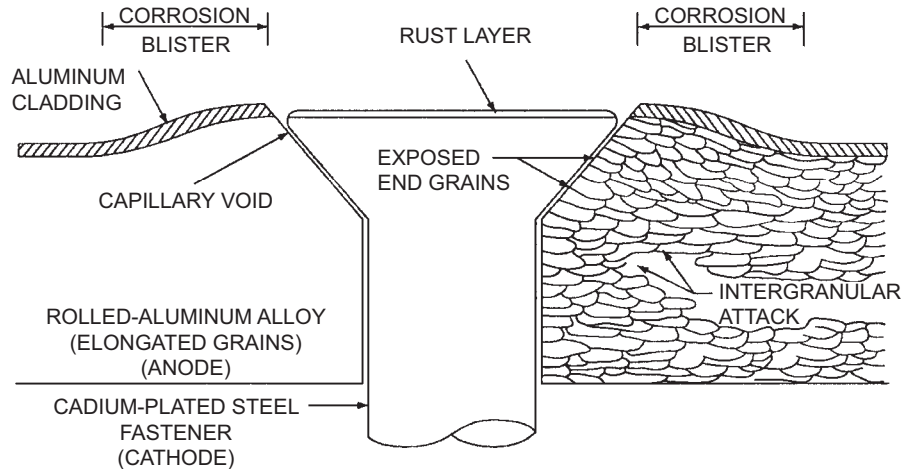
1.7.2 Galvanic Corrosion. Galvanic corrosion (see [Figure 1-7](#)) occurs when different metals are in contact with each other and an electrolyte (such as salt water). It is usually recognizable by a buildup of corrosion at the joint between the metals. If two dissimilar metals that are widely separated in [Figure 1-2](#) are in direct electrical contact, galvanic corrosion is probably occurring. The less corrosion-resistant metal (the higher metal in [Figure 1-2](#)) becomes the anode and the more corrosion resistant metal (the lower metal in [Figure 1-2](#)) becomes the cathode. As stated earlier, the anode will corrode. The farther apart the metals are in [Figure 1-2](#), the more severe corrosion will be on the anodic material, especially when the metals are joined electrically and are placed in an electrolyte. In most cases, the galvanic series listed in [Figure 1-2](#) is a good predictor of how metals will corrode in a galvanic couple. A major factor in galvanic corrosion is the size of the anode and cathode. A small anode in contact with a large cathode will corrode much more severely than a large anode in contact with a small cathode.



TO-35-1-3-008

Figure 1-8. Example of Pitting Corrosion

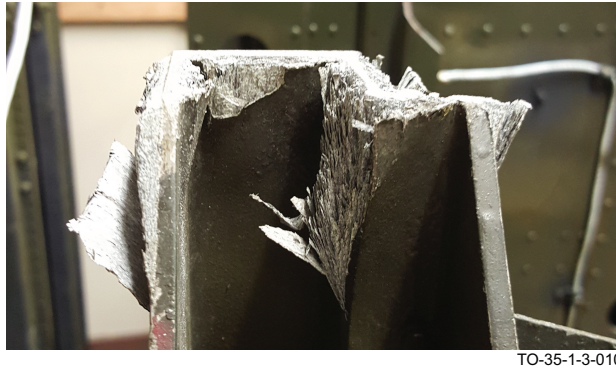
1.7.3 Pitting Corrosion. The most common corrosion on aluminum and magnesium alloys is called pitting corrosion. (See [Figure 1-8](#).) It is first noticeable as a white or gray powdery deposit, similar to dust, that blotches the surface. When the deposits are cleaned away, tiny pits or holes can be seen in the surface. Pitting corrosion may also occur in other types of alloys. The combination of small active anodes to large passive cathodes causes severe pitting. Pitting starts as an advanced form of uniform etch. It can worsen into very severe corrosion that results in localized and relatively deep holes in the metal. Pits are isolated holes that can vary in shape and size and usually take several months to a year before they become visible. Pitting is an extremely destructive and insidious form of corrosion. It causes equipment to fail from perforation with very little weight or material loss on the entire structure. It is also difficult to detect as the pits are often covered with corrosion products. Pitting usually initiates at anodic points on a metal surface such as breaks in protective coatings or films, scratches, and irregularities that are exposed to an aggressive electrolyte. Even though a pit is slow to initiate, once started, it will progress at an ever-increasing rate and will tend to undercut the surface as it grows.



TO-35-1-3-009

Figure 1-9. Illustration of an Intergranular Corrosion Cell

1.7.4 Intergranular Corrosion. Intergranular corrosion (see [Figure 1-9](#)) is an attack on the grain boundaries of the metal. A highly magnified cross-section of any commercial alloy shows the granular structure of the metal. This consists of quantities of individual grains, each having a clearly defined boundary that chemically differ from the metal within the grain. The grain boundaries are frequently anodic (i.e., tend to corrode more easily) to the metal within the grain. When in contact with an electrolyte, rapid corrosion occurs at the grain boundaries.



TO-35-1-3-010

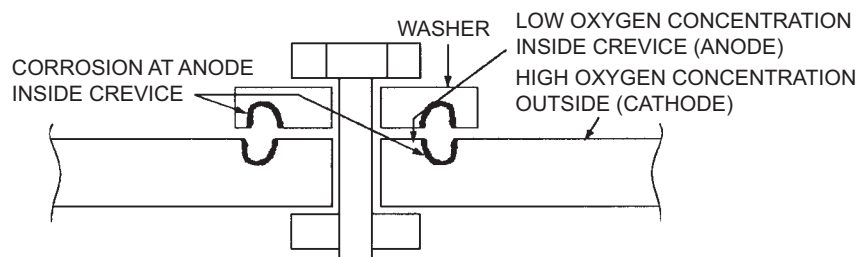
Figure 1-10. Example of Exfoliation Corrosion

1.7.5 Exfoliation Corrosion. Exfoliation corrosion (see [Figure 1-10](#)) is an advanced form of intergranular corrosion and occurs when the surface grains of a metal are lifted up by the force of expanding corrosion products occurring at the metal grain boundaries. The lifting up or swelling is visible evidence of exfoliation corrosion. Exfoliation occurs on extruded, rolled, wrought, and forged high strength aluminum and magnesium parts.



TO-35-1-3-011

Figure 1-11. Examples of Concentration/Crevice Corrosion



TO-35-1-3-012

Figure 1-12. Illustration of Concentration/Crevice Corrosion

1.7.6 Concentration/Crevice Corrosion. Crevice corrosion (see [Figure 1-11](#) and [Figure 1-12](#)) occurs when the electrolyte in a crevice has a different concentration than the area adjacent to the crevice. This type of corrosion is also known as concentration cell corrosion. Electrolytes inside the crevice contains less oxygen and more metal ions than electrolytes just outside the crevice. As a result, the metal surfaces have different activities, even though they may be part of the same metal, and corrosion occurs inside the crevice. This form of corrosion often occurs between faying surfaces or when a surface is covered by a foreign material (such as dirt) or under gaskets, rubber, or plastic tape. The mecha-

nisms involved in crevice corrosion are very similar to pitting corrosion. Crevice corrosion most often occurs where there are stagnant solutions (electrolytes) in holes, gasket surfaces, lap joints, under surface deposits (sand, dirt, corrosion products, etc.), and in crevices under bolt and rivet heads. To become a site for corrosion, a crevice must be wide enough to allow liquid entry but narrow enough to keep the liquid stagnant. As with pitting, crevice corrosion is slow to start, but once started, progresses at ever increasing rates (due to various electrochemical factors). Crevice corrosion is most intense when exposed to solutions containing chlorides (saltwater). Metals susceptible to pitting (stainless steel, aluminum, magnesium) are also susceptible to crevice corrosion. However, not all metals that are susceptible to crevice corrosion will be susceptible to pitting. There are three general types of crevice corrosion are: Metal ion concentration cells, oxygen concentration cells, active-passive cells.

1.7.7 Stress Corrosion Cracking. SCC is the inter granular cracking of a metal caused by the combined effects of constant tensile stress (internal or applied) and corrosion. Internal or residual stresses are produced by cold working, forming, and heat treatment operations during manufacture of a part and remain concealed in the part unless stress relief operations are used. Other hidden stresses are induced in parts when press or shrink fits are used, and when slightly mismatched parts are clamped together with rivets and bolts. All these stresses add to those caused by applying normal loads to parts in operation. Metals have threshold stresses below which SCC will not occur. This threshold stress varies from metal to metal and depends on the characteristics of the stress that is applied. The following conditions must be present for SCC to occur: (1) the component or structure must be under a tensile stress. This tensile stress may be provided by an externally applied service load or a residual stress resulting from manufacturing procedures such as rolling, punching, deep drawing, or welding; and (2) the material must also be exposed to an environment that causes SCC. Whereas all metals will form stress corrosion cracks in some environment under the proper conditions, there is no one environment that will cause SCC in all metals. SCC is most prevalent and of the most concern in high strength steels, stainless steels (mostly in the austenitic group), high strength aluminum alloys (2,000 and 7,000 series), copper-based alloys, and titanium alloys.

1.7.8 Hydrogen Embrittlement. Hydrogen embrittlement is the weakening of materials such as high-strength steel (typically 180 Ksi and above), some high-strength aluminum, titanium, and some types of stainless steels when they are exposed to acidic materials such as acid paint removers, acidic metal pretreatments and cleaners, plating solutions, and some alkaline materials. This occurs when the materials induce a cathodic reaction on the metal surface producing hydrogen. The hydrogen diffuses into the bulk metal, accumulating at grain boundaries and weldments weakening the structure. If the part is under load or contains residual manufacturing stresses, sudden catastrophic failure occurs when the part can no longer sustain the internal and/or applied stresses. Hydrogen embrittlement has been known to occur in parts stressed to only 15 percent of nominal tensile strength.

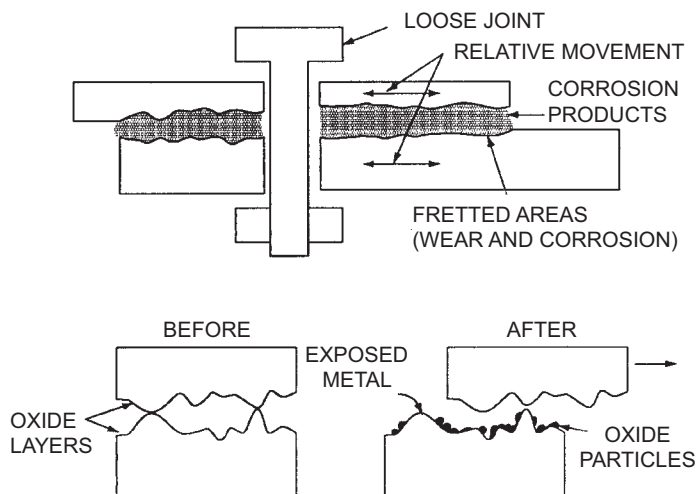
1.7.9 Corrosion Fatigue. Corrosion fatigue is the cracking of metals caused by the combined effects of cyclic stress and corrosion and is very similar to SCC. If it is in a corrosive environment, no metal is immune to some reduction in resistance to cyclic stressing. Corrosion fatigue failure occurs in two stages. During the first stage, the combined action of corrosion and cyclic stress damages the metal by pitting and forming cracks in the pitted area. The second stage is the continuation of crack propagation, in which the rate of cracking is controlled by the stresses of operation. In simplified terms, corrosion fatigue is mechanical fatigue aggravated by a corrosive environment. In corrosion fatigue, the corrosive environment causes a lowering or reduction of the fatigue limit (the ability of a metal to resist fatigue cracking) of a metal as it undergoes cycles of stress. In the absence of a corrosive environment, this same metal would be able to withstand significantly more cycles of stress before cracking. Corrosion fatigue seems to be most prevalent in environments that cause pitting corrosion.



TO-35-1-3-013

Figure 1-13. Example of Filiform Corrosion

1.7.10 Filiform Corrosion. Filiform corrosion is a special form of oxygen concentration cell corrosion (or crevice corrosion) that occurs on metal surfaces having an organic coating system. It is recognizable by its characteristic worm-like trace of corrosion products beneath the coating. (See [Figure 1-13](#).) Filiform occurs when the relative humidity of the air is between 78 percent and 90 percent and when the surface is slightly acidic. It starts at breaks in the coating system (such as scratches and cracks around fasteners and seams) and proceeds underneath the coating due to the diffusion of water vapor and oxygen from the air through the coating. Filiform corrosion can attack steel, magnesium, and aluminum surfaces and may lead to more serious corrosion in some locations. Filiform corrosion can be prevented by: (1) storing equipment in an environment with a relative humidity below 70 percent; (2) using coating systems with a low rate of diffusion for oxygen and water vapors; (3) maintaining coatings in good conditions; and (4) washing equipment to remove acidic contaminants from the surface (such as those created by air pollutants). Filiform corrosion most often occurs in humid environments. Once the humidity drops below 65 percent, filiform corrosion stops. When the humidity rises above 95 percent, blisters form rather than filaments. Filiform corrosion forms mostly on steel, aluminum, magnesium, and zinc.



TO-35-1-3-014

Figure 1-14. Illustration of a Fretting Corrosion Cell

1.7.11 Fretting Corrosion. Fretting corrosion (see [Figure 1-14](#)) is a special form of concentration cell corrosion that occurs in combination with surface wear. The corrosion products increase the wear of the surface, and the wear exposes additional bare metal surface to be corroded. The overall effect is greater than the single effects of corrosion and wear added together. It has the general appearance of galling, in which chunks of metal are torn from the surface with corrosion at the torn areas or ragged pits. This type of corrosion occurs on faying surfaces of close tolerance and on parts under high pressure in a corrosive environment when there is slight relative movement of parts (such as that caused by vibration). Fretting corrosion is normally encountered in heavily loaded static joints that are subject to vibration and that are not sealed to prevent moisture entry. Fretting corrosion is corrosion that occurs between metals that are under load and subject to vibration and/or slip. It appears as pits or grooves in the metal surrounded by corrosion products. Fretting corrosion can be very destructive in that it loosens mated parts and close tolerance fittings that in turn lead to stress or fatigue failures. In the case of iron alloys, brown to red iron oxide will be visible from the area or interface experiencing fretting corrosion. On aluminum alloys, a black corrosion product is evident. Fretting corrosion is most commonly found in heavily loaded joints that are subject to vibration such as press fitted ball bearing races, bolted flanges, fayed surfaces, electrical connections, and riveted areas.

1.8 METALS AFFECTED BY CORROSION.

The characteristics of corrosion on SE metals are summarized in [Table 1-1](#). The following is a discussion of corrosion characteristics of commonly used metals.

1.8.1 Magnesium. Magnesium alloys are the lightest structural metals used for SE construction. These alloys are highly susceptible to corrosion, which appears as white, powdery mounds or spots when the metal surface is exposed to the environment without a protective finish. The normal oxide-carbonate film formed on magnesium alloys does not provide sufficient corrosion protection even in the mildest environment. The rate of corrosion of a magnesium alloy increases when the alloy is immersed in water or periodically subjected to moisture. Corrosion may also be accelerated by dissimilar metal couples and when conductive contaminants are dissolved in water. Corrosion of magnesium alloys can be greatly diminished by the use of the proper protective finish. Some magnesium parts in use were originally protected by anodizing processes, such as HAE and DOW 17 coatings. The HAE process can be identified by the brown to mottled gray appearance of the unpainted surface. DOW 17 coatings have a green to grayish-green color. Electrolytic coatings are thicker than those applied by immersion or brushing. Electro-

lytic finishes cannot be restored in the field. Take care to minimize removal of these coatings. At the field level, corrosion removal and surface pretreatment on magnesium parts should be referred to the ASM technicians for repair of the conversion coatings.

1.8.2 Steel. Ferrous (iron) alloys are used to manufacture many components and assemblies in SE and other equipment such as frames and bodies of trailers, and lesser structural parts such as brackets, racks, and panels. If unprotected, ferrous alloy surfaces, (with the exception of stainless steels also known as Corrosion Resistant Steel (CRES)), corrode easily in the presence of moisture. Ferrous alloy surfaces are normally painted or plated and painted to prevent corrosion. Corrosion of steel is easily recognized since the corrosion product is red or black color. When ferrous alloys corrode, a dark corrosion product usually forms first. When moisture is present, this coating is converted to the common red or black corrosion product. Effective sacrificial coatings that prevent corrosion on ferrous alloys are cadmium plating or low hydrogen embrittling zinc nickel (LHE Zn-Ni) plating in accordance with drawing 201027456 (for all steels including high strength steels) or 201427084 (for low strength steel fasteners). LHE Zn-Ni is an environmentally friendly alternative to cadmium that provides equivalent corrosion protection for ferrous alloys including high strength steels. When switching from cadmium to LHE Zn-Ni, the LHE Zn-Ni should be specified with the same Type and Class (thickness) as the original cadmium coating. Coatings are often applied over cadmium or LHE Zn-Ni plated surfaces to provide additional protection. Testing has shown good performance when painting over LHE Zn-Ni coatings with epoxy primers in accordance with MIL-PRF-85582, Type I, Class N or MIL-PRF-23377 Type I, Class N, MIL-PRF-32550, Type I, Form A, Class S, or MIL-DTL-53022, Type IV, Class L.

1.8.3 Aluminum. Aluminum and aluminum alloys are widely used for SE construction. Aluminum is highly anodic, as evidenced by its position in the galvanic series. However, the formation of a tightly adhering oxide film offers increased resistance under mild corrosive conditions. Some aluminum parts are protected with an electrochemically applied anodized coating. Aluminum oxide film on aluminum is a naturally occurring protective film; anodizing increases the thickness of the oxide film. When this coating is damaged, it can only be partially restored by chemical surface treatment. Avoid unnecessary destruction of the anodized surface layer during the processing of anodized aluminum.

1.8.3.1 The corrosion product of aluminum is a white to gray powdery material (aluminum oxide or hydroxide), which can be removed by mechanical polishing or brushing with an abrasive. Aluminum is anodic to most other metals and when in contact with them, galvanic corrosion of the aluminum will occur. Aluminum alloys are subject to pitting, intergranular corrosion, and SCC. In some cases, the corrosion products of a metal in contact with aluminum are corrosive to aluminum. Therefore, it is necessary to clean and protect aluminum and its alloys against corrosion.

1.8.3.2 Because pure aluminum is more corrosion-resistant than most alloys, aluminum sheet stock is often covered with a thin layer of nearly pure aluminum called cladding. Cladding is often removed by harsh treatment with abrasives and tooling, exposing a more corrodible surface. In such areas, paints and CPCs are especially important. However, in environments where SE is exposed to salt-laden atmosphere or significant industrial pollutants, all bare aluminum surfaces require protection.

1.8.4 Copper and Copper Alloys. Copper and copper alloys are quite corrosion-resistant, with corrosion usually limited to staining and tarnish. Generally, such changes in surface conditions are not dangerous and usually do not affect the part. Copper corrosion is evidenced by the accumulation of blue or blue-green corrosion products. Protective coatings are seldom required due to the inherent resistance of the metal. However, coatings may be applied for appearance purposes. The green patina is merely a thin coating consisting mainly of basic copper sulfate and perhaps some hydrated copper carbonate. The patina in the thin, firmly adhering state actually offers increased corrosion protection to the base metal, but the patina in a rough or frosted state should be removed. When coupled with most metals used in SE construction, copper is the less active metal and greatly accelerates the corrosion of other metals. This is especially true in copper/aluminum couples. Examples are usually found in electrical components and in areas where copper bonding strips or wires are fastened to an aluminum chassis or structural components.

1.8.5 Stainless Steel. Stainless steel or CRES, as they are more properly described, are alloys of iron with chromium. Many other elements such as nickel, sulfur, molybdenum, vanadium, cobalt, columbium, titanium, and aluminum are added in various amounts and combinations to develop special characteristics. Stainless steels are much more resistant to common rusting, chemical actions, and high-temperature oxidation than ordinary steels due to the formation of an invisible oxide film or passive layer on the surface of these alloys. Corrosion and heat-resistance are the major factors in selecting stainless steels for a specific application. However, it should be emphasized that stainless steels are not a cure for all corrosion problems as service conditions can destroy the oxide film on their surfaces. Stainless steels are highly susceptible to crevice corrosion and SCC in moist, salt-laden environments. In addition, if proper techniques of sealing and protective coating are ignored, they can cause galvanic corrosion of almost any other metal with which they are in contact. Stainless steels may be magnetic or nonmagnetic. Magnetic steels are identified by numbers in the American Iron and Steel Institute (AISI) as 400-series (such as 410 and 430). These steels are not as corrosion-resistant as nonmagnetic steels, which are identified by numbers in the AISI 300-series (such as 304 and 316). The AISI 300-series steels have nickel contents ranging from 6 percent to 22 percent; the 400-series steels have nickel contents of only 2 percent.

1.8.6 Nickel and Chromium. Nickel and chromium are used as protective plating. Chromium plating is also used to provide a smooth, wear resistant surface and to reclaim worn parts. A nickel undercoat is used for corrosion resistance in a marine environment. The degree of protection depends on plating thickness. Both of these metals form continuous oxide coatings that can be polished to a high luster and still protect themselves and any underlying metal. Chromium coatings contain cracks, and corrosion originates at the base metal below these separations.

Table 1-1. Corrosion of Metals-Type of Attack and Appearance of Corrosion Products

Alloy	Corrosion Susceptibility	Appearance of the Corrosion
Magnesium	Pitting	Rough, white powdery deposits
Low Alloy Steel	Surface oxidation, pitting, concentration cell	Reddish-brown or black deposits
Aluminum Alloy	Surface oxidation, pitting, inter granular, exfoliation, stress corrosion, fatigue, and fretting, concentration cell	White to gray powdery deposits
Stainless Steel/CRES (300-400 Series)	Crevice corrosion, some pitting in a marine environment or water storage containers with high chlorine levels, corrosion cracking inter granular corrosion (300 series) and surface corrosion (400 series)	Rough surface, sometimes a red, brown, or black uniform stain or pits
Copper-Base Alloys, Brass, Bronze	Surface oxidation, pitting	Blue to blue-green powdery deposits
Chrome/Nickel	Pitting (promotes rusting of the substrate steel where the pits in the plating occur).	Usually there are no visible corrosion products on the plating surfaces. Blistering of the plating is due to the rusting and lifting of the substrate metal.

CHAPTER 2

CLEANING

2.1 GENERAL.

2.1.1 Introduction. A well-developed cleaning program utilizing approved cleaning materials and processes is a key factor in reducing the impact of corrosion. Use of untested or unauthorized cleaning materials may cause premature coating system failure and/or accelerated corrosion.

2.1.2 Support Equipment (SE) Wash Cycles.

NOTE

Washing is a critical element of a comprehensive corrosion program which also includes using only qualified products for washing, painting, and other corrosion prevention processes. This program must include refurbishment of the equipment prior to deterioration from corrosion, routine touch-up of the coating system, use of Corrosion Preventive Compounds (CPC) where touch-ups cannot be accomplished immediately, and covered storage where practical.

For the purpose of this chapter, SE refers only to powered and non-powered Aerospace Ground Equipment (AGE) to include propulsion and munitions handling trailers. However, when unique operational requirements exist for specific equipment, the wash schedules, corrosion prevention and inspection processes can be extended and specified in the equipment/end-item specific manual, if approved by the cognizant engineering authority. Corrosion prevention, maintenance inspection, repair and overhaul addressed in equipment/end-item commodity manuals take precedence over this manual. Major Commands (MAJCOM) may add additional types of equipment to the wash program. SE must be washed in accordance with [Table 2-1](#). Wash can be scheduled in conjunction with phased inspections if scheduled within due month. MAJCOMs and local Units may mandate or implement wash intervals more frequently than those reflected in [Table 2-1](#). If the corrosion protective systems (primers and topcoats) are in poor condition or are compromised in any way, the coatings have not been touched up, the equipment is stored outdoors, and/or there is already evidence of corrosion, more frequent washing and/or rinsing is of increased importance. Where corrosion of this equipment is already a problem, wash cycles even more frequent than 90 days/quarterly is recommended. If the SE is temporarily assigned to locations where cleaning is not practical, the affected equipment shall be cleaned, inspected, and lubricated within 30 days of returning to home station. Base locations not listed in [Table 2-1](#) will use the requirements of the nearest base location unless within 1.25 miles of salt water. Locations within 1.25 miles of salt water are considered severe and require a 90-day wash interval. Contact the Air Force Corrosion Prevention and Control Office (AFCPCO) for further guidance if needed.

2.1.2.1 War Reserve Materiel (WRM) Support Equipment Wash Exemption Waivers. In accordance with Department of the Air Force Instruction (DAFI) 21-101, acceptance inspections are required for newly assigned SE. During acceptance inspections, the equipment's corrosion condition will be evaluated and scored in accordance with [Paragraph 3.3.1.2](#). All newly assigned WRM SE must be cleaned/washed prior to storage. Afterwards, in accordance with this chapter's instructions, minimum wash intervals must comply with [Table 2-1](#) requirements.

2.1.2.2 The wash interval for WRM SE (Use Code D) located at a SEVERE location (see [Table 2-1](#)) and stored inside a fully enclosed facility may be extended from a 90 day interval to a 180 day interval when the following practices and requirements are met:

- WRM SE removed from a fully enclosed facility for more than two (2) hours in a 24-hour period must be washed in accordance with this chapter prior to placing the equipment back in the storage facility.
- The facility's access doors (e.g. rollup doors, hangar doors, etc.) must not exceed four (4) hours of being partially or fully opened during a 24-hour period. Exceeding the total allowed time of being partially or fully opened during a 24-hour period will result in the stored WRM SE reverting back to its regular wash interval as outlined in [Table 2-1](#). Wash will be due based on date of the last wash.
- Waiver requests must be coordinated through the respective MAJCOM's Fabrication and AGE Functional Managers to ensure the facility is qualified and meets all requirements as well as assessing the overall corrosiveness of the environment and condition of the SE at the operating base location.

NOTE

Tropical environments experience long periods of heavy rainfall. Extended periods of high heat and humidity contribute to rapid corrosion of metals, cracking and flaking of rubber and plastic materials, and deterioration of seals. Intensive preventive maintenance and the best possible protective techniques are necessary to safeguard the readiness of SE within tropical environments. Climate and humidity-controlled storage facilities greatly enhance corrosion prevention/control programs and increase the likelihood of operating within this waiver.

- For WRM SE located in MODERATE/MILD locations, waiver requests to extend the wash interval from a 180-day interval to a 365-day interval can be submitted to the respective MAJCOM's Fabrication and AGE Functional Managers for review and approval/disapproval.

2.1.3 Definition of Cleaning. Cleaning is a broad term covering methods and materials needed to remove soils from a surface. Selection of an appropriate cleaning method in any given case depends on three important factors: (1) type and amount of soil, (2) base material composition and surface condition, and (3) degree of cleanliness required.

2.1.4 Types of Cleaners. Cleaners that are used in this technical manual may be placed in types as follows:

2.1.4.1 Alkaline cleaners remove soil by displacement of the contaminants from the surface rather than by direct solution in the cleaner. After displacement, the soils may be carried in the body of the cleaner as a suspension; it may separate, or in the case of fatty soils, it may react partially or completely with the cleaner to form water-soluble soap. Cleaners of this type usually have components that aid in cleaning by lifting the soils and other contaminants from a surface.

2.1.4.2 Solvent cleaners remove a soil by dissolving the soil and usually leave a thin film or residue of an oily nature. Removal of this oily film or residue is accomplished by using an alkaline cleaner.

2.1.4.3 Solvent emulsion cleaners remove soils by emulsifying the oil constituent of the soil and holding it in suspension until rinsed from the surface with water.

2.1.5 Methods of Cleaning. Methods of cleaning used in this technical manual are four types, as follows:

2.1.5.1 Hand cleaning is commonly used when the parts/equipment cleaning volume of work is too small, or the parts too large to justify the expense of special equipment. Cleaning solutions may be applied by means of brushes, swabs, or cloths. Wherever the cleaning materials may be harmful to the skin, personnel shall be supplied with proper safety equipment. Hand cleaning is time consuming and may use more water than other washing techniques. Pressure washers are normally used; however, organizations sometimes use foamers to wash equipment, increasing the effectiveness of authorized cleaners.

2.1.5.2 Spray washing is usually the most-rapid method for cleaning. The chief feature of spray washing is the application of the mechanical force of the spray in addition to the chemical and physical actions of the cleaning solution. By means of these combined actions, the soil is rapidly wetted, penetrated, loosened, removed from the surface, and suspended in the solution in a free-rinsing condition.

2.1.5.3 Immersion in cleaning tanks is usually used for disassembled parts submerged in an authorized cleaning compound(s). Since the cleaning compounds may act as an electrolyte between two or more metals, care shall be taken not to intermingle the different metals together in the same cleaning tank.

2.1.5.4 Use of foamers involve injecting air into a tank containing a cleaning solution, which rapidly mixes the air and solution as it leaves the tank via a hose. This process produces a very thick, foamy solution that adheres well to the exterior of the SE allowing the cleaning solution to maintain contact with the surface being cleaned.

2.1.5.5 The solution is allowed to dwell on the SE briefly, scrubbed with wash pads or mops, then is rinsed off the SE with fresh, potable water.

2.1.5.6 Cleaners can be added at a pre-set and controlled rate when using foamers or pressure washers for SE cleaning. These methods are preferred over hand mixing, which does not effectively regulate the amount of cleaner used.

Table 2-1. Wash Interval Based on Corrosion Severity Zones

Location	Severe (90 days)	Moderate/Mild (180 Days)
Afghanistan (All Locations)		X
AJ Taif, Saudi Arabia		X
Al Dhafra, United Arab Emirates		X
Al Jouf, Saudi Arabia		X
Al Udeid AB, Qatar		X
Ali Al Salem, Kuwait		X
Allen C. Thompson Field, Jackson, MS (ANG)		X
Altus AFB, OK		X
As Sulayyil, Saudi Arabia		X
Andersen AFB, Guam	X	
Anchorage International Airport, AK (ANG)		X
Andrews AFB, MD (DC)		X
Atlantic City International Airport, NJ (ANG)		X
Aviano AB, Italy		X
Bahrain (All Locations)	X	
Balad AB, Iraq		X
Bangor International Airport, ME (ANG)		X
Barksdale AFB, LA		X
Battle Creek Executive Airport, MI (ANG)		X
Beale AFB, CA		X
Bradley International Airport; Windsor Locks, CT (ANG)		X
Brindisi/Casale AB, Italy	X	
Buckley SFB; Denver, CO (ANG)		X
Burlington International Airport, VT (ANG)		X
Byrd Field; Richmond, VA (ANG)		X
Camp Lemonnier, Djibouti	X	
Cannon AFB, NM		X
Capital City Airport; Springfield, IL (ANG)		X
Channel Islands ANG; Port Hueneme, CA (ANG)	X	
Charlotte Douglas Intl. Airport; Charlotte, NC (ANG)		X
Cheyenne Regional Airport, WY (ANG)		X
Charleston AFB, SC		X
Columbus AFB, MS		X
Curaçao, Netherlands, Antilles	X	
Dannelly Field; Montgomery, AL (ANG)		X
Davis-Monthan AFB, AZ		X
Des Moines International Airport, IA (ANG)		X
Dhahran, Saudi Arabia		X
Diego Garcia, Mauritius	X	
Dobbins ARB; Marietta, GA (AFRC)		X
Dover AFB, DE		X
Duke Field (Eglin Auxiliary Field No. 3), FL		X
Duluth International Airport, MN (ANG)		X
Dyess AFB, TX		X
Eareckson Air Station; Aleutian Islands, AK	X	
Eastern WV Regional Airport; Martinsburg, WV (ANG)		X

Table 2-1. Wash Interval Based on Corrosion Severity Zones - Continued

Location	Severe (90 days)	Moderate/Mild (180 Days)
Edwards AFB, CA		X
Eglin AFB, FL	X	
Eielson AFB, AK		X
Ellington Field JRB; Houston, TX (ANG)		X
Ellsworth AFB, SD		X
Fairchild AFB, WA		X
Forbes Fld., KS (ANG)		X
Fort Smith Mun. Spt., AR (ANG)		X
Fort Wayne Airport, IN (ANG)		X
Francis E. Warren AFB, WY (ANG)		X
Francis S. Gabreski Apt., Westhampton Beach, NY (ANG)	X	
Frankfurt Airport, Germany	X	
Fresno-Yosemite International Airport, CA (ANG)		X
Geilenkirchen, GE		X
Gowen Field, ID (ANG)		X
Grand Folks AFB, ND		X
Great Falls International Airport, MT (ANG)		X
Griffiss AFB, NY		X
Grissom ARB; Peru, IN (AFRC)		X
Hanscom AFB, MA		X
Harrisburg International Airport, PA (ANG)		X
Hector International Airport; Fargo, ND (ANG)		X
Hill AFB, UT		X
Holloman AFB, NM		X
Homestead AFB, FL (AFRC)		X
Howard AB, Panama		X
Hurlburt Field, FL	X	
Incirlick AB, Turkey		X
Istres AB, France		X
Jacksonville International Airport, FL (ANG)		X
JB Cape Cod; Buzzards Bay, MA (ANG)		X
JB Elmendorf-Richardson, AK	X	
JB Langley-Eustis, VA	X	
JB Lewis-McChord, WA		X
JB McGuire-Dix-Lakehurst, NJ		X
JB Pearl Harbor-Hickam, HI	X	
Jeddah, Saudi Arabia		X
Joe Foss Field; Sioux Falls, SD (ANG)		X
Kadena AB, Japan	X	
Keesler AFB, MS	X	
Key Field; Meridian, MS (ANG)		X
Khamis Mushay, Saudi Arabia		X
Khandahar, Afghanistan		X
Kiruk, Iraq		X
King Khalid, Saudi Arabia		X
Kingsley Field; Klamath Falls, OR (ANG)		X

Table 2-1. Wash Interval Based on Corrosion Severity Zones - Continued

Location	Severe (90 days)	Moderate/Mild (180 Days)
Kirtland AFB, NM		X
Fort Huachuca Army Base, AZ		X
Kunsan AB; Republic of Korea	X	
Lackland AFB, TX		X
Lajes Field; Azores, Portugal	X	
Lambert Field; St. Louis, MO (ANG)		X
Larnaka International Airport, Cyprus	X	
Laughlin AFB, TX		X
Lincoln Airport; Lincoln, NE (ANG)		X
Little Rock AFB, AR (AETC & ANG)		X
Louisville International Airport; Louisville, KY (ANG)		X
Luis Munoz Marin Intl. Airport; San Juan, Puerto Rico	X	
Luke AFB, AZ		X
MacDill AFB, FL	X	
Malmstrom AFB, MT		X
Manas, Kyrgystan		X
Mansfield Lahm Regional Airport, OH (ANG)		X
Mantas, Ecuador	X	
March ARB; Riverside, CA (AFRC & ANG)		X
Martin State Airport; Baltimore, MD (ANG)		X
Maxwell AFB, AL		X
McConnell AFB, KS		X
McEntire JNGB; Eastover, SC (ANG)		X
McGhee Tyson Airport; Alcoa, TN (ANG)		X
McMurdo Station, Antarctica		X
Memphis International Airport, TN (ANG)		X
Milwaukee Mitchell Intl. Airport; Milwaukee, WI (ANG)		X
Minot AFB, ND		X
Minneapolis-St. Paul Intl. Airport, MN (ARFC & ANG)		X
Misawa AB, Japan		X
Moffett Field; Sunnyvale, CA (ANG)		X
Moody AFB, GA		X
Moron AB, Spain		X
Mountain Home AFB, ID		X
NAS JRB Fort Worth, TX (ANG & AFRC)		X
NAS Keflavik, Iceland	X	
NAS JRB New Orleans, LA (ANG & AFRC)		X
NAS Rota, Spain	X	
NAS Sigonella, Italy		X
NAS Souda Bay (Chania Airport), Crete	X	
Nashville International Airport, TN (ANG)		X
Nellis AFB, NV		X
New York International Airport; New Windsor, NY (ANG)		X
Niagara Falls International Airport, NY (AFRC & ANG)		X
Offutt AFB, NE		X
O'Hare International Airport; Chicago, IL (AFRC)		X

Table 2-1. Wash Interval Based on Corrosion Severity Zones - Continued

Location	Severe (90 days)	Moderate/Mild (180 Days)
Osan AB, Republic of Korea		X
Patrick SFB, FL	X	
Pease ANGB; Portsmouth, NH (ANG)		X
Peoria International Airport, IL (ANG)		X
Peterson SFB; Colorado Springs, CO		X
Phoenix Sky Harbor Intl. Airport; Phoenix, AZ (ANG)		X
Pittsburgh International Airport, PA (AFRC & ANG)		X
Pope Field, NC		X
Portland International Airport, OR (ANG)		X
Prince Sultan AB; Al Kharj, Saudi Arabia		X
Quonset State Airport; Providence, RI (ANG)		X
RAF Akrotiri, Cyprus	X	
RAF Fairford, United Kingdom		X
RAF Lakenheath, United Kingdom		X
RAF Mildenhall, United Kingdom		X
Ramstein AB, Germany		X
Randolph AFB, TX		X
Reno-Tahoe International Airport, NV (ANG)		X
Rickenbacker International Airport; Columbus, OH (ANG)		X
Riyadh, Saudi Arabia		X
Robins AFB, GA		X
Rosecrans Memorial Airport; St. Joseph, MO (ANG)		X
Salt Lake City International Airport, UT (ANG)		X
Savannah/Hilton Head International Airport, GA (ANG)		X
Schenectady County Airport, NY (ANG)		X
Schriever SFB, CO		X
Scott AFB, IL		X
Selfridge ANGB; Mount Clemens, MI (ANG)		X
Seymour Johnson AFB, NC		X
Shaw AFB; SC		X
Sheppard AFB, TX		X
Sioux Gateway Airport; Sioux City, IA (ANG)		X
Spangdahlem AFB, Germany		X
Springfield-Bleckley Municipal Airport, OH (ANG)		X
Syracuse Hancock Intl. Airport; Syracuse, NY (ANG)		X
Tabuk, Saudi Arabia		X
Taegu, Republic of Korea		X
Talil, Iraq		X
Terre Haute International Airport, IN (ANG)		X
Thumrait, Oman		X
Tinker AFB, OK		X
Toledo Express Airport; Swanton, OH (ANG)		X
Travis AFB, CA		X
Truax Field; Madison, WI (ANG)		X
Tuscon International Airport, AZ (ANG)		X
Tulsa International Airport, OK (ANG)		X

Table 2-1. Wash Interval Based on Corrosion Severity Zones - Continued

Location	Severe (90 days)	Moderate/Mild (180 Days)
Tyndall AFB, FL	X	
Utapao International Airport, Thailand	X	
Vance AFB, OK		X
Vandenberg AFB, CA		X
West Virginia Intl. Yeager Airport; Charleston, WV (ANG)		X
Westover AFB; Chicopee, MA (AFRC)		X
Whiteman AFB; MO		X
NAS JRB Willow Grove, PA (AFRC & ANG)		X
West Virginia International Yeager Airport, WV (ANG)		X
Westfield-Barnes Regional Airport; Westfield, MA (ANG)		X
Will Rogers Intl. Airport; Oklahoma City, OK (ANG)		X
Wilmington Airport; Wilmington, DE (ANG)		X
Wright-Patterson AFB; OH		X
Yokota AB, Japan		X
Youngstown-Warren Regional Airport; ARS, OH (AFRC)		X

2.1.6 Cleaning Materials. An effective cleaning program significantly reduces the adverse impact of corrosion. The cleaning program includes the selection of authorized cleaning materials, mixed in the proper ratio for the surface to be cleaned, properly applied, and removed.

2.1.6.1 Material compatibility is a key element in a cleaning program. Cleaning material composition and surface condition affect the methods and materials to be used in cleaning. Certain nonferrous metals, such as zinc and aluminum, present special problems where heavy-duty alkaline or strong acid cleaners attack the metal. Roughness of surface tends to hold a soil, thereby making it harder to remove.



Selection and use of unapproved cleaning compounds or approved cleaning compounds improperly diluted may cause damage to the components or painted surfaces. Each cleaner has specific uses and must be carefully used to prevent personal injury or damage to equipment. Only use authorized cleaners that are listed on the Qualified Product List/Qualified Products Database (QPL/QPD) for a specific specification. Also, ensure all cleaning compounds are properly diluted for the types of soils to be cleaned. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

- A listing of the most current QPL/QPD for a specific cleaning compound can be found on the Defense Logistics Agency (DLA) website for specifications, handbooks, and QPL/QPD data (<https://qpldocs.dla.mil/default.aspx>) or on the Air Force Corrosion Prevention and Control Office SharePoint.
- Many of the authorized cleaning compounds are biodegradable in many waste treatment facilities, however some are not. Before purchasing and using a specific product, consult with the Base's environmental management section to verify that the cleaner(s) can be introduced into the wastewater treatment system.

2.1.6.2 Authorized cleaning materials, mixing ratios and cleaning procedures that may be used on SE are shown in [Table 2-2](#). MIL-PRF-87937, is the preferred cleaning compound for SE. However, if MIL-PRF-87937 is not available, MIL-PRF-85570, may be used. Spot cleaning may be conducted with CID A-A-59921 or ready-to-use types of MIL-PRF-85570/87937. The following is a brief general description of the different cleaning compounds.

2.1.6.2.1 CID A-A-59921, Class IA, is a very effective aerosol spot cleaner. It should not be used where ventilation is poor or on non-polyurethane paints/markings, vinyl markings/decals, unpainted/unprotected plastic or composite surfaces.

2.1.6.2.2 MIL-PRF-85570, Type I, is for general use on exterior surfaces, and is effective for use on heavy soils and grease. Type I cleaners contain solvents and should not be used in poorly ventilated areas or on painted lacquer surfaces, unpainted plastic or unpainted composite surfaces.

2.1.6.2.3 MIL-PRF-85570, Type IA, is the same product as Type I, but is in an aerosol used for spot cleaning on exterior surfaces. Type IA contains solvents and should not be used in poorly ventilated areas or on painted lacquer surfaces, unpainted plastic or unpainted composite surfaces.

2.1.6.2.4 MIL-PRF-85570, Type II, does not contain solvents and is used for general use on exterior and interior surfaces. It is effective on light oils and hydraulic fluids.

2.1.6.2.5 MIL-PRF-85570, Type III, is for use on high gloss surfaces only. It contains abrasives that remove soils by wearing away the surface that holds the soil. This cleaner will raise the gloss of gloss, semi-gloss, or flat topcoats. Type III is used to spot clean, and clean engine exhaust areas on gloss finishes.

2.1.6.2.6 MIL-PRF-85570, Type IV, contains solvents, detergents, and suspended rubber particles. It is a spot cleaner, for use on tactical coating systems. It effectively cleans exhaust tracks, smudges, boot marks, or other embedded soils. When this cleaning compound is rubbed on a soiled surface, the particles act like tiny erasers and remove soil by entrapping the soil in the rubber particles. This cleaner will not alter the gloss of a camouflage coating.

2.1.6.2.7 MIL-PRF-85570, Type V, is a low solvent (less than ten percent), gelled cleaner which can be used to replace solvent cleaning where water rinsing is allowed and can be used to clean vertical surfaces where thin cleaners will run off. To be fully effective, Type V must be applied to a dry surface, do not prerinse the SE before application of the Type V cleaning compound.

2.1.6.2.8 MIL-PRF-87937, Type I, is a terpene based solvent emulsion cleaning for general use on exterior surfaces. It is effective for removing heavy oils, greases and carbon deposits. Suitable for use on high gloss or tactical coating systems. Type I should not be used in poorly ventilated areas. Do not heat above 115 Fahrenheit (°F) (46 degrees Celsius (°C)). Type I will separate out oily waste, so the waste can be removed and disposed of while the remainder of the liquid is sent to a waste treatment facility.

2.1.6.2.9 MIL-PRF-87937, Type III, is a gelled cleaner, and is effective for cleaning medium to heavily soiled surfaces. May be used on painted or unpainted surfaces where additional dwell time is desired. It should be used in areas that can tolerate the high volumes of water rinsing necessary to remove the gelled cleaning compound. Since the cleaning compound is a gel, it will adhere to vertical surfaces for more effective cleaning. To ensure the cleaning compound effectiveness, apply the cleaning compound to dry surfaces. Type III will separate-out oily waste, however, since the cleaning compound is a gel-type material the oil/cleaner, separation is difficult to determine unless the solution sits for several hours.

2.1.6.2.10 MIL-PRF-87937, Type IV, is heavy duty cleaner, effective for cleaning heavy oils and greases. This material differs from Type I in that it has no flash point. Suitable for use on high gloss or tactical coating systems. Type IV will separate out oily waste, so the oil can be removed and disposed of while the remainder is sent to a waste treatment facility.

NOTE

MIL-PRF-87937, Types I and IV, cleaners may be used in dip tanks but are not formatted for use in vapor degreasing tanks. The gel-type cleaning compounds, MIL-PRF-85570, Type V, and MIL-PRF-87937, Type III, are not suitable for dip tank cleaning operations.

Table 2-2. Authorized Cleaning Materials

Type of Soils or Surfaces To Be Cleaned	Cleaning Material	Mixing Directions	Cleaning Procedures	Comments
Light Soils (Dirt, Dust, Mud, Salt, Loose Soot)	MIL-PRF-85570, Type I	1 part cleaner to 16 parts water	Apply cleaner solution with a foam generator, spray, sponge, soft bristle brush or cloth. Scrub and then rinse with fresh water and dry.	Best used for general cleaning on painted and unpainted surfaces. Suitable for use on high gloss or tactical paint systems.
	MIL-PRF-85570, Type II	1 part cleaner to 9 parts water		
	MIL-PRF-87937, Type I	1 part cleaner to 20 parts water		
	MIL-PRF-87937, Type III or MIL-PRF-85570, Type V	Undiluted	Allow the cleaner to dwell for 1-2 minutes, then agitate with a brush and completely rinse with water and allow drying.	The gel-type cleaning compound is designed to adhere to vertical surfaces for more effective cleaning. The cleaning compound contains abrasives that remove soils by wearing away the surface that holds the soil. This cleaner will raise the gloss of gloss, semi-gloss, or flat topcoats. The cleaning compound should be used in areas that can tolerate high volumes water rinsing necessary to remove the gelled cleaning compound. Do not use on plastic parts.
Moderate to Heavy Soils, Oils Hydraulic Fluid, Lube Oil, Light Preservatives and Carbon Buildup	MIL-PRF-680, Type II, III, or V	Undiluted	Apply with a brush, pad, or cloth and agitate, repeat until surface contaminants are removed from the surface or suspended in the solvent. If oily residue is acceptable, rinse with water and wipe dry with a clean cloth. If oily residue is not acceptable use the diluted cleaning compounds listed under the moderate soils section of this table.	
	MIL-PRF-87937, Type IV or MIL-PRF-85570, Type III	Undiluted	Allow the cleaner to dwell for 1-2 minutes, then agitate with a brush and rinse with water. If the surface is oily or greasy apply the cleaning compound to the dry surface, allow the cleaning compound to dwell for 5-15 minutes, then agitate and rinse with water. Agitate the area again with a brush and rinse with water to completely clean/rinse the area.	The gel-type cleaning compound is designed to adhere to vertical surfaces for more effective cleaning. The cleaning compound contains abrasives that remove soils by wearing away the surface that holds the soil. This cleaner will raise the gloss of gloss, semi-gloss, or flat topcoats. The cleaning compound should be used in areas that can tolerate high volumes water rinsing necessary to remove the gelled cleaning compound. Do not use on plastic parts.
	MIL-PRF-85570, Type I	1 part cleaner to 9 parts water	Apply with a brush, pad, or cloth and agitate, repeat until surface contaminants are removed from the surface or suspended in the solvent. Completely rinse with clean water. Wipe dry with a clean cloth.	Has a very high solvent content. Should not be used where ventilation is poor or on nonpolyurethane paints/markings, unprotected plastics or composite surfaces.
	MIL-PRF-85570, Type II	1 part cleaner to 4 parts water		

Table 2-2. Authorized Cleaning Materials - Continued

Type of Soils or Surfaces To Be Cleaned	Cleaning Material	Mixing Directions	Cleaning Procedures	Comments
Heavy Oils, Greases and Carbonized Exhaust Deposits	MIL-PRF-680, Type II, III, or V	Undiluted	Apply with a brush, pad, or cloth and agitate, repeat until surface contaminants are removed from the surface or suspended in the solvent. If oily residue is acceptable, rinse with water and wipe dry with a clean cloth. If oily residue is not acceptable use the diluted cleaning compounds listed under the heavy soils section of this table.	MIL-PRF-680, also known as Stoddard's Solvent or Dry Cleaning Solvent, can be used to clean a variety of soils, particularly oils, greases and hydraulic fluids. This is desirable if flash-rusting protection is needed. If the part cleaned with MIL-PRF-680 is to be painted or surface bonding is to occur, wiping the affected surfaces with a clean cloth dampened with a nonpetroleum based cleaning compound, or solvent cleaner such as Isopropyl Alcohol TTI-735 or Acetone ASTM D329.
	MIL-PRF-87937, Type I	1 part cleaner to 4 parts water	Wet surface with fresh water. Apply cleaning solution and scrub briskly with abrasive mat (CID A-A-58054, Type I, Grade A or B). Rinse with fresh water and dry.	Solvent emulsion cleaner. Should not be used in poorly ventilated areas. Do not heat the cleaning compound above 115 °F (46 °C).
	MIL-PRF-85570, Type I	1 part cleaner to 4 parts water		Should not be used in poorly ventilated areas or on painted lacquer surfaces, unpainted plastic or unpainted composite surfaces. After cleaning, the area must be thoroughly rinsed with water to prevent streaking or paint deterioration.
	MIL-PRF-85570, Type IA	No mixing, this is a premixed aerosol		
	CID A-A-59921, Class IA	No mixing, this is a premixed aerosol		
Spot Cleaning-Engine Exhaust Areas	MIL-PRF-85570, Type IV or V	Undiluted	Type IV: Apply full strength with a non-abrasive cleaning pad. Allow 1 to 3 minutes dwell time. Scrub with a circular motion. Rinse thoroughly, and then dry with a clean cloth. Do not allow cleaner to dry on surface.	Do not allow the cleaner to dry on the surfaces or rinsing may be difficult.
			Type V: Apply full strength with brush or pump spray device. Allow 5 minutes dwell time. Brush if necessary, then spray with fresh water to rinse.	

Table 2-2. Authorized Cleaning Materials - Continued

Type of Soils or Surfaces To Be Cleaned	Cleaning Material	Mixing Directions	Cleaning Procedures	Comments
Spot Cleaning-Stubborn Soil on Gloss Painted Surfaces	MIL-PRF-85570, Type III	Undiluted	Apply full strength with damp cloth. Allow the cleaner to dwell for 1-2 minutes. Rub with a circular motion. If the surface is oily or greasy apply the cleaning compound to the dry surface, allow the cleaning compound to dwell for 5-15 minutes, then agitate and rinse with water. Rub with a circular motion and completely rinse area, then dry with a clean cloth. Do not allow cleaner to dry on surface.	Abrasive spot cleaner for gloss surfaces only. This cleaner will raise the gloss of gloss, semi-gloss, or flat topcoats.
Spot Cleaning-Stubborn Soils on Tactical Paint Schemes Exhaust Tracks, Smudges, Boot Marks, or Other Embedded Soils	MIL-PRF-85570, Type IV	Undiluted	Apply cleaner with a nonabrasive cleaning pad. Allow 1-3 minutes dwell time. Rub with a circular motion. Rinse thoroughly, and then dry.	Cleaning compound contains rubber particles that aid in the cleaning process. Do not allow the cleaner to dry on the surfaces or rinsing may be difficult.

2.1.7 General Cleaning Material and Processes. Cleaning compounds facilitate oils, grease, and soil removal. However, cleaning compounds can damage certain material surfaces and parts if they are improperly diluted and applied.

2.1.7.1 Cleaning Solutions. Using cleaning solutions more concentrated than the manufacturer's dilution ratios are not acceptable. This action will have a detrimental effect on washing operations due to concentrated cleaning solutions tending to make surfaces slippery, the cleaning solutions will not properly dissolve or lift the contaminants from the surface being cleaned, and can impede the washing pads from loosening the soils. In addition, concentrated solutions require more rinse water to remove excess cleaner and may cause coating deterioration or corrosion.

2.1.7.2 Cleaning Compounds. Cleaning compounds may impart biochemical oxygen demand to the wash water and increase the Potential of Hydrogen (pH). Therefore, use of excessive amounts of cleaning compounds should be avoided.

2.1.7.3 High Pressure Wash/Hot Water Wash Equipment.



- High pressure wash equipment developing more than 175 Pound Per Square Inch, Gauge (PSIG) nozzle pressure shall not be used to apply cleaning compounds unless specifically authorized by the cognizant engineering authority. The use of high pressure equipment can cause damage to metal or composite structures. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
- High pressure wash equipment shall never be used on components, wheels, and brakes as they can force lubricants out of bearings and attach points and cause corrosion and wear problems. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

If approved by the cognizant engineering authority, high pressure/hot water wash equipment can be used for general purpose cleaning of support equipment, and vehicles. Reference Technical Order (TO) 1-1-691 for high pressure wash equipment information. These machines can deliver four gallon per minute of water and/or cleaning solution at a temperature of 210 °F (99 °C) and a pressure of 3,000 PSIG at the attach points on the machine for each output hose. These machines shall be operated in accordance with these instructions and the directions in the specific equipment operating manual.

- a. Fill the cleaner reservoir with only approved cleaning compounds.

- b. Set the water/cleaning compound mixture ratio to fifty parts water to one part cleaner.
- c. Use only 40 degrees flat fan spray nozzles (white plastic insert or metallic equivalent).
- d. Ensure that the nozzle stand-off distance to the surface is always at least 12 inches and never less.

NOTE

Pressure and temperature at the nozzles will be less than at the hose attach points on the machine due to losses in the hoses. This equipment may remove any loose sealant and coatings.

2.1.7.4 Water Temperature. Hot water washing breaks the bond between the grease/oil and the SE, flushing away the grease and oil. Engineering studies have concluded that hot water washers reduce the cleaning compound usage, as opposed to cold water washing, by approximately 80 percent, cleaning times by 20 to 75 percent, and potable water usage 30 to 90 percent. Hot water, not to exceed 140 °F (60 °C), shall be used, when feasible, for SE cleaning operations.

2.1.7.5 Deployed/Remote Sites. At deployed/remote sites, untreated, raw water can significantly impact the levels of dissolved metals/minerals in the wash water. Raw water could dissolve metals from building and wash water plumbing systems, including copper from copper pipe, zinc and lead from galvanized pipe, etc. Unless an emergency exists, organizations should have the nearest Department of War (DoW) civil engineer assess the water quality standards at the deployed locations prior to the commencement of washing operations. See [Chapter 7](#) for Units deploying or returning from Southwest Asia (SWA) environments, and [Chapter 8](#) for Units deploying or returning from Indo-Pacific (INDOPAC) environments. To assist Units in deployed locations, water quality standards are listed below in [Paragraph 2.1.7.6](#).

2.1.7.5.1 Water Assessment. In assessing the site wash water, the key water quality parameters: Potential of Hydrogen, water hardness, total dissolved solids, and Dissolved Oxygen (DO) helps assess the corrosivity of the water supply. In general, low pH (less than 7.0), and hardness (less than 50 milligrams per liter), and high DO content, values approaching saturation, greatly increase the corrosivity of the water.

2.1.7.5.2 Engines and Engine Components. Engines and engine components are usually washed in a wash rack using a pressurized hot water or steam cleaner. Cleaning compounds may be used in the washing process. Care should be taken to ensure the forced water and/or steam is not allowed to migrate or be forced into confined areas that would prevent proper drying as subsequent corrosion could result. A water displacing CPC should be applied as soon as possible after washing to corrosion prone areas such as piano hinges, behind seals, etc.

2.1.7.6 Water Quality/Recycled Water. Use only clean/fresh potable water for all equipment washing and rinsing operations. If using a closed-loop, recirculating water system, water shall meet the following requirements and be tested every 30 days to detect any build-up of corrosive salts and/or other contaminants. Any abnormal readings should be reported to the AFCPCO for waiver consideration.

- Chloride content shall be 400 milligrams per liter (mg/L) maximum (somewhat higher than environmental protection agency potable drinking water standard of 250 mg/L).
- pH shall be between 6.5 and 8.5.
- Total dissolved solids content shall be 500 mg/L maximum.
- Total suspended solids content shall be 5 mg/L maximum.
- The Langelier Saturation Index shall be slightly above 0.
- The biological oxygen demand concentration shall be 5 mg/L maximum.
- Adequate disinfection of the water shall be provided to control the growth of micro-organisms in the water.
- The water hardness shall be between 75 and 150 mg/L as CaCO₃.
- The total petroleum hydrocarbon content shall be 10 mg/L maximum.

2.1.8 Cleaning of Non-metal Parts Prior to Painting.



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

4



ISOPROPYL ALCOHOL, TT-I-735

9



ACETONE, ASTM-D329

20

To ensure proper adhesion between the coating and non-metal part being painted special consideration must be given to ensure the part is properly prepared for painting.

2.1.8.1 Composites. Clean with Isopropyl Alcohol, TT-I-735, Acetone, ASTM D329, or a solution of one part MIL-PRF-87937 to fifteen parts water.

- a. (MIL-PRF-87937 only). Rinse with water or wipe clean with a damp cloth.
- b. (MIL-PRF-87937 only). Allow to dry or blow dry with compressed air not to exceed 30 PSIG.

2.1.8.2 Plastics. Clean with a solution of one part MIL-PRF-87937 to four to fifteen parts water, depending on the soil levels. The heavier the soil, the stronger the solution needs to be. MIL-PRF-87937 must be diluted to work effectively.

- a. Rinse or wipe clean with a damp cloth.
- b. Allow to dry or blow dry with compressed air at less than 30 PSIG.

2.1.9 Cleaning of Electrical Parts. Electrical insulation, wiring, contact pins and components are subject to the collection of oil, fungus, and dirt. Cleaning can be accomplished as follows:

WARNING

Do not clean electrical equipment with the power on. There are hazards of personnel being shocked or electrocuted. Disconnect batteries prior to cleaning electrical generator sets as shorting of switches may cause power to be applied to system. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

CAUTION

Any solvent must be used with extreme care on insulation and insulated wires, particularly in electric equipment. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

2.1.9.1 Insulation, wiring and parts shall be cleaned with a clean cloth or sponge and TT-I-735 Isopropyl Alcohol. Solvents such as dry-cleaning fluids, mineral spirits, or paint thinners shall not be used to clean electrical insulation, insulated wiring and parts due to the injurious effect of these solvents on materials, such as rubber and fiber, and they are fire hazards.

2.1.9.2 Pins (male contacts) and receiver holes (female contacts) which are contaminated by fungus growth can be cleaned by wiping with TT-I-735 Isopropyl Alcohol. A clean, lint-free cloth moistened with the solvent should be used to wipe the pins and a toothpick or pipe cleaner saturated with the solvent should be used to wipe out the holes.

2.1.10 Preparation of SE for Cleaning. The cleaning operation is recommended in planned steps to obtain satisfactory results. In general, steps to be followed are as follows:

- To protect against cleaning solution entrapment, lubricate all fittings which will be exposed to wash solutions in accordance with end item maintenance manuals or maintenance cards. If fittings do not accept lubrication, replace and lube prior to wash.
- Inspect the surface to be cleaned and determine the type of cleaning compound and mixing ratio of cleaning compound that should give the satisfactory cleaning results. (See [Table 2-2](#).) From the inspection, determine what areas should be masked or protected.
- Protect louvers, scoops and other natural entrapments from the cleaning mixture by masking. Masking tape, ASTM D6123 or CID A-A-1689, Type I, Class 2, and/or barrier paper, MIL-PRF-121, can be effectively used for masking purposes.
- The cleaning solution shall not be allowed to dry on plastics, plate glass, and painted surfaces. The cleaning solution shall not be applied to large areas that cannot be adequately agitated and thoroughly rinsed before it dries. Streaks and less effective cleaning will result if mixture dries on the surface being cleaned.
- Cleaning operations being conducted outdoors will be closely controlled or not accomplished during the warmest part of the day or on windy days, as the cleaning solution will dry rapidly. Wetting the surface with clean, potable water before applying the cleaning solution will cool the surface and help prevent fast drying in hot weather. Cleaning shall be accomplished in shaded areas whenever possible during hot weather (above 80 °F (27 °C)).
- Apply the cleaning solution until the area to be cleaned is completely covered.
- Agitate the compound by scrubbing the surface with a nonmetallic brush. Vigorous scrubbing action with a brush is not usually required except in extremely soiled areas. Depending on weather conditions, allow approximately five to ten minutes from application of mixture before rinsing.

NOTE

Do not allow the cleaning mixture to dry on the equipment before rinsing. Doing so may result in damage to the protective coatings.

- Thoroughly rinse cleaning solution from the area being cleaned by using large amounts of clean, potable water. Heated water, not exceeding 140 °F (60 °C), will produce the best results.

NOTE

Water needed for thoroughly rinsing shall be readily available at the surface being cleaned. Streaking (white powder and surface dulling) will result if the cleaning solution remains on the surface being cleaned too long or dries.

- If streaking appears, immediate reapplication of the cleaning solution, followed by rinsing with clean, potable water will usually reduce or eliminate this condition.

2.1.11 Cleaning of Engine Components and Enclosures.



CLEANER, NON-AQUEOUS, LOW-VOC, HAP-FREE, MIL-PRF-32295

3



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

4



DEGREASING SOLVENT, MIL-PRF-680

8



REMOVER, CARBON, SAE AMS-C-19853

48

Remove carbon from disassembled engine parts with SAE AMS-C-19853, Carbon Removing Compound. Follow material manufacturer's instructions on the use of this product. This is a compound for removing or loosening carbon from engine components by means of immersion at ambient temperatures without agitation. This solution will remove many standard coatings. This material shall be used in a tank provided with a cover and in a well-ventilated area, although a water seal is provided to reduce evaporation and loss of the solvent. The water seal aids in pre-rinsing, reduces toxicity somewhat, and absorbs a portion of the contamination introduced when parts are being cleaned.



Carbon remover compound SAE AMS-C-19853 contains chemical compounds that are hazardous and must be confined to tank use. Disposal of this compound must be in accordance with state, local, and federal requirements. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

- a. To prevent contamination of carbon remover solution, remove all loose oil, grease and dirt from the parts with solvent MIL-PRF-680, Type II or III, or MIL-PRF-32295, Type II.
- b. Place parts in a mesh basket, or suspend by wire, and immerse in the lower layer of the solution. Agitation or excessive mixing of the two layers shall be avoided during cleaning operations.



- Ensure the parts are below the water seal. Do not allow the basket or parts to rest on the bottom of the tank. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
 - Do not intermingle ferrous and nonferrous metal parts in the same immersion tank of carbon remover or other cleaning compounds as corrosion will likely occur. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
- c. Close the lid of the tank and allow the parts to soak approximately two hours, depending on the hardness and extent of the deposits to be removed.
 - d. Raise the parts slowly, permitting the parts to come in contact with the upper layer for approximately 30 seconds, then remove from the tank.
 - e. Rinse parts with hot water under pressure and allow to dry. When heated water is not ready available, cold water may be used. However, a longer time rinsing is required when cold water is utilized.
 - f. If the SAE AMS-C-19853 cleaning compound is not available, MIL-PRF-87937, Type I, is capable of removing carbon. Use shall be at a concentration of two parts water to one part cleaner at ambient temperatures in the tank. Do not allow parts to remain immersed in the MIL-PRF-87937, Type I, for more than four hours without removal and inspecting the parts for cleanliness. For heavy carbon deposits, immersion for a maximum total of 16-hours may be necessary. After immersion, rinse with clean, potable water.

2.2 MECHANICAL CLEANING.

NOTE

Do not blast valve stems or precision-machined parts. All oil ports, passages and coolant passages shall be taped or plugged to prevent grit or beads from entering.

2.2.1 General Information. For the purposes of this TO, mechanical cleaning consists of sanding, grinding, wire brushing of the repair areas only or general scuff sanding only. For complete SE chemical or mechanical depainting and/or corrosion removal using medium pressure water blasting, abrasive media blasting operations to remove coatings and corrosion refer to TO 1-1-691 for information for advanced corrosion removal and surface treatment, and TO 1-1-8 for complete coating removal and replacement of protective finishes.

2.2.2 Coating Removal on Composite Surfaces.

WARNING

Paints may contain toxic materials such as chromates, barium, strontium, isocyanates, or lead. Use goggles, gloves, and cartridge respirator during mechanical cleaning of painted surfaces. Hearing protection and air respirator shall be worn during plastic media blasting operations as directed by your local Bioenvironmental Engineering Flight (BEF). Contact the local safety and health office for proper Personal Protection Equipment (PPE). Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

CAUTION

- SE personnel assigned to coating removal tasks must be specifically trained for the function to which they are assigned such as, the use of chemical coating removers, abrasive blasting materials and processes, powered tools, and damage limitations. Inadequate training will lead to further damage of equipment and poses a safety hazard to the individual. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
- For repainting operations, under no circumstances shall the primer be completely removed to expose the composite material substrate. Damage to surface fibers usually occurs when primer is completely removed. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

Coatings shall be removed from composites, such as fiberglass, carbon/graphite, and Kevlar® using only mechanical removal techniques as specified in this chapter, unless specific exceptions are provided in the appropriate maintenance manuals. Due to the irregularities in composite surfaces, complete removal of the topcoat and primer can damage fibers in the composite surface layers. Therefore, coating removal, for the purposes of recoating operations shall not go beyond the initial primer coat.

2.2.2.1 Coatings removed from composite surfaces for the purposes of performing coating repairs shall be performed by hand sanding or by using an orbital sander. The use of other types of powered sanders is prohibited due to the high potential for causing laminate damage. Use extreme care during topcoat and primer removal to prevent sanding into the laminate.

2.2.2.2 To scuff sand a composite surface for overcoating only use CID A-A-58054, Grade C (medium grade) abrasive mats without powered tools for scuff sanding of painted composite surfaces. Grade B (fine) or Grade A (very fine) abrasive mats maybe used with an orbital sander. The abrasive mat can be wet with fresh water, or diluted cleaning compounds listed in [Table 2-2](#) for light soils, to prevent clogging the pad.

2.2.3 Coating Removal on Metallic Surfaces. For areas of several square inches, coatings may be removed using abrasive mats or flap brushes, taking care not to remove underlying metal. Chemical coating removal may be used for areas larger than several square inches. Plastic media blasting, or medium pressure water blasting, may be used at organizational levels of maintenance activities and depots to remove coatings on equipment with panel skins thicker than 0.0625 inches (16 gauge).

2.2.4 Grinding. Grinding is normally accomplished with motorized grinding equipment and rubberized abrasive wheels, discs or abrasive belts. Grinding is normally used to remove heavy corrosion by wearing the corrosion away. Care should be taken with this corrosion removal process as sound metal is also removed with the corrosion product. The basic steps in grinding are:

- Protect adjacent components from scale, chips, and corrosion products.
- If grease or oil is present, clean areas with the appropriate cleaner(s) listed in this TO prior to mechanical removal operations. Ensure all oil and grease residues are removed before proceeding.
- Remove coatings and corrosion until a corrosion-free surface is reached. Continue grinding to remove coarse irregularities. Use fine abrasive paper to polish the surface to the desired finish.
- After mechanical cleaning and rework has been completed, immediately apply surface treatments and coatings in accordance with [Table 3-4](#).

2.2.5 Wire Brushing.

WARNING

The use of goggles or face shield is mandatory when using motor driven wire brushes since corrosion particles can break loose and fly off. Conduct all painting operations only in an approved spray booth equipped with adequate ventilation and exhaust. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

CAUTION

Do not use carbon steel or copper wire brushes on aluminum surfaces. Carbon steel or copper particles may become embedded in the aluminum causing galvanic corrosion to occur. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

Wire brushing is a mechanical cleaning operation usually accomplished with a hand wire brush or a wire brush mounted on a motor driven wheel. By using different types of brushes, and various kinds, length, and gages of wire, a wide range of mechanical cleaning actions are possible. Wire brushing is used to remove heavy corrosion and imbedded coatings or other contaminants. A typical wire brushing procedure follows:

- a. Protect adjacent components from scale, chips, and corrosion products.
- b. If grease or oil is present, clean areas with the appropriate cleaner(s) listed in this TO prior to wire brushing operations. Ensure all oil and grease residues are removed before proceeding.
- c. Remove loose corrosion with a hand scraper or pneumatic tools.
- d. Wire brush area to a sound metal subsurface, ensuring all of the corrosion deposits are removed from the corrosion pits.
- e. After mechanical cleaning and rework has been completed, immediately apply surface treatments and coatings in accordance with [Table 3-4](#).

2.2.6 High-Pressure Water (HPW) Coating Removal Method.

CAUTION

HPW coating removal system can cause severe damage to equipment and injury of personnel if instructions are not followed properly. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

HPW (40,000 PSIG) coating removal is authorized for use at depot and field-level operations subject to meeting all personnel training, safety, and technical data requirements. HPW equipment is an excellent method for coating removal from support equipment with a minimum panel thickness of 0.0625 inches (16 gauge). The HPW system can be used with or without blast abrasive such as bicarbonate of soda. These instructions are not intended to be all-inclusive, but are general guidelines to be used in conjunction with applicable system-specific equipment manuals and/or a definitive process order.

2.2.6.1 Authorized HPW Equipment. This removal method requires the use of HPW and may be used with a bicarbonate of soda injection system with control hoses, and handheld nozzles of various configurations. The injection system shall consist of a positive feed control system, such as an auger/computer-controlled system. Only the equipment listed in [Table 2-3](#) has been approved for Air Force use.

2.2.6.2 Training Requirements. There are several types of training that can be used to properly train personnel in the proper use and safe operations of the HPW equipment and processes. Regardless of the training method, all personnel shall be properly trained prior to operating equipment.

2.2.6.2.1 Manufacturer Provided Training. The equipment manufacturer may provide on-site, video, or computer-based training for the safe operations of the equipment.

2.2.6.2.2 Locally Developed Training. A locally developed training program can be used for general instruction of equipment operation and safety requirements. This training should include hands-on practical training in HPW coating removal using all appropriate safety equipment.

2.2.6.3 Personnel and Equipment Preparation Prior to HPW.

WARNING

- HPW can cause serious personal injury if the nozzles are directed at personnel. Never point the nozzle in the direction of other personnel. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.
- Water and blast media can create slippery conditions. Walking on top of equipment should be avoided. Use fall protection and all work stands shall have guardrails in place. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

Prior to performing the HPW coating removal process, the following measures should be taken to ensure the safety of personnel and protection of the equipment to be depainted.

- a. Defuel and disconnect the battery of the equipment to be depainted.
- b. Ensure the SE seams, and crevices are protected from water intrusion/entrapment to prevent corrosion.
- c. Remove and protect from the HPW steam, all soft metal/non-metal components such as data plates, copper parts, hoses, etc.
- d. All sources of ignition shall be kept a minimum of 50 feet away from the HPW coating removal process.
- e. Personnel involved in the HPW process shall wear as a minimum: earplugs, earmuffs, full-face shield, wet weather gear, water-resistant hood, waterproof shoes, and shin and instep guard assemblies. The skin and instep assembly should be puncture resistant aluminum with a 5-inches wide x 6-inches long instep section attached by a hinge assembly to a shin section of at least 20-inch length.

2.2.6.4 HPW Coating Removal Operation. HPW coating removal operations can damage equipment and personnel if instructions and precautions are not followed. Following the requirements below are necessary to prevent damage:

- a. The HPW equipment should have operating parameters of water pressure not to exceed 40,000 PSIG, water flow of 2.85 gallon per minute, and bicarbonate of soda blast media flow rate 1/4 to 1/2 pound per minute.
- b. The nozzle standoff distance should be within the range of 2 to 4 inches from the tip of the nozzle to the working surface.
- c. The angle of incidence between the nozzle and the work surface should be within the range of 40 to 60 degrees from the surface being stripped.
- d. The nozzle should be moved across the surface at a minimum rate of 4 inches every second.

2.2.6.5 Post HPW Coating Removal Cleaning.

CAUTION

Care should be taken in HPW coating removal operations to preclude blasting media intrusion and warpage of unsupported thin panels. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

NOTE

HPW coating removal will present a high potential for flash rusting on equipment. Ensure equipment is primed or treated with a flash rust inhibitor within a maximum of 48 hours after coating removal.

After completing the HPW coating removal process, the following steps should be taken to ensure equipment is protected against flash rust and corrosion:

- a. Remove any protective materials.
- b. Areas where the coating was shielded from the HPW process should have coatings mechanically or chemically removed in accordance with TO 1-1-8, Organic Finish System Removal.
- c. Open, inspect, and flush all areas where blast media may be entrapped with clean, fresh water.
- d. The equipment or components should be thoroughly washed in accordance with [Chapter 2](#).
- e. Allow the equipment and/or components to thoroughly dry.
- f. Prepare equipment and/or components for a coating system or treat with a flash rust inhibitor such as Hold-Tight 102. Flash rust inhibitors are temporary rust inhibitors that usually allow an additional 48-hour interval before priming without flash occurring.

Table 2-3. Authorized HPW Equipment

Equipment	National Stock Number (NSN)	Notes
E-75 Electric Unit	4940-01-438-7212	Aqua Miser water only unit, with 75 Horsepower (Hp) motor; includes rotary gun and 50 feet hose assembly.
D-115 Diesel Unit	4940-01-451-0022	Aqua Klean Centrifuge Unit, 115 Hp diesel; 40,000 PSIG with abrasive injection; includes rotary gun and 50 feet hose assembly.
E25M Electric Unit	4940-01-413-5627	Electric, 25 Hp, Utilities required 30 standard cubic feet per minute at 100 PSIG of compressed air, 6 gallon per minute at 45 PSIG clean fresh water, 70 Amperes service of 460 volts, 60 cycle 3-phase electricity with exact feed media controls.
E25M Electric Unit	4940-01-395-9471	Standard 25 Hp unit. Has controls, breaker box, and a computer to regulate the pressure of bicarbonate of soda; the computer gives the exact amount continuously without fluctuating.
D44 Diesel Unit	4940-01-413-5629	Diesel, 44 Hp, 16-1/2 gallon fuel tank, pressure feed media system with micro adjusted regulator. Utilities required 6 gallon per minute at 45 PSIG clean fresh water.
D44 Repair Kit Model 900-500 Rotary Gun	4940-01-411-9829	Repair kit for D44 high pressure cleaner unit. Contact HPW equipment vendor directly for part number and ordering information.
Bicarbonate of Soda Blast Media Combo Foot Shin Guard	5350-01-414-1894	Water, Soluble, Powder Form, 50 pounds bag. Contact HPW equipment vendor directly for part number and ordering information.

2.2.7 Handheld Laser (HHL). The HHL is a portable Class IV laser system that effectively removes coatings, corrosion, and significantly reduces the generation of hazardous waste via a process known as ablation. Ablation causes oxidized substrates and organic-based coatings to go directly from a solid state to gaseous phase where remaining particulates are vacuumed through the 3-stage HEPA filtration system from the point of contact. When correctly applied to the corrosion/coating removal and surface preparation processes on SE, it eliminates the requirement for a respirator, significantly increasing an Airman's comfort during use.

2.2.7.1 Prior to considering procurement of an HHL, the Unit shall coordinate with the Installation Laser Safety Officer (ILSO) and the local BEF. The ILSO will be responsible for approving your standard operating procedures and advising you on your laser safety training program; templates are available for this in MIL-HDBK-529. The BEF will be responsible for validating PPE requirements and may elect to do sampling for chromates and other potential hazards during HHL use.

2.2.7.2 Use of the HHL requires the following facility requirements:

- 480 volts, 3-phase, 20 amperes, 50 or 60 hertz power with a receptacle compatible with HBL2431 plugs.
- Dry, compressed air (54 PSIG maximum).

- Dedicated area where all windows, cracks, and other openings that can transmit light must be masked with aluminum, protected with qualified laser safety glass, or appropriately covered with properly rated laser safety curtains to ensure no laser beam transmission.
- Equipment is designed to operate between 40 and 95 °F (4 to 35 °C) with up to 95 percent Relative Humidity (RH); lower RH is desired for efficiency. Units requiring portability should procure a wheeled trailer capable of attaining the same environmental conditions.

2.2.7.2.1 Ideal use of the HHL is inside of a dedicated room with limited entries. This makes control of the laser much easier and presents a safer environment to operate the HHL. The area should be clean to prevent injury or contamination of the laser; a blast media or paint booth may not be appropriate. In the event a dedicated room is not available, laser safety curtains shall be used to provide an appropriate barrier from laser beam transmission.

2.2.7.2.2 It is essential that facilities are prepared for receipt of a HHL. Any Units interested in procuring a HHL shall coordinate with the equipment manufacturer prior to installation/use. Failure to have proper facilities and safety equipment will render the HHL useless until all requirements have been met.

2.2.7.3 HHLs are a very unique tool for corrosion and coating removal, and require special training in order to be safely and effectively utilized. All previous testing, validations, and demonstrations have been conducted by the Product Support Engineering Division, AFLCMC/EZP to develop these protocols. All HHL inquiries shall be directed to the AFCPCO at afcorr@us.af.mil.

2.2.7.4 Safety is of utmost importance when using a HHL. Section Chiefs should use discretion in who they allow to be trained. HHL users should be Airmen with mature judgement who can be relied upon to follow standard operating procedures and recommended control procedures.

2.2.7.4.1 Appropriate safety measures can be found in MIL-HDBK-529, cleanLASER's operating manuals, and local standard operating procedures (where applicable). These requirements for safety shall be adhered to at all times.

2.2.7.5 The cleanLASER 300 W (CL300; NSN: 5860-01-674-6025) and cleanLASER 1,000 W (CL1000; NSN: 5860-01-687-7673) have been demonstrated on SE at multiple locations across the USAF.



Use of the HHLs have not been approved on aircraft parts. Under no circumstance shall an HHL be used on any aircraft or aircraft part unless specifically referenced in the applicable weapon system TO. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

2.2.7.5.1 HHLs are not a drop-in replacement for other mechanical or chemical corrosion and coating removal methods. There are some areas where use of the laser may prove more beneficial than others when stripping SE. Given feedback from various demonstration sites, the following is a list of areas where the HHL would likely be superior to other chemical or mechanical stripping methods:

- Spot stripping: Stripping small areas of coatings/corrosion prior to touch-up.
- Removal of decals: Decals that are fastened using an adhesive backing may come off much more easily after running the laser across it a few times.
- Weld stripping: SE with broken welds or welds required to undergo non-destructive inspection on a periodic basis is easily stripped using the HHLs.
- Removing corrosion: The HHLs, especially the CL1000, have shown good results in removing corrosion. Coatings are removed at a rate of approximately 2 mils per square foot per minute using the CL1000.

2.2.7.5.2 Sections primarily focused on large areas of coating removal, or completely depainting SE, would likely not benefit from use of the HHLs. This is due to a slower removal rate when compared to other approved mechanical or chemical methods.

NOTE

Stripping using the HHL does not require a respirator if the approved vacuum unit (TEKA LFE-301 (NSN: 5860-01-688-0784) or LFE-401) is used, unless mandated by the local BEF. Multiple tests conducted internal and external to the DoW have shown all contaminant levels are below the Occupational Safety and Health Administration (OSHA) required operational exposure limits. Thus, use of the HHLs by personnel that are not respirator certified, e.g., AGE or Metals Technology section personnel, may provide an added logistical benefit by reducing the transport of SE to multiple Sections during the repair processes.

2.2.7.6 Use of the HHL shall be in accordance with MIL-HDBK-529. All appropriate operational, maintenance, and safety information is stated within unless otherwise referenced by this handbook. Any questions or concerns shall be directed to the AFCPCO in accordance with [Paragraph 2.2.7.3](#).

CHAPTER 3

PAINTING, SEALING, CORROSION SCORING, AND CORROSION PREVENTIVE COMPOUND (CPC) APPLICATION

3.1 GENERAL.

Operators may need to wear respiratory protective equipment when spraying coatings, or the area may need proper exhaust ventilation. United States Air Force (USAF) organizations that apply protective coatings will request initial and annual surveys by the local Bioenvironmental Engineering Flight (BEF) and Wing Safety Office. Their recommendations for complying with Air Force Occupational Safety and Health Standards (AFOSH) will be followed. Contractor personnel will comply with all BEF instructions, Wing Safety Office guidelines, and Occupational Safety and Health Administration (OSHA) Standards.

3.2 DEFINITION OF EXPOSURE.

Exposure is defined as Support Equipment (SE) that is subjected to combined direct action of climatic elements (to include the interior of such units). Climatic elements include temperature extremes, humidity extremes, rain, hail, snow, sleet, salt-laden air, industrial atmospheres, direct solar radiation, dust, and scouring action of wind-blown sand.

3.3 REQUIREMENTS FOR PAINTING-FIELD LEVEL.

NOTE

Fabrication and AGE Flight Chiefs/Superintendents, and Wing Corrosion Managers (WCM) are authorized to make the determination if SE requires complete repainting.

SE shall be repainted when painted surfaces have become bare or exposed due to coating deterioration or damage, or when it is determined that the equipment is inadequately protected from corrosion. Repainting of SE for purely cosmetic reasons is prohibited. SE units will be prioritized through the workflow on a **worst first** basis as determined by SE scoring documentation. See [Table 3-1](#) for SE scoring guidance. All SE receiving a coating refurbishment will have a contrasting color or black (color number 37038) paint block of no less than 2-1/2 inches applied to the SE as close as practical to identification plate by the activity that applied the coatings. Stencils or decals may be used for the paint block. [Figure 3-1](#) shows an example of a typical paint block.

Painted By: _____ Date: _____ MIL SPEC, Type, Class, P/N: Pretreat if applicable _____ Primer: _____ Topcoat: _____

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Figure 3-1. Typical Marking for Paint Facility/Finish Identification Block

NOTE

For non-standard, unique coatings, or unknown MIL-Specs, add manufacturer's part number or product code to the paint block.

3.3.1 Coating Requirements. Comply with all cited coating requirements in [Chapter 3](#).

3.3.1.1 Corrosion Control Scoring Program and Complete Repainting Criteria. SE requires a robust corrosion program to ensure the longevity of the equipment. A system of scoring, prioritizing, and scheduling will assist with preservation and refurbishment.

3.3.1.1.1 Corrosion Scoring. The SE corrosion condition shall be scored annually during periodic scheduled maintenance inspections. This allows prioritization and scheduling with the appropriate corrosion control facility. The SE shall be prioritized and scheduled on a **worst first** basis. The SE's owning work center will score the equipment using categories ranging from 1-4 as described in [Table 3-1](#), and track the scores as referenced in [Paragraph 3.3.1.1.2](#).

3.3.1.1.2 Corrosion Scoring Records. The score assigned to SE during the corrosion inspection process shall be recorded and stored within the Maintenance and Utilization (M&U) module of the Enterprise Logistics Management System (ELMS). Units may utilize an additional local tracker for ease of refurbishment prioritization. SE will be evaluated to determine an accurate corrosion score. The minimum areas evaluated for deterioration and corrosion are:

Deterioration involves:

- Panels or component surfaces.
- Framework, sub-frame, chassis, and axles.
- Panel or component edges.
- Welds and spot-welded panel seams.
- Fasteners and latches.
- Attachment points.

Deterioration involves:

- Chipped, peeled or blistered paint on panel surface.
- Visible corrosion (rust, pits, white powdery deposits or rust leaching from panel seams).
- Cracked coating around welds or fastener heads.
- Cracked, peeled or discolored paint at panel seams.
- Cracked or peeled coating at attachment points.
- Coating deterioration caused by environmental agents, ultraviolet light, corrosive fluids as evidenced by excessive fading or a chalky residue on panel surfaces.
- Missing coatings over recent weld repairs.

3.3.1.2 Scoring Categories. To set the priority of scored equipment, technicians evaluate the SE and place it in one of four categories. (See [Table 3-1](#).) These categories range from Category 1 being best, requiring no touch-up, and Category 4 as worst, requiring either extensive disassembly, repair, and refurbishment, or disposal of the equipment. [Figure 3-2](#) through [Figure 3-5](#) show examples of the various corrosion categories in order to provide visual reference to match the descriptions provided in [Table 3-1](#). Leadership, as noted in the beginning of [Chapter 3](#), should utilize this tool to determine the priority for induction of **worst first** into the refurbishment workflow unless the maintenance situation requires a different prioritization methodology.

Table 3-1. SE Scoring/Category Criteria

Category	Deterioration/Corrosion	Action Required	Examples
Category 1	New coatings or recently touched-up. No chips, cracks, or scratches exposing bare metal. Coatings aren't faded or mismatched. No visible rust or blistering of coating at seams.	SE requires no touch-up. Apply CPCs in corrosion prone interior and exterior areas as preventive maintenance. (See Paragraph 3.13 .) No visible rust or blistering of coating at seams.	Figure 3-2

Table 3-1. SE Scoring/Category Criteria - Continued

Category	Deterioration/Corrosion	Action Required	Examples
Category 2	Minor corrosion or surface rust that can be removed by sanding or wire brush. Minor chipping, peeling or scratches of coatings. Minor fading or chalking of coatings. Replacement of corroded fasteners, latches, fittings, and handles.	Any of these conditions can be repaired by spot sanding or wire brushing and touched up with spot aerosol spray, brush or roller. See Paragraph 3.3.3 for touch-up guidance. An application of CPC can be applied as a temporary repair until the SE can be scheduled for permanent repair. (See Paragraph 3.13.) Once the above repair actions are accomplished, the SE can be placed in Category 1.	Figure 3-3
Category 3	Moderate corrosion or surface rust. Moderate chipping, peeling or scratches of coatings. Moderate fading or chalking of coatings. Moderate to localized extensive corrosion on removable panels or parts. Spot-welded panel seams leaching rust. Overall look is excessively faded or weathered.	Conditions can be repaired by removing panels and routing through fabrication flight for repair and repainting or by sending whole SE for a partial or complete scuff and overcoat. See Paragraph 3.3.2.3 for scuff sand and overcoat instruction. An application of CPC can be applied as a temporary repair until the SE can be scheduled for permanent repair. (See Paragraph 3.13.) Once the above repair actions are accomplished, the SE will be placed in the appropriate category.	Figure 3-4
Category 4	75 percent of the total exterior surface displays obvious oxidation, bleaching, peeling, cracking, flaking, etc. Severe corrosion or surface rust and pitting. Extensive chipping or peeling of coatings covering whole sections. Rusting through leaving holes through panels, seams, framework, chassis or axles. Units requiring extensive local manufacturing of new panels, framework, or chassis components.	Conditions necessitating extensive disassembly of the SE prior to complete stripping by media blasting to remove corrosion. SE will be de-painted and repainted in accordance with Table 3-4. An application of CPC can be applied as a temporary repair until the SE can be scheduled for permanent repair. (See Paragraph 3.13.) Once the above repair actions are accomplished, the SE shall be placed in the appropriate category.	Figure 3-5



Figure 3-2. Example of Category 1 Corrosion



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Figure 3-3. Example of Category 2 Corrosion



TO-35-1-3-137

Figure 3-4. Example of Category 3 Corrosion



TO-35-1-3-134

Figure 3-5. Example of Category 4 Corrosion

3.3.1.2.1 Complete Repaint Criteria. SE requires complete repainting when the coating system fails. A coating system is considered failed when over 75 percent of the total exterior surface displays obvious oxidation, bleaching, peeling, cracking, flaking, etc. When the coating system has failed it will be completely stripped and repainted by qualified personnel in accordance with [Table 3-4](#). The corrosion control facility performing the SE repaint (i.e., Fabrication Flight, contractors, depot, etc.) will validate the need for a complete repaint prior to accepting the SE into the corrosion flow.

3.3.2 Abrasive Blasting. The most effective means of completely depainting and removing corrosion from SE is by mechanical means such as abrasive blasting using approved engineered media blasting, water blasting, or water blasting with abrasive grit injected into the water stream. Engineered media blasting is effective in removing coatings and light surface corrosion from SE but will not effectively remove heavy corrosion. Technical Order (TO) 1-1-691 and TO 1-1-8 provide in depth guidance on abrasive blasting material selection and processes. Refer to these TOs for the effective development and execution of all SE abrasive blasting corrosion and coating removal programs.

3.3.2.1 Several coating systems require complete coating removal and surface preparation to include a white metal or near white metal surface condition with a minimum of a 2-mil surface profile. This requirement can only be achieved through abrasive blasting or High-Pressure Water (HPW) blasting. Several HPW blasting systems will allow the injection of abrasive grit into the water stream to achieve the required surface profile. Consult the equipment manufacturer's data sheet for additional guidance. Ensure the combination of abrasive grit and medium/HPW will not cause warping or other structural damage to SE and that this process is environmentally acceptable prior to the requisition of the abrasive blasting equipment.

3.3.2.1.1 For complete coating and corrosion removal and surface preparation to include white metal or near white metal surface condition of iron and steel substrates (other than stainless steel), 0.0625 inch (16-gauge) or thicker, use one of the authorized products listed in the table below:

Table 3-2. Authorized Blasting Materials for Iron/Steel

Product	Manufacturer
Starblast™/Starblast XL™	Chemours Company 5222 Treat Rd, Starke, FL 32091 https://www.chemours.com/ Commercial and Government Entity (CAGE) Code: 9Z037
Starblast™	Cesco, Inc 7251 Cross Country Rd, North Charleston, SC 29418 Phone: 888-772-3726 http://www.blastandpaint.com CAGE Code: 6K233
Quickstrip-G® (20-40 mesh)	UST Media 509 Water St SW, Bolivar, OH 44612 Phone: 330-455-1181 http://www.ustmedia.com/ CAGE Code: 7CHT8
Galaxy Garnet	Opta Industrial Minerals Group 300 Corporate Pkwy-118N, Amherst, NY 14226 Phone: 716-446-8888 http://optagroupllc.com/galaxy-garnet CAGE Code: L4566

3.3.2.1.2 For complete coating and corrosion removal and surface preparation, to include white metal or near white metal surface condition, of aluminum, magnesium, stainless steel alloys and for iron and steel substrates less than 0.0625 inch (16-gauge), use dry glass bead blasting media meeting MIL-PRF-995 or SAE AMS2431/6 specifications.

3.3.2.2 **Medium Pressure Water Blasting.** Medium pressure water blasting, with operating pressures less than 40,000 Pound Per Square Inch, Gauge (PSIG) is also authorized for coating removal on SE. All requirements and safety considerations listed in abrasive blasting sections of TO 1-1-691 and TO 1-1-8 apply. Ensure the SE seams, and crevices are protected from water intrusion/entrapment to prevent subsequent corrosion. Remove or protect from the HPW stream, all soft metal/nonmetal components such as data plates, copper parts, hoses, etc.

3.3.2.2.1 The use of the optional variable speed drive for the medium pressure water blasting units is required if abrasive media will be introduced into the pressurized water stream.



- Care should be taken in coating removal preparation with all pressurize coating/corrosion removal processes to preclude blasting media intrusion and warpage of unsupported thin panels. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
- Water blasting of equipment that has been primed with a chromate containing primer may allow leaching of the chromate into the wastewater. Organizations shall gain approval from the appropriate environmental management office of primary responsibility prior to the commencement of water blasting activities. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

3.3.2.2.2 Use the lowest effective water pressure when removing paint or when abrasive media is used in combination with the medium pressure water to remove corrosion.

3.3.2.3 Scuff Sand and Overcoat.



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

4



CLEANING COMPOUND, AIRCRAFT EXTERIOR, MIL-PRF-85570

5



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

11



PRIMER, EPOXY, HIGH SOLIDS, CORROSION INHIBITING, CHROME FREE, 02GN093

12



PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377

13



TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285

17



ADHESION PROMOTER, COATINGS, AEROSOL, SUR-PREP™ AP-1

21



PRIMER, EPOXY, WATER BASED, LEAD AND CHROMATE FREE, MIL-DTL-53030

25



PRIMER, EPOXY, NON-CHROMATED, AEROGLAZE™

26



THINNER, AIRCRAFT COATING, MIL-DTL-81772

27

If disassembly and complete mechanical removal is impractical within the organization, or due to environmental constraints, the requirements of [Table 3-4](#) for mechanical removal and application of the two-layer metal-rich primer (MIL-PRF-32550)/intermediate primer (MIL-DTL-53030), on ferrous alloys waived and replaced with MIL-DTL-53022, Type IV, Class L. Aluminum, fiberglass, and stainless steel equipment and parts will not be coated with metal-rich primers at any time.

3.3.2.3.1 Unless otherwise directed by end item technical orders, bare aluminum and fiberglass parts and equipment shall be primed with MIL-DTL-53022, Type IV, Class L (preferred), or MIL-PRF-23377, Type I, Class N.

3.3.2.3.2 If existing coating system has maintained a smooth, undamaged surface, Zip-Chem Sur-Prep® AP-1 is authorized for use in lieu of scuff sanding. Sur-Prep® AP-1 shall be used in accordance with manufacturer's instructions.

3.3.2.3.3 All equipment receiving the scuff sand and overcoat type of maintenance painting, where bare metal is not exposed, may use the listed non-chromated tie-coats over existing MIL-PRF-85285 coating systems:

- MIL-DTL-53022, Type IV, Class L (preferred)
- MIL-PRF-23377, Type I, Class N
- MIL-DTL-53030
- Aeroglaze 9741 (light gray)
- Aeroglaze 9743 (red)
- Aeroglaze 9744 (dark gray)
- PPG 02GN093, Rare Earth Conversion Coating (RECC), Chrome Free, Epoxy Primer

3.3.2.3.4 Preparation and Priming of Plastic Components/Panels. Plastic components/panels should be prepared and coated as follows:

NOTE

- All contaminants must be removed prior to sanding to prevent embedment of contaminants into the plastic surfaces.
 - Do not use water-borne primers on plastic components. Only solvent-borne primers will allow the primer to bond to the plastic.
 - Do not use sandpaper coarser than 240 grit, as it can damage the plastic surfaces.
- a. Clean with properly diluted MIL-PRF-87937/MIL-PRF-85570 cleaning compound in accordance with [Chapter 2](#).
 - b. Scuff sand with 240 grit sandpaper to remove coating imperfections, taking care not to sand into the component substrate.
 - c. Wipe with solvent thinner MIL-DTL-81772, Types I, II or III, in accordance with TO 1-1-8.
 - d. Apply a non-chromated primer (tie-coat) listed in [Paragraph 3.3.2.3.3](#), excluding MIL-DTL-53030.
 - e. Apply MIL-PRF-85285, Type IV, topcoat in accordance with TO 1-1-8.

3.3.3 Temporary Coating Repairs. For temporary repairs of chipped coatings and mild to moderate corrosion, use the appropriate CPC listed in [Paragraph 3.13](#). For severe corrosion that cannot be permanently repaired, the use of rust converters is recommended. For more permanent repairs of small, chipped areas, use authorized coating systems that are contained in items such as but not limited to: SEMPENs, Preval® sprayers, Clip-Paks®, brush and roller, or two-component MIL-PRF-85285, Type IV, Class H, aerosol cans. Single component aerosols, including enamels, lacquers or polyurethanes, are not authorized coatings and shall not be used. Larger defects in coatings or damaged areas will be grounds to repaint the complete section as determined by Fabrication or AGE Flight Chief/Superintendent.

3.3.3.1 Rust Converters.



CONVERTER, RUST, RUST TRAP™

39



CONVERTER, RUST, RUST REFORMER

40



CONVERTER, RUST, LOCTITE® EXTEND RUST NEUTRALIZER

41



CONVERTER, RUST, LOCTITE® SF 754

42



CONVERTER, RUST, VPCI CORRVERTER® RUST PRIMER

43



CONVERTER, RUST, NEUTRARUST® 661

44

Rust converters typically consist of mixtures of phosphoric acid, organic alcohols, and tannates in a latex matrix that forms a protective film on the metal surface that protects against rust. They are designed to be applied directly to rusty surfaces where they convert residual surface rust on steel surfaces to harmless and adherent chemical compounds. Unlike the standard sand, prime, and paint regime, the surface does not require stripping to bare metal. See the table below for authorized rust converter products.

3.3.3.1.1 Recommended Rust Converter Products:

Table 3-3. Authorized Rust Converters

Product	Manufacturer
Rust Trap™	SEM Products, Inc. 1685 Overview Dr, Rock Hill, SC 29730 Phone: 888-772-3726 http://semproducts.com/
Rust Reformer	Rust-Oleum Corp 11 E. Hawthorn Pkwy, Vernon Hills, IL 60061 Phone: 847-367-7700 http://www.rustoleum.com
LOCTITE® Extend Rust Neutralizer	Henkel Corp 26235 First St, Westlake, OH 44145 Phone: 800-624-7767

Table 3-3. Authorized Rust Converters - Continued

Product	Manufacturer
LOCTITE® SF 754	http://www.loctiteproducts.com Henkel Corp 26235 First St, Westlake, OH 44145 Phone: 800-624-7767 http://next.henkel-adhesives.com
VpCI CorrVerter® Rust Primer	Cortec Corp 4119 White Bear Pkwy, St. Paul, MN 55110 Phone: 651-429-1100 http://www.coretecvc.com
Neutrast® 661	Neutra Rust Europe Limited 4 Comet House, Calleva Park, Aldermaston, Berkshire, RG7 8JA Phone: +44 (0) 118-206-7788 http://neutrast.co.uk/

3.3.3.1.2 Lightly abrade the surface with a Scotch-Brite™, or equivalent, pad (CID A-A-58054, Type I, Grade A), wire brush, sandpaper, or other equivalent material to remove loose rust only, leaving adherent rust on surface, and gently wipe abraded area with towel or cloth to remove dust and debris. Apply the rust converter in accordance with manufacturer's instructions. Apply a second coat if required.

3.3.3.1.3 After the rust converter has cured in accordance with the manufacturer's instructions, apply a coating system in accordance with the scuff sand and overcoat process of [Table 3-4](#) utilizing standard maintenance painting procedures as soon as possible. Once completed, this process will serve as a permanent repair.

3.3.4 Touch-up Primer.



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

11



PRIMER, METAL-RICH, MIL-PRF-32550

14

If steel surfaces on SE requires scuff sanding and overcoating, and the prepared surface is exposed, bare metal, a metal-rich primer MIL-PRF-32550, Type I, Form A, Class S, or MIL-DTL-53022, Type IV, Class L, primer shall be utilized. If the prepared surface is not exposed, bare metal, a tie-coat primer in accordance with [Paragraph 3.3.2.3.3](#) shall be utilized.

3.4 REQUIREMENTS FOR PAINTING-DEPOT LEVEL AND CONTRACTOR SUPPORT.

3.4.1 Coating Requirements. Comply with all cited coating requirements in [Chapter 3](#), if a conflict exists, follow the manufacturer recommendation.

3.4.1.1 Corrosion Rework Determination. The extent of rework to be accomplished during overhaul will be determined by the repair contract requirements. The decision on extent of corrosion repair will be determined by the government quality assurance personnel utilizing the requirements of this technical order.

3.4.1.2 When it is determined that corrosion is a significant factor, and total repaint of the SE is within economic repair, then disassembly, abrasive blasting, application of the proper surface treatment and coating system will be accomplished in accordance with [Table 3-4](#). The lack of surface pretreatment or abrasive blasting capability by a contractor shall not grant authority to deviate from these requirements.

3.4.1.3 When it is determined that corrosion is not a significant factor, or the SE is not within economic repair limits, then coating touch-ups will be accomplished. The coating material used in the touch-up shall be the same material that is on the equipment unless otherwise specified. If the SE requires scuff sanding and overcoating and the prepared surface is not exposed to bare metal, the use of a tie-coat primer in accordance with [Paragraph 3.3.2.3.3](#) is authorized.

3.4.2 **Contractor Compliance.** If contractor supported corrosion prevention and control is utilized, compliance with the proper cleaning, surface preparation, preservation, pretreatment, and painting requirements of this manual, as well as TO 1-1-691 and TO 1-1-8, shall be included in the contract's Statement of Work.

3.5 AUTHORIZED COLORS AND MATERIALS.

3.5.1 SE Standardized Colors.

NOTE

It is possible to have slight variances in color. Equipment shall not be repainted so as to have all equipment or components the same shade, i.e., beautification.

The Air Force has instituted a tone down program for SE. The standard color for all flight line SE is SAE AMS-STD-595, color number 26173 (gray), MIL-PRF-85285, Type IV, Class H, topcoat. The color change shall be integrated into the Units' regular corrosion schedule and equipment will be aligned with the new scheme on an attrition basis. Newly manufactured, Commercial Off the Shelf (COTS), or refurbished equipment shall be painted SAE AMS-STD-595 color number 26173, in a MIL-PRF-85285, Type IV, Class H, topcoat. Mobile communication equipment will maintain its current color scheme to meet mission needs/requirements. The authorized colors for mobile communications equipment are SAE AMS-STD-595, color number 24052/34052 (green), color number 33303 (light tan), color number 30279 (tan), and color number 20400 (brown); all MIL-PRF-85285, Type IV, Class H, topcoat. This guidance does not apply to Basic Expeditionary Airfield Resources SE.

3.5.1.1 **Authorized Colors for Liquid Oxygen, Nitrogen, Storage Carts and Tanks.** All liquid oxygen, liquid nitrogen servicing carts and storage tanks shall be finished in color schemes as follows and in accordance with [Table 3-4](#).

3.5.1.1.1 Liquid oxygen and nitrogen servicing carts, that are used on the flight line, shall have the control housing, interior and exterior, and chassis painted SAE AMS-STD-595, color number 26173 (gray).

3.5.1.1.2 All 50 to 400 gallon liquid nitrogen tanks shall be painted SAE AMS-STD-595, number 16187 (gray), in accordance with MIL-STD-101C, DAFMAN 91-203 and the equipment-specific TO.

3.5.1.1.3 All 50 to 400 gallon liquid oxygen tanks shall be painted SAE AMS-STD-595, color number 14187 (green), in accordance with MIL-STD-101C, DAFMAN 91-203 and the equipment-specific TO.

3.5.1.1.4 Only 2,000 gallon or larger liquid oxygen and nitrogen tanks, that are not used on the flight line, shall be painted SAE AMS-STD-595, color number 17925 (white).

3.5.1.2 **Metallized SE.** SE having metallization applied with 85/15 percent zinc/aluminum shall remain in the original gray color of the metallization material without an additional topcoat applied. (See [Table 3-4](#) and [Paragraph 3.16.4](#).)

3.5.1.3 **Passenger or Loading Ramps.** Passenger or loading ramps may be painted SAE AMS-STD-595, color number 17925 (white). The steps and lettering shall be blue, SAE AMS-STD-595, color number 15045 (blue), except those surfaces covered with anti-skid walkway coatings.

3.5.1.4 **Presidential Support Equipment and USAF Demo Team.** SE associated with the Presidential fleet and the USAF Demo Team are authorized to deviate from the color and coating requirements of this technical order.

3.5.2 **SE Standardized Coatings.** All SE receiving new coatings will be in accordance with [Table 3-4](#), and have a paint block applied in accordance with [Paragraph 3.3](#) and [Figure 3-1](#).

3.5.2.1 Air Force will accept Chemical Agent Resistant Coating (CARC) painted SE procured through US Army when it would increase the cost to change the coating to an epoxy/polyurethane coating system in accordance with [Table 3-4](#). If SE coated with CARC requires repainting, the Unit shall refinish and maintain equipment using the appropriate coating system required for the assigned location/mission. This is to be accomplished only during the normal maintenance cycle.

3.6 CORROSION TREATMENT FOR STEEL CABLES.



CLEANER, NON-AQUEOUS, LOW-VOC, HAP-FREE, MIL-PRF-32295

3



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

6



DEGREASING SOLVENT, MIL-PRF-680

8



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10

If the surface of a cable is corroded, relieve cable tension and carefully force the cable open by reverse twisting. Visually inspect the interior. Corrosion on the interior strands constitutes failure and the cable must be replaced. If no internal corrosion is detected, remove loose external rust and corrosion with a clean, dry, coarse-weave rag or fiber brush. Clean the cables with a clean dampened cloth with MIL-PRF-680, Type II or III, or MIL-PRF-32295, Type II. After thorough cleaning, apply a thin film of either MIL-DTL-87177, Type I or II, Grade B, or MIL-PRF-16173, Class II, Grade 3, water displacing CPC to the cable surface by aerosol spray, or a cloth dampened with the CPC followed by a liberal application of MIL-PRF-16173, Class II, Grade 4, CPC with a nonmetallic brush. Wipe off any excess CPC. If excessive CPC is allowed to build up, it will interfere with the operation of cables at fairleads, pulleys, or grooved bell-crank areas.

3.7 PIANO TYPE HINGES.



CLEANER, LUBRICANT, AND PRESERVATIVE FOR WEAPONS AND WEAPON SYSTEMS, MIL-PRF-63460

2



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10

Water displacing, corrosion inhibiting CPCs are often applied to hinge pins and nodes to provide lubrication and to reduce corrosion problems unless otherwise directed by a specific system work card, immediately after SE washing concludes. Apply a coating of MIL-PRF-63460 or MIL-DTL-87177, Type I or II, Grade B, to the piano hinge, hinge pins and nodes.

3.8 MATING SURFACES PROTECTION REQUIREMENTS.

To prevent corrosion between mating surfaces (faying or back to back surfaces of a part) on attaching parts, fasteners and panels, the metal surfaces shall be insulated with the proper primer following [Paragraph 3.8.1](#) and [Paragraph 3.8.1.1](#) and/or with sealant following the information in paragraphs and subparagraphs of [Paragraph 3.8.2](#).

3.8.1 Mating Surfaces-Bare Steel. For clean bare steel alloys, except stainless steel, the primer shall be MIL-PRF-32550, Type I, Form A, Class S, or MIL-DTL-53022, Type IV, Class L. If the surface or part is already primed and the primer is intact, further coating of the mating surface is not required.

3.8.1.1 Mating Surfaces-All Other Metals. For nonferrous metals, the primer shall be MIL-DTL-53022, Type IV, Class L, or MIL-PRF-23377, Type I, Class N.

3.8.2 Sealers and Sealant Usage. Sealants prevent the intrusion of moisture, rain, salt water, dust and other fluids which can lead to extensive corrosion. Sealants are one of the most important tools for corrosion prevention and control.

Table 3-4. Authorized Coating Systems

Process		Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
1	Abrasive Blast, White (Bare) Metal (Paragraph 3.3.2.1)	Ferrous alloys other than stainless steel, mill-galvanized, mill-electrozinc coating, or mill-aluminized surfaces	Corrosion Inhibiting Primer and High Solids Topcoat	New Procurement TT-C-490 Type IV. For depot and/or contractor refurbishment TTC-490 Type IV is suggested but not required. (Optional)	MIL-PRF-32550, Type I, Form A, Class S MIL-DTL-53022, Type IV, Class L		MIL-PRF-85285, Type IV, Class H	Use only spray equipment designed for the application of metal-rich primer.	1. Depot and/or contractor, if using the zinc-phosphate pre-treatment apply TT-C-490 Type IV material. 2. Prime to a Dry Film Thickness (DFT) of 2.0-2.5 mils. 3. Topcoat to a DFT of 1.6 to 2.4 mils.
2	Abrasive Blast (Bare Metal) (Paragraph 3.3.2.1)	Non-Ferrous alloys (bare aluminum alloys), and stainless steel, mill-galvanized, mill-electrozinc coating, or mill-aluminized surfaces)	Corrosion Inhibiting Primer and High Solids Topcoat	Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A III (Depot or Contractor level only). Anodize in accordance with MIL-PRF-8625, Type II or TO 1-1-691.	MIL-DTL-53022, Type IV, Class L		MIL-PRF-85285, Type IV, Class H	MIL-DTL-53022, Type IV, Class L is preferred for maximum corrosion protection of bare aluminum. Tie-coats cannot be used on bare metal substrates.	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or anodize in accordance with MIL-PRF-8625, Type II or III (Depot or Contractor level only) in accordance with TO 1-1-691. 2. Prime bare aluminum areas to a DFT of 1.5 (±0.2) mils. 3. Topcoat to a DFT of 1.6 to 2.4 mils.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
3	Abrasive Blast (Bare Metal) Paragraph 3.16.2 Non-Chromated Alternative, use only with System Program Office approval. Paint Placard must be applied showing coating system and will be applied within close proximity to Data Plate/FieldNo. . (Use TO 1-1-8 as an example) Size as required.	Non-Ferrous (bare Aluminum alloys)	Use SAE AMS-STD-32239	Use SAE AMS-STD-32239	Use SAE AMS-STD-32239		Use pretreat-ment, primer, and top coat in accordance with SAE AMS-STD-32239.	Use pretreat-ment, primer, and top coat in accordance with SAE AMS-STD-32239.	Apply SAE AMS-STD-32239 coating system in accordance with manufacturer’s instruc-tions. NOTE SAE AMS-STD-32239 is designed to encompass pretreat, primer and topcoat as a system.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
4	Scuff-sand and Overcoat (Paragraph 3.3.2.3)	Ferrous alloys, bare aluminum alloys, and fiberglass components	Standard Primer and High Solids Topcoat	Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A, or PreKote in accordance with TO 1-1-8.	MIL-DTL-53022, Type IV, Class L (Preferred) MIL-PRF-23377, Type I, Class N	Tie-coat materials in accordance with Paragraph 3.3.2.3.3 shall be utilized on painted metal.	MIL-PRF-85285, Type IV, Class H	MIL-DTL-53022, Type IV, Class L, is preferred for maximum corrosion protection. MIL-PRF-23377, Class N, is suitable for both bare ferrous and bare aluminum. If coating system has maintained a smooth, undamaged surface, Zip-Chem Sur-Prep® AP-1 is authorized for use in lieu of scuff sanding. (Paragraph 3.3.2.3.2)	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or Anodize in accordance with MIL-PRF-8625, Type II or III (Depot or Contractor level only). 2a. Prime bare aluminum or ferrous areas with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (±0.2) mils. 2b. Prime bare aluminum or ferrous areas with MIL-PRF-23377, Type I, Class N, to a DFT of 0.6 to 0.8 mils. 2c. Intermediate prime over existing coating system to a DFT of 0.6 to 0.8 mils. 3. Topcoat to a DFT of 1.6 to 2.4 mils.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
5	Units deployed with US Army (Paragraph 3.5.2.1)	Ferrous alloys and bare aluminum alloys	CARC			Tie-coat materials shall be utilized on painted metal surfaces in accordance with Paragraph 3.3.2.3.3 .	MIL-DTL-64159	Three-part waterborne coating system requires specialized application equipment. If SE is not to be deployed with the US Army, use MIL-PRF-85285, Type IV, topcoat. MIL-DTL-53022, Type IV, Class L is preferred for maximum corrosion protection. Tie-coats cannot be used on bare metal substrates.	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or anodize in accordance with MIL-PRF-8625, Type II or III, (depot or contractor level only) TO 1-1-691. 2a. Prime bare aluminum or ferrous areas with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (± 0.2) mils. 2b. Prime bare aluminum or ferrous areas with MIL-PRF-23377, Type I, Class N, to a DFT of 0.6 to 0.8 mils. 2c. Intermediate prime over existing coating system to a DFT of 0.6 to 0.8 mils. 3. Topcoat to a DFT of 2 (± 0.2) mils.
6	Thermal Coating Systems (Paragraph 3.16.4)	Abrasive blasted ferrous alloys and bare aluminum alloys	Metalization				MAJCOM Option	Topcoating is not required.	Refer to Paragraph 3.16.4 .
7	Walkways and Stepping Surfaces (Paragraph 3.19)		Non-slip				A-A-59166	MIL-PRF-24667, adhesive backed, non-slip material may be used as an alternate.	Follow manufacturer's application instructions.
8	Undercoating (Paragraph 3.21)		Undercoat				A-A-59295	Topcoating prior to undercoating is not required.	Follow manufacturer's application instructions.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
9	Liquid Nitrogen Servicing Carts (50 to 400 gallons) (Paragraph 3.5.1.1.2)	Ferrous alloys, bare aluminum alloys, and fiberglass components	Standard Primer and High Solids Topcoat	Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A, or PreKote in accordance with TO 1-1-8.	MIL-DTL-53022, Type IV, Class L (Preferred) MIL-PRF-23377, Type I, Class N		MIL-PRF-85285, Type IV, Class H	MIL-DTL-53022, Type IV, Class L, is preferred for maximum corrosion protection. Chassis must be SAE AMS-STD-595 color number 26173. (Paragraph 3.5.1.1.1) Tank must be SAE AMS-STD-595 color number 16187. (Paragraph 3.5.1.1.2)	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or anodize in accordance with MIL-PRF-8625, Type II or III, (depot or contractor level only) TO 1-1-691. 2a. Prime bare aluminum or ferrous areas with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (±0.2) mils. 2b. Prime bare aluminum or ferrous areas with MIL-PRF-23377, Type I, Class N, to a DFT of 0.6 to 0.8 mils. 3. Topcoat to a DFT of 2 (±0.2) mils.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
10	Liquid Oxygen Servicing Carts (50 to 400 gallons) (Paragraph 3.5.1.1.3)	Ferrous alloys, bare aluminum alloys, and fiberglass components	Standard Primer and High Solids Topcoat	Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A, or PreKote in accordance with TO 1-1-8.	MIL-DTL-53022, Type IV, Class L (Preferred) MIL-PRF-23377, Type I, Class N		MIL-PRF-85285, Type IV, Class H	MIL-DTL-53022, Type IV, Class L, is preferred for maximum corrosion protection. Chassis shall be SAE AMS-STD-595 color number 26173. (Paragraph 3.5.1.1.1) Tank shall be SAE AMS-STD-595 color number 14187. (Paragraph 3.5.1.1.3)	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or anodize in accordance with MIL-PRF-8625, Type II or III, (depot or contractor level only) TO 1-1-691. 2a. Prime bare aluminum or ferrous areas with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (±0.2) mils. 2b. Prime bare aluminum or ferrous areas with MIL-PRF-23377, Type I, Class N, to a DFT of 0.6 to 0.8 mils. 3. Topcoat to a DFT of 2 (±0.2) mils.

Table 3-4. Authorized Coating Systems - Continued

	Process	Substrate	Coating System	Pretreatment	Primer	Intermediate (Tie-coat)	Topcoat	Remarks	Finish Process
11	Liquid Nitrogen and Oxygen Tanks (2,000+ gallons) (Paragraph 3.5.1.1.4)	Ferrous alloys, bare aluminum alloys, and fiberglass components	Standard Primer and High Solids Topcoat	Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A, or PreKote in accordance with TO 1-1-8.	MIL-DTL-53022, Type IV, Class L (Preferred) MIL-PRF-23377, Type I, Class N		MIL-PRF-85285, Type IV, Class H	MIL-DTL-53022, Type IV, Class L, is preferred for maximum corrosion protection. Chassis shall be SAE AMS-STD-595 color number 26173. (Paragraph 3.5.1.1.1) Tank shall be SAE AMS-STD-595 color number 17925. (Paragraph 3.5.1.1.4)	1. Pretreat bare aluminum areas with MIL-DTL-5541, Class 1A or anodize in accordance with MIL-PRF-8625, Type II or III, (depot or contractor level only) TO 1-1-691. 2a. Prime bare aluminum or ferrous areas with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (± 0.2) mils. 2b. Prime bare aluminum or ferrous areas with MIL-PRF-23377, Type I, Class N, to a DFT of 0.6 to 0.8 mils. 3. Topcoat to a DFT of 2 (± 0.2) mils.
12	Rust Converter (Paragraph 3.3.4)	Ferrous alloys other than stainless steel, mill-galvanized, mill-electrocoat, or mill-aluminized surfaces	Standard Primer and High Solids Topcoat	Pretreat corroded bare steel with rust converter (Table 3-3)	MIL-DTL-53022, Type IV, Class L		MIL-PRF-85285, Type IV, Class H		1. Prime bare ferrous alloys with MIL-DTL-53022, Type IV, Class L, to a DFT of 1.5 (± 0.2) mils. 2. Topcoat to a DFT of 1.6 to 2.4 mils.

Table 3-5. Pretreatment Instructions

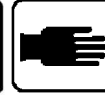
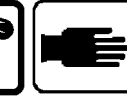
Material	Finish Process
     	11
PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022	
     	13
PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377	
     	14
PRIMER, METAL-RICH, MIL-PRF-32550	
     	17
TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285	
     	24
CHEMICAL CONVERSION MATERIALS FOR COATING ALUMINUM AND ALUMINUM ALLOYS, MIL-DTL-81706	
     	32
ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOY, MIL-PRF-8625	
     	47
CHEMICAL CONVERSION COATINGS AND PRETREATMENTS FOR METALLIC SUBSTRATES, TT-C-490	

Table 3-5. Pretreatment Instructions - Continued

Material	Finish Process
FERROUS ALLOYS other than stainless steel, mill-galvanized or mill-electrozinc coating, or mill-aluminized surfaces.	1. Chemically clean the areas in accordance with Chapter 3. Remove all remaining coating and corrosion by abrasive blasting or other mechanical cleaning processes. Field Units without abrasive blasting capabilities may proceed to Step 3. Depot and/or contractor level of maintenance apply zinc phosphate TT-C-490, Type I or II. 2. The blasted surfaces will be in a near-white condition in accordance with The Society For Protective Coatings SSPC-SP 10. A near-white blast cleaned surface finish is defined as one from which all oil, grease, dirt, mill scale, rust, corrosion products, oxides, coatings or other foreign matter have been completely removed from the surface except for very light shadows, very slight streaks, or slight discolorations caused by rust stain, mill scale oxides, or slight, tight residues of coatings that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above. SSPCSP 6 shall be used as a visual standard to compare properly prepared surfaces. The blast-cleaned surface must be primed before any rusting occurs, otherwise the benefit of the near-white blast cleaning is lost. Under normal atmospheric conditions it is best practice to prime within one hour of blast cleaning. The following areas are exceptions to blasting: • Abrasive blasting will not be performed on surfaces where there is a danger of warping or distorting the base metal. Sheet metal thinner than 0.0625 inch (U.S. Standard 16 gauge) will not be abrasive blasted. 3. Prime with one coat of MIL-PRF-32550, Type I, Form A, Class S (preferred for SE blasted to near-white metal), or MIL-DTL-53022, Type IV, Class L. Follow the coating manufacturer's instructions for the mixing, application, time between coats, and the required application equipment. The DFT shall be thickness of the MIL-PRF-32550 shall be 2.5 to 3.5 mils. The DFT of MIL-DTL-53022, shall be 1.5 (± 0.2) mils. If the surface is not reconditioned to bare metal, the use of a non-chromate tie-coat in accordance with Paragraph 3.3.2.3.3 is required. 4. Topcoat with one coat of MIL-PRF-85285, Type IV, Class H, applied to a DFT of 1.6 to 2.4 mils.
STAINLESS STEEL AND NICKEL BASE ALLOYS.	1. Most stainless steel surfaces do not require finishing. If there are requirements in the equipment specific technical order to coat stainless steel, and the technical order provided the coating procedures those instructions shall take precedence. If no instructions are available and coatings are required use the following application processes. 2. Clean in accordance with Chapter 2, if the surface remains contaminated reference TO 1-1-691. 3. Passivate the surface in accordance with SAE AMS-QQ-P-35 (Depot or contractors only). 4. Prime with MIL-DTL-53022, Type IV, Class L. Allow the primer to dry. DFT shall be 1.5 (± 0.2) mils. 5. Topcoat with one coat of MIL-PRF-85285, Type IV, Class H, applied to a DFT of 1.6 to 2.4 mils. 6. Total DFT of all coatings shall be 2.9 to 4.1 mils.
MAGNESIUM ALLOYS	1. Clean in accordance with Chapter 2, if the surface remains contaminated refer to TO 1-1-691. 2. Pretreat with dichromate film in accordance with SAE AMS-M-3171, Type III.(Depot or contractors only). 3. Prime with one coat of epoxy primer, MIL-DTL-53022, Type IV, Class L, or MIL-PRF-23377, Type I, Class N. DFT for MIL-DTL-53022 shall be 1.5 (± 0.2) mils. DFT for MIL-PRF-23377 shall be 0.6 to 0.8 mils. 4. Topcoat with one coat of MIL-PRF-85285, Type IV, Class H, applied to a DFT of 1.6 to 2.4 mils. 5. Total DFT of all coatings shall be 2.9 to 4.1 mils (53022) or 2.2 to 3.2 mils (23377).

Table 3-5. Pretreatment Instructions - Continued

Material	Finish Process
CADMIUM OR ZINC PLATED SURFACES, mill-galvanized, millelectro-zinc coated.	1. Clean in accordance with Chapter 2, if the surface remains contaminated refer to TO 1-1-691. 2. Pretreat by applying MIL-C-17711 (Depot and/or contractors only). 3. Prime with one coat of epoxy primer, MIL-DTL-53022, Type IV, Class L, or MIL-PRF-23377, Type I, Class N. DFT for MIL-DTL-53022, shall be 1.5 (± 0.2) mils. DFT for MIL-PRF-23377 shall be 0.6 to 0.8 mils. 4. Finish with one coat of MIL-PRF-85285, Type IV, Class H, applied to a DFT of 1.6 to 2.4 mils. Total DFT of all coatings shall be 2.9 to 4.1 mils (53022) or 2.2 to 3.2 mils (23377).
MILL-ALUMINUM STOCK.	1. Clean in accordance with Chapter 2, if the surface remains contaminated refer to TO 1-1-691. 2. Pretreat with MIL-DTL-5541, Class 1A, or anodize in accordance with MIL-PRF-8625, Type II or III (Depot or contractors only) as specified in TO 1-1-691. 3. Prime with one coat of epoxy primer, MIL-DTL-53022, Type IV, Class L, or MIL-PRF-23377, Type I, Class N. DFT for MIL-DTL-53022 shall be 1.5 (± 0.2) mils. DFT for MIL-PRF-23377 shall be 0.6 to 0.8 mils. 4. Finish with one coat of MIL-PRF-85285, Type IV, Class H, applied to a DFT of 1.6 to 2.4 mils. 5. Total DFT of all coatings shall be 2.9 to 4.1 mils (53022) or 2.2 to 3.2 mils (23377).

3.8.2.1 Many components of the SE contain joints and flanges. The use of an appropriate sealant and/or sealer to prevent the entry of water and contaminants into crevices and joints is an excellent way to minimize corrosion. Sealants and/or sealers can also be used to separate two conductive metal surfaces, preventing galvanic or crevice corrosion.

3.8.2.2 For sealants and/or sealers to be effective, it is critical that the correct sealant be chosen for a specific area/situation and that it be applied correctly. Refer to TO 1-1-691, Sealants, for the selection and applications of sealants and sealers. Refer to said chapter if sealing conditions or requirements are encountered that are beyond the scope of this manual.



SEALING COMPOUND, POLYSULFIDE, NON-CHROMATED, LOW ADHESION, PR-1773

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SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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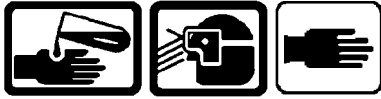
SEALING COMPOUND, LOW ADHESION, CORROSION INHIBITING, FOR REMOVABLE PANELS AND FUEL TANK INSPECTION PLATES, SAE AMS3267

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3.8.2.3 When repairs are made on equipment or accessories and/or components are installed or structures are reinstalled, the attaching or faying surfaces shall be protected by sealing all metal-to-metal and composite to metal contact surfaces. All permanent structures shall be installed with faying surfaces wet with MIL-PRF-81733, Type I or IV, Class 1 or 2, Grade A or B sealant. All removable structure such as access doors, inspection plates, floor panels and plates, and other removable panels (components requiring frequent removal for maintenance requirements) shall either be installed with faying surfaces wet with SAE AMS3267, Class A or B, or PR-1773, Class B, sealant, or Av-DEC™ HT3935-7 or HT3000FR sealant tape in the joints as specified by the system specific maintenance manual. In addition to faying surface sealing, fillet seal all interior seams and all exterior seams (those exposed to the outside environment) that would allow water intrusion using MIL-PRF-81733, Type II, Class 1 or 2, Grade A or B sealant.

NOTE

The following does not apply to parts that are lubricated in the joint areas immediately before or after installation, or to close tolerance bolts and parts that are removed frequently for maintenance requirements.



CLEANER, LUBRICANT, AND PRESERVATIVE FOR WEAPONS AND WEAPON SYSTEMS, MIL-PRF-63460

2



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

6



CORROSION PREVENTIVE COMPOUNDS, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

7



SEALING COMPOUND, POLYSULFIDE, NON-CHROMATED, LOW ADHESION, PR-1773

15



SEALING COMPOUND, FUEL-RESISTANT, INTEGRAL FUEL TANKS AND FUEL CELL CAVITIES, SAE AMS-S-8802

16



CHEMICAL CONVERSION MATERIALS FOR COATING ALUMINUM AND ALUMINUM ALLOYS, MIL-DTL-81706

24



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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SEALING COMPOUND, LOW ADHESION, CORROSION INHIBITING, FOR REMOVABLE PANELS AND FUEL TANK INSPECTION PLATES, SAE AMS3267

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LUBRICANT, SOLID FILM, AIR-CURED, CORROSION INHIBITING, MIL-L-23398

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LUBRICANT, SOLID FILM, AIR CURED, CORROSION INHIBITING, MIL-PRF-46147

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3.8.2.3.1 Attaching parts, such as nuts (standard, speed, and self-locking), bushings, spacers, washers, screws (standard and self-tapping), sleeves for shake-proof fastener studs, clamps, bolts, etc., do not need to be painted in detail except when dissimilar metal or wood contact is involved with the materials being joined or exposure to a corrosive interior environment or the exterior environment will occur in service. However, all parts shall be installed wet with sealant. For permanent installations, use MIL-PRF-81733, Type I or IV, Class 1 or 2, Grade A or B sealant and coat the entire mating surface of the parts. For removable installations, use SAE AMS-3267, Class B, or PR-1773, Class B, sealant and coat only the lower side of the heads of screws and bolts with sealant. For removable installations, do not coat the threads and shanks of screws and bolts or the holes into which they are inserted. This will make future removal almost impossible without damaging the parts. As an alternate for removable installations, the shanks, threads, and lower side of the heads of standard screws and bolts may be coated with MIL-PRF-63460, MIL-PRF-16173, Class II, Grade 3, before they are installed. Close tolerance bolts and parts shall be coated with corrosion inhibiting, solid film lubricant. Use MIL-L-23398 or MIL-PRF-46147, Type I or II, on all metallic parts. The solid film lubricant shall be applied and completely cured prior to assembly. Bolts shall be coated on shanks and threads only. A thin bead of sealant shall be applied under the bolt head to impart a wet seal.

3.8.2.3.2 All rivets shall be installed wet with MIL-PRF-81733, Type I or IV, Class 1 or 2, Grade A or B, sealant. In fuel contact areas, the exposed rivet head and approximately 1/4-inch of the adjacent structure shall be brush over coated with SAE AMS-S-8802, Class A, sealant.

3.8.2.3.3 All machine screws, countersunk fasteners, bolts (head end) and nuts which are used in contact with magnesium shall be installed with 5056 aluminum alloy washers. These parts, including the washers, shall be installed wet with MIL-PRF-81733, Type II, Class 1, Grade A or B, sealant and shall be completely fillet sealed with the same material after installation.

3.8.2.3.4 Adjustable parts, such as tie rod ends and turnbuckles shall be installed with corrosion protection. If possible, surfaces and threads shall be lubricated and protected before assembly with a film of MIL-L-23398 or MIL-PRF-46147, Type I or II, corrosion inhibiting, solid film lubricant which shall be completely cured prior to assembly. After installation, apply a thin coating of MIL-PRF-63460, MIL-PRF-16173, Class II, Grade 3, or MIL-PRF-81309, Type II, water displacing, CPC to all surfaces of these parts. If solid film lubricants cannot be applied, use a thin coating of MIL-PRF-63460, MIL-PRF-16173, Class II, Grade 3, or MIL-PRF-81309, Type II, water displacing CPC after assembly.

3.8.2.3.5 When practical, slip fit parts shall be assembled with mating surfaces wet with MIL-PRF-81733, Type I or IV, Class 1 or 2, Grade A or B, sealant. If this process is not practical, coat the inner diameter of the holes in the receiving part, which is normally the larger structure, with a corrosion inhibiting, solid film lubricant conforming to MIL-L-23398 or MIL-PRF-46147, Type I or II, and the outer diameter of the mating part with one conforming to MIL-L-23398 or MIL-PRF-46147, Type I or II. The solid film lubricant shall be applied and completely cured prior to assembly.

3.8.2.3.6 All cut edges and holes drilled or reworked for bolts, screws, rivets, studs, and bushings of aluminum alloy structures or parts shall receive a chemical conversion coating treatment prior to the installation of the fasteners or bushings and prior to installing or refinishing the structure or parts. Apply a conversion coating to aluminum surfaces, using a Bonderite M-CR 1132 Aero Touch-N-Prep pen. On steel surfaces use the appropriate primer in accordance with [Table 3-4](#), to coat the cut edges of holes prior to reinstallation of the parts.

3.8.2.4 Sealant may be applied by brush, spatula, or caulking gun application.

3.8.2.5 To prevent sealant from contacting adjacent areas during application and smooth-out, outline the areas being sealed with masking tape conforming to SAE AMS-T-21595, Type I, so that each tape strip is 1/8 to 1/4 inch from the edge of the seams.

3.8.2.5.1 Apply the sealant between tapes with a nonmetallic spatula or spreader, brush or caulking gun. Avoid the entrapment of air. Work sealant into recesses by sliding the edge of the spatula firmly back over the recesses. Smoothing will be easier if the nonmetallic spatula is first dipped in water.

3.8.2.5.2 Remove masking tape after the sealant has been applied and before it begins to set. Cure time will depend upon the application life of the materials used.

3.8.2.6 Sealant application life and cure times are dependent on environmental considerations and the formulation cure times. The application life of a sealant is the length of time that a mixed sealing compound remains usable at 75 °F (24 °C) and 50 percent relative humidity. This time (in hours), known as a dash number, is denoted as the last number in a sealant designation, e.g. MIL-PRF-81733, Type II-2, has an application life of two hours. For each 18 °F (10 °C) increase in the temperature above 75 Fahrenheit (°F) (24 degree Celsius (°C)), the application time is cut by approximately half with a similar reduction in tack free and cure time. When sealants are applied in an environment where the relative

humidity is greater than 50 percent, its application life is shortened to some degree. Maintenance personnel should be aware of the effects of temperature and humidity on the application life of a sealant. Mix only the amount of material that can be applied during the rated work life of the sealant.

3.8.2.7 There are sealants that can damage SE. For example, Room Temperature Vulcanizing (RTV) adhesive/sealant, MIL-A-46106, unless it is called-out for a specific repair, shall not be used in sealing metal parts. This sealant emits acetic acid during its curing process and can cause corrosion when sealing metals or when sealing non-metals in a confined metallic space or areas containing electronic components. The approved qualified product for use is MIL-A-46146 (non-corrosive). Both sealants are packaged alike and are often substituted within the base supply system. A telltale odor of vinegar identifies the acetic acid (corrosive version) evolving is being used.



SOLVENT, ECO-FRIENDLY, ACRASTRIP 600

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SOLVENT, ECO-FRIENDLY, SKYKLEEN® 1000

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3.8.2.8 Remove sealant with a nonmetallic scraper, such as plastic or phenolic. The pneumatic vibro gun sealant removal kit or a rapid desealing system may also be used. (See [Table A-1.](#)) Clean remaining residue from the component or structure using undiluted AcraStrip 600 or SkyKleen® 1000.

3.9 ACOUSTICAL MATERIAL PRECAUTIONS.

Most of the acoustical material used in powered SE is open cell polyurethane foam. The property of open cell polyurethane that results in the reduction of sound also results in the foam holding water and water vapor like a sponge. In severe corrosion environments, the foam also absorbs the contaminants, such as salt, in the water vapor. The water vapor is slow to dry and will be sufficient to cause and accelerate corrosion. Additionally, as the water vapor evaporates, it will leave the contaminants lodged in the foam against the metal surfaces and over time, the concentration of the contaminants will worsen the corrosive effects. To prevent corrosion that will occur from the open cell polyurethane, field units are authorized to remove existing foam and replace with Coustifoam polyurethane insulation or acoustic foam (heat reflective) or equivalent.

3.9.1 COUSTIFOAM Polyurethane Insulation and Acoustic Foam. COUSTIFOAM polyurethane insulation and acoustic foam is also an open cell polyurethane foam but the side that has the vapor/waterproof backing shall be installed against the metal panels. This action will help prevent fluid transfer to the metal surfaces of the equipment where the foam is mounted. All exposed edges, tears, and perforations of the foam will be sealed prior to installation. Sealing can be accomplished by brushing the edge with MIL-PRF-81733 or equivalent sealant. The sealant shall also be used to repair any tear or puncture in the polyvinyl fluoride film that is made to accommodate fastener installation.

3.9.2 Nonmetallic Fasteners.



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

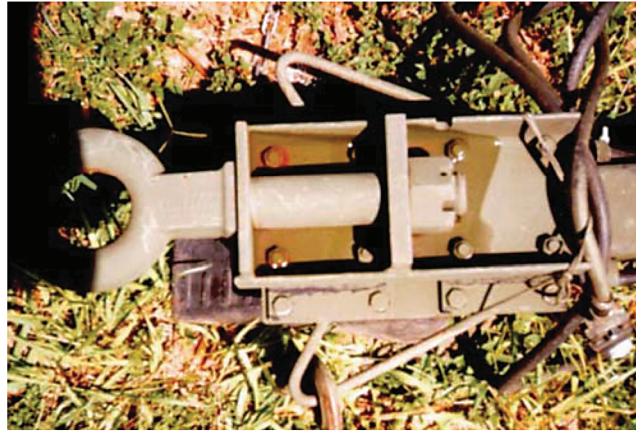
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Nonmetallic fasteners shall be used to mount the foam in the SE. Corrosion inhibiting sealant, MIL-PRF-81733 or PR-1733 shall be applied around the fastener head and the fastener shank, which protrudes through the equipment structure/skin, thoroughly sealing the fastener hole to prevent water intrusion. Do not apply sealant to threaded portions of the fasteners.

3.10 DRAINAGE.

3.10.1 Fluid Collection Points. Angles, channels, panel lips, handrail holders, or other pockets that can collect water will be avoided or have adequate drainage when stored in the equipment's normal position. (See [Figure 3-6.](#))

3.10.2 Modifying Fluid Collection Points. Sealants such as MIL-PRF-81733, or self-leveling sealing compounds such as Av-DEC HT3326 or equivalent, may be used to fill voids and entrapped areas, redirecting the water to the appropriate drain-through-drain to location. The minimum size for any drain hole shall be 0.25 inch.



TO-35-1-3-015

Figure 3-6. Example of Standing Water Due to Inadequate Drainage Provisions

3.11 MAINTENANCE STAND RAILS AND RAIL HOLDERS.

3.11.1 Drain Holes.

WARNING

Do not drill drain holes in weldments seams or beads. Failure to comply could result in injury to, or death of, personnel or long term health hazards.

NOTE

Using activities that find standing or entrapped water in equipment due to the lack of drainage should forward this information to the responsible equipment specialist or system engineer for action through Material Deficiency Reporting channels as outlined in TO 00-35D-54.

Field units are authorized to drill necessary drain holes at the lowest point on the maintenance stands rail holders to avoid water from collecting in the holders.

3.11.2 Drain Hole Corrosion Prevention and Treatment.



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

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CORROSION PREVENTIVE COMPOUNDS, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

7



LUBRICANT, SOLID FILM, AIR-CURED, CORROSION INHIBITING, MIL-L-23398

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LUBRICANT, SOLID FILM, AIR CURED, CORROSION INHIBITING, MIL-PRF-46147

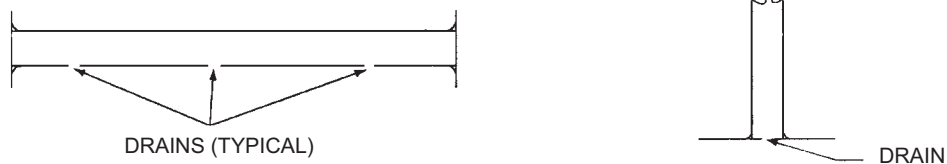
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Apply authorized coatings to the edges of the drain holes after drilling to prevent corrosion from occurring around the holes in accordance with [Table 3-4](#).

3.11.2.1 Since repeated installation and removal of the rail into the rail holder will result in damage to the paint on both items, additional protection is required on the inside diameter of the holder and the outside diameter of the bottom part of the rail.

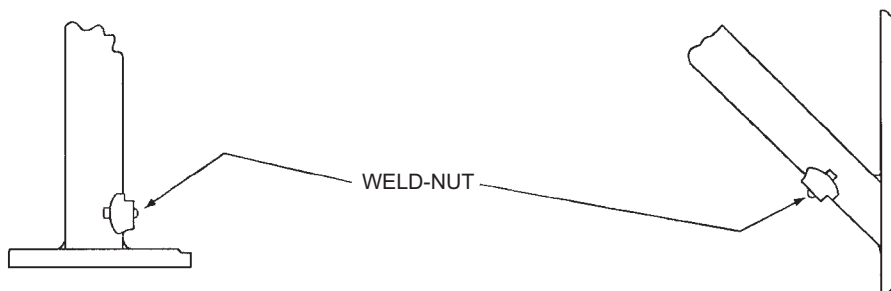
3.11.2.2 Coat the inner diameter of the rail holder and the bottom part of the stand rail that are inserted into the holder with solid film lubricant conforming to MIL-L-23398 or MIL-PRF-46147, Type I or II. The solid film lubricant shall be applied and completely cured prior to assembly.

3.11.2.3 To prevent corrosion, a CPC, MIL-PRF-16173, Grade 4, or MIL-PRF-81309, Type II, shall be applied periodically to the exterior bottom of the rail and interior of the holder and the interior of the stand rails. Use the appropriate length 360-degree Zip-Chem Formit® spray wand, or equivalent, to apply CPC through the drain holes the entire length of the stand rails.



TO-35-1-3-016

Figure 3-7. Hollow Member Drain Hole Configuration



TO-35-1-3-017

Figure 3-8. Hollow Member Weld-Nut Configuration

3.12 HOLLOW STRUCTURAL MEMBERS.

3.12.1 Drainage for Closed Hollow Members, When Open Drain Holes are Possible. A completely airtight weld is required for closed hollow members to prevent condensation of moisture in the interior surface. To prevent moisture accumulation from occurring (since it is difficult to obtain perfect welds), all closed hollow members will have drainage provisions at the lowest drain-through point of the member. (See [Figure 3-7](#).)

3.12.1.1 For horizontal members, drain hole(s) will be provided on the lower side equally spaced across the hollow member at an approximately 36-inch interval.

3.12.1.2 For vertical members, drain hole(s) will be provided on bottom end-cap.

3.12.2 Drainage for Closed Hollow Members, When Open Drain Holes are Not Possible. If a drain hole is not possible due to design (such as a butt joint with a plate behind it or two pipes forming a saddle joint) then a drain hole shall be placed at the lowest possible drain-through point. (See [Figure 3-7](#).) Application of sealant that is formed to direct the drainage to the drain hole is authorized to facilitate fluid drainage.

3.12.2.1 The drain hole should not penetrate a weld and must be approved by the cognizant engineering organization. Since the location of the drain hole could allow water inside the hollow member insert a removable plug (weld-nut) into the drain hole. (See [Figure 3-8](#).) Preferred size of the hole for the weld-nut is 0.50 inch, minimum size is 0.375 inch, with length being determined by the hollow member wall thickness. A suggested source of supply for the weld nuts is available from McMaster-Carr, Fastenal or any Chevrolet truck parts department.

3.12.2.2 Weld nuts should be removed periodically so the hollow member can be checked for water accumulation and condition of the corrosion prevention compound. If water has to be drained, completely dry the area and reapply the appropriate CPC to the entire length of the hollow member. If a weld nut becomes damaged, cut the weld-nut flush with the surface, punch the remainder of the nut inside the hollow member and install a new weld-nut.

3.13 CORROSION PREVENTIVE COMPOUNDS.

WARNING

CPC shall not be used on or adjacent to oxygen lines, fittings or equipment. The compound shall not be used on surfaces where temperatures exceed 300 °F (149 °C). Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

CAUTION

CPC can be separated into two major categories: water displacing and non-water displacing compounds (see TO 1-1-691). Some CPCs have a flash point above 100 °F (38 °C), but contain flammable solvents. These compounds should be handled, stored, and applied in accordance with manufacturer's instructions and the product Safety Data Sheet (SDS). Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

CPC are used for temporary protection of painted and unpainted surfaces and where coating system has been damaged or removed. CPCs function by preventing corrosive materials from contacting and corroding bare metal surfaces. The selection for the type of CPC to be used shall take into consideration CPC appearance to help maintain overall condition of the SE for scoring purposes and help reduce the need for increased complete repaints. Dark color CPC should not be used in highly visible areas. Transparent or lightly tinted CPCs are the best selection for temporary corrosion prevention and control on visible areas. Some of the compounds have the capability of displacing moisture in seams, joints and faying surfaces. Some CPCs also provide lubrication as well as corrosion protection. The thicker CPCs provide the best corrosion protection, are longer lasting, and more difficult to remove. The thinner materials provide some lubrication and do not crack; chip or peel but must be removed and replaced. The protection provided is temporary, so the compound must be reapplied periodically and after removal by washing or contact with solvents or fuel. The recommended maximum frequency of application is based on the corrosion severity of the operational environment. The frequency of application can be set to coincide with wash cycles and periodic inspections but should not be extended. These compounds should not be considered as a long-term alternative for proper painting. The CPCs should not be applied at temperatures above 95 °F (35 °C) or below 50 °F (10 °C). A brief description of authorized CPCs are listed in this section.

3.13.1 MIL-PRF-81309.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

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MIL-PRF-81309 is a general-purpose CPC that can be used whenever a CPC or a water-displacing compound is called for but no specification is referenced. MIL-PRF-81309 materials are excellent water displacing compounds that provide an ultra-thin, soft protective film (0.5 millime-

ter (mil) or less). The specification covers four Types, which can be applied by dipping, spraying, brushing, or an aerosol container. They provide temporary protection from corrosion and are easily removable with a solvent. The two types primarily used for SE are Types II and III.

- Type II. A soft, thin film for general use, particularly on moving or sliding parts where some lubrication is needed, such as hinges or bomb racks. It may be washed away by rain or wash procedures. Type II shall be used to protect areas which cannot be properly drained or contain recesses that are particularly difficult to reach.
- Type III. An ultra thin, soft film primarily for use on avionics and electronic equipment. Although this coating is nonconductive, it will allow electrical contact because it is soft and very thin. Do not use MIL-PRF-16173, Grade 3 as a substitute.

3.13.2 MIL-DTL-85054.



CLEANER, NON-AQUEOUS, LOW-VOC, HAP-FREE, MIL-PRF-32295

3



DEGREASING SOLVENT, MIL-PRF-680

8



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, TRANSPARENT, MIL-DTL-85054

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MIL-DTL-85054 is a water displacing CPC that forms a clear, dry, flexible film. It is intended for use as a protective coating until painting is practical. Because of its paint-like characteristics, this CPC does not provide any lubrication. It can be applied by dipping, brushing, spraying, or from aerosol containers. However, dipping provides a very thin coating with less corrosion protection. After each use of an aerosol can, invert the can and spray until spray tip (nozzle) is clear of entrapped material. If an aerosol can does not spray, invert and depress the spray tip several times to clear the delivery tube and spray head. If the can still does not spray, remove and clean the plastic spray head then spray again to clear the delivery tube. Since MIL-DTL-85054 buildup is difficult to remove, especially after prolonged exposure to direct sunlight, previously applied coatings should be removed with MIL-PRF-680, Type II or III or MIL-PRF-32295, Type II.

3.13.3 MIL-PRF-16173.



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

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MIL-PRF-16173 provides five different grades of CPCs that can be applied by brushing or dipping. Grades 1, 2, 4, and 5 do not displace water and must be applied to dried surfaces or to surfaces that have been treated with MIL-PRF-81309. Grade 3 is a water displacing soft film compound but is not a substitute for MIL-PRF-81309. All five grades are very effective in preventing corrosion. As a soft film CPC, care must be taken to ensure dirt and other contaminants do not collect on the soft CPC surface for extended periods of time.

- Grade 1. A thick hard, black CPC that is difficult to remove. However, it offers the most corrosion protection of all the CPCs indoors and outdoors and may be used at temperatures down to 0 °F (-18 °C). This compound should not be used in highly visible areas. Use either Grade 4 or MIL-DTL-85054 semitransparent CPC.
- Grade 2. A thick, soft, grease-like, brown CPC that remains tacky and can be removed with mineral spirits or MIL-PRF-680. It protects under relatively severe conditions and, given adequate maintenance touch-up as necessary, can be used for most maximum protection requirement. It may be used at temperatures down to -40 °F (-40 °C).
- Grade 3. A thin, soft film CPC. MIL-PRF-81309, Type III can be used as a substitute for MIL-PRF-16173; however, MIL-PRF-16173 cannot be used as a substitute for MIL-PRF-81309.

- Grade 4. A thin, non-tacky, semitransparent film through which identification can be read. It may be used at temperatures down to -40 °F (-40 °C).
- Grade 5. A soft film CPC removable using low pressure steam.

3.13.4 MIL-PRF-63460.

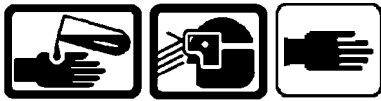


CLEANER, LUBRICANT, AND PRESERVATIVE FOR WEAPONS AND WEAPON SYSTEMS, MIL-PRF-63460

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MIL-PRF-63460 is a thin, water displacing, protective, penetrating lubricant used for cleaning, lubrication and preservation of components. This material has good lubricating properties between -65° and 105 °F (-54° and 41 °C). It may be applied by brushing, dipping, or spraying.

3.13.5 MIL-DTL-87177.



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10

MIL-DTL-87177 covers two Types and Grades of a synthetic, water displacing lubricant that has shown excellent corrosion preventive qualities, especially on electrical contacts, contact pins, electrical quick disconnect connectors, etc. Type I, Grade B is a water displacing lubricant with an added corrosion inhibitor and is the preferred material for use on SE electrical contacts and connectors.

3.13.6 CPC Methods of Application. CPCs can be applied by brushing, dipping, or spraying. The area of application, viscosity of the CPC and the conditions under which the CPC needs to be applied are factors which determine which methods of application to use. Use of the Formit® extension wand applicator, or equivalent, may be used to fog the thinner version of CPCs inside drain holes or other access areas.

3.14 CORROSION PREVENTIVE COMPOUND APPLICATION ON FERROUS ALLOYS.



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

6



CORROSION PREVENTIVE COMPOUNDS, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

7



ANODIC COATINGS FOR ALUMINUM AND ALUMINUM ALLOY, MIL-PRF-8625

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CHEMICAL CONVERSION COATINGS AND PRETREATMENTS FOR METALLIC SUBSTRATES, TT-C-490

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Clean the surface where CPC is to be applied by removing loose/lifting materials with a steel/stainless wire brush or Scotch-Brite™, or equivalent, pad (CID A-A-58054, Type I, Grade A). Wipe the area clean prior to applying CPC. Apply by brush, dip, or spray. For hard-to-reach recesses, Units can utilize spray wands, aerosol extension applicators such as the Formit® extension applicators, or equivalent devices, to fog or

spray the MIL-PRF-16173, Grade 4, or MIL-PRF-81309, Type II, onto the interior surfaces of the hollow members. Fully insert the Formit ® 360-degree extension wands, or equivalent applicators, into the drain hole and slowly withdraw the spray wand while applying the CPC to the interior of the hollow member. Repeat this process for each drain hole ensuring complete coverage between drain holes. Depot overhaul or contractor maintenance shall condition the interior of the hollow members with an iron phosphate pretreatment in accordance with TT-C-490, Type II, then apply the CPC as above.

3.15 CORROSION PREVENTIVE COMPOUND APPLICATION ON OTHER ALLOYS.



CHEMICAL CONVERSION MATERIALS FOR COATING ALUMINUM AND ALUMINUM ALLOYS, MIL-DTL-81706

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Clean the surface where CPC is to be applied by removing loose/lifting materials with a stainless wire brush or Scotch-Brite™, or equivalent, pad (CID A-A-58054, Type I, Grade A). Wipe the area clean prior to applying CPC. Field Units shall utilize spray wands, Formit ® 360-degree extension wands, or equivalent devices, to fog or spray the MIL-PRF-16173, Grade 4, or MIL-PRF-81309, Type II, onto the interior surfaces of the hollow members ensuring complete interior coverage. Depot overhaul or contractor maintenance shall condition the interior of aluminum hollow members with a chromate conversion coating per MIL-DTL-5541, Class 1A, or anodize per MIL-PRF-8625, Type II or III, in accordance with TO 1-1-691. The specific treatment shall depend on the alloy. Apply the appropriate CPC, as above, after the pretreatment operations.

3.16 COATING APPLICATIONS.

3.16.1 Material Selection. To provide optimum protection from deterioration and corrosion, the proper coating system (a combination of cleaning, pretreatment, priming and topcoat) must be selected for a specific application. See [Table 3-4](#) for authorized coating systems. [Table 3-5](#) is a brief abstract of the pretreatment, priming, and painting functions necessary to maintain the coating systems on SE.

3.16.2 SE Surface Preparation Categories. SE surface preparation for painting operations fall into four general categories:

- Coating removal (removal of old coating system)
- Cleaning
- Corrosion removal and pretreatment
- Prime and topcoat

3.16.3 MIL-PRF-85285 Polyurethane, Type IV. The standard topcoat used on SE shall be MIL-PRF-85285, Type IV, Class H. The selection of polyurethane paint, MIL-PRF-85285, Type IV, Class H, by field, depot, and contractor operations, is restricted to only those vendors who have been qualified to the performance specification as listed on the Qualified Products Database. To download the latest version of current specifications, handbooks, or Qualified Products List/Qualified Products Database (QPL/QPD) use the Defense Logistics Agency (DLA) specification search engine located at <https://qpldocs.dla.mil/default.aspx>.

NOTE

When polyurethane is applied below 40 percent relative humidity and/or 60 °F (16 °C), the cure time is appreciably lengthened. The coating application range for MIL-PRF-85285 is relative humidity 20 to 80 percent and ambient temperature 50 to 90 °F (10 to 32 °C).

3.16.4 Thermal Spray Coating Systems. The USAF has chosen Metal Wire Arc Spray (MWAS) as its approved variant of thermal spray coatings. Metal wire arc spray is a thermally sprayed, sacrificial metallized coating for effective protection of structural iron and steel in corrosive environments. In the MWAS process, two electrically isolated wires of the selected coating material are given opposite Direct Current (DC) polarity using an arc-welder power supply. The wires are simultaneously fed to an application gun where they are brought into close proximity to initiate an electric arc. The arc between the two impinging wires results in a local region of high temperature plasma and molten metal. A jet of compressed air, directed through the arc region from behind, disperses and projects the molten metal to the surface being coated. The metal droplets impinge on the substrate, solidify and bond to form a continuous barrier/sacrificial metal coating for cathodic protection of the metal structure. The application gun remains 6 to 8 inches from the metal surface and negligible heat is imparted to the substrate even during extended coating activities.

3.16.4.1 **MWAS Application Equipment.** Equipment shall be able to support field and depot production levels. Organizations shall select from the recommended equipment in [Table 3-6](#).

Table 3-6. Metallization Equipment and Consumables

Equipment/Consumable	Use	Part Number(s)	Recommended Source of Supply
Metallizing Equipment	Used to apply MWAS to structural steel and iron components of Support Equipment	Thermion Precision Arc 3.2 TMS Bridgmaster	Thermion PO Box 80 Silverdale, WA 98383 TMS Metalizing Systems 8349 Dickey Rd NW, Bldg 1 Silverdale, WA 98383
Replica Tape	Manual method used to measure the profile of the surface to be sprayed for proper profile depth	Testex® Replica Tape 122 Testex® Replica Tape	DeFelsko Corp 800 Proctor Ave. Ogdensburg, NY 13669 Elcometer Inc. 6900 Miller Drive Warren, MI 48092
10x Magnifier (Illuminated)	Inspection tool to verify coating integrity after application	Illuminated 10x Magnifier 137 LED Illuminated (x10) Magnifier	DeFelsko Corp 800 Proctor Ave. Ogdensburg, NY 13669 Elcometer Inc. 6900 Miller Drive Warren, MI 48092
Profilometer	Digital surface profile gauge used to measure the profile of the surface to be sprayed for proper profile depth	PosiTector® SPG 224 Digital Surface Profile Gauge	DeFelsko Corp 800 Proctor Ave. Ogdensburg, NY 13669 Elcometer Inc. 6900 Miller Drive Warren, MI 48092
Multi-Metal DFT Gauge	Handheld electronic gauge used to measure coatings	PosiTector® 6000 with FN Probe 456 Coating Thickness Gauge with FNF Probe	DeFelsko Corp 800 Proctor Ave. Ogdensburg, NY 13669 Elcometer Inc. 6900 Miller Drive Warren, MI 48092
Blast/MWAS Masking Materials	Used to protect surfaces not being blasted or having MWAS applied.	310-16S Super Tough Tape Masking Fabric 6525-08 RD Tape 7322W Masking Blanket	Green Belting Industries 61 North Gates Ave. Lackawanna, NY 14218 Taconic 136 Coonbrook Road Petersburgh, NY 12138

3.16.4.1.1 **Metallization Materials.** See the table below for authorized metallization materials, uses, and recommended sources of supply.

Table 3-7. Approved Metallization Materials

Material	Use	Source of Supply
85/15 percent zinc/aluminum	Best overall general purpose corrosion protection on abrasive blasted carbon steel surfaces. This is the recommended material for ferrous surfaces of Support Equipment.	The Platt Brothers & Company 2670 S. Main St, Box 1030 E. Waterbury, CT 06271 AUFHAUSER Corporation 39 West Mall Plainview, NY 11803
100 percent aluminum	For coating hot sections of equipment mufflers, and aluminum components. Consult the Support Equipment SPO prior to applying to aluminum surfaces.	Alcotec Wire Corporation 2760 Aero Park Dr. Traverse City, MI 49686 AUFHAUSER Corporation 39 West Mall Plainview, NY 11803
90/10 percent aluminum/ aluminum oxide alloy	For the application of a tough durable, long-term anti-slip coating to steel and aluminum surfaces.	Alcotec Wire Corporation 2760 Aero Park Dr. Traverse City, MI 49686 AUFHAUSER Corporation 39 West Mall Plainview, NY 11803
100 percent zinc	Excellent corrosion protection except in seawater immersion conditions.	The Platt Brothers & Company 2670 S. Main St, Box 1030 E. Waterbury, CT 06271 AUFHAUSER Corporation 39 West Mall Plainview, NY 11803

3.16.4.1.2 Surface Profile Measuring Equipment. Replica tape is the preferred method for characterizing the prepared surface profile. It is simple, relatively inexpensive and shows good correlation with results from other methods. Replica tape kits are available from DeFelsko, Elcometer, Testex and other vendors. This is a very easy method where a piece of replica tape is placed on the area that needs to be measured. Follow manufacturer's instructions to obtain the surface profile. Alternatively, a surface profile gauge available from DeFelsko, Elcometer, or other vendors may also be used. This is a digital depth micrometer that records peak to valley measurements and displays the results on a screen. See [Table 3-6](#) for recommended equipment and sources of supply.

3.16.4.1.3 Coating Thickness Measuring Equipment. A multi-metal DFT gauge shall be used to measure the post-MWAS application coating thickness. See [Table 3-6](#) for recommended equipment and sources of supply.

3.16.4.2 MWAS Operator Training. Specialized training shall be completed prior to operating MWAS equipment.

3.16.4.2.1 The MWAS operator shall be trained on specific equipment prior to use with the initial training being provided by the equipment manufacturer. The training will cover the following areas:

- Operational safety and PPE requirements.
- Surface preparation and masking.
- Fixturing equipment and gun movement control.
- Setting and maintaining thermal spray parameters.
- Quality control to include inspection of surface preparation.
- Defect identification and correction and acceptance inspection including thickness measurements.

3.16.4.3 MWAS Facility Requirements. The main components of the MWAS facility requirements are electrical power, compressed air, and application booth (enclosed area). The following shall be considered during initial planning for this capability:

- Consult manufacturer's installation specifications to ensure adequate electrical power is available for all process related equipment.
- Clean, dry compressed air 90 to 100 PSIG at 65 Cubic Feet per Minute (CFM). Ensure air supply line is a minimum 3/4 inch inside diameter. The air supply must be sufficiently free of oil and moisture so that no visible oil or moisture appears on the blasted surface.
- Spray booth construction and ventilation equipment shall meet local, State, and Federal Environmental Safety and Occupational Health (ESOH) requirements.
- Spray booth dust collection and filtration shall meet local, State, and Federal ESOH requirements.
- Preferred usage is in a separate area from existing media blast equipment to help eliminate the chance of contamination during application. If the existing media blast equipment area is utilized, it shall be sectioned off with welding screens between media blast and the wire arc spray areas.

3.16.4.4 Pre-Media Blasting Surface Preparation. Surface to be blasted for MWAS coating application shall be cleaned utilizing materials and procedures in accordance with [Chapter 2](#).

3.16.4.5 Masking for Media Blasting. Masking materials shall consist of any material which protects the substrate and does not cause contamination or corrosion such as fiberglass tape, aluminum tape, masking fabric or masking compounds. Masking material shall be able to withstand the MWAS application process. See [Table 3-6](#) for recommended materials and sources of supply.

NOTE

Any masking material not able to withstand MWAS application process shall be removed after media blasting and before MWAS coating application.

3.16.4.6 Masking Procedures. Masking shall cover all adjacent areas which may be affected by blasting or MWAS application. All fit and function surfaces such as slots, keyways, machined surfaces, bearing surfaces, etc. that would be damaged by MWAS coating shall be masked. When holes, slots, keyways, or other critical areas cannot be protected by tapes or shields, inserts of silicone rubber, carbon or metal may be used. These inserts are left in place during abrasive blasting and MWAS coating application and may be removed upon completion of surface finishing. Potential over-spray surfaces shall be protected with removable masking materials to prevent over-spray from depositing on surfaces not already sprayed to the specified thickness.

3.16.4.7 Media Blast Equipment. Media blasting equipment required for MWAS surface preparation media blasting process is an approved blasting cabinet or booth capable of producing the required surface profile. Media blasting equipment and materials shall conform to requirements within [Paragraph 3.3.2](#) and TO 1-1-8, Operation Safety Requirements.

3.16.4.8 Surface Preparation Requirements. All surfaces to be thermal sprayed shall be abrasive blasted to a minimum of a near-white metal blasted surface and roughened to a minimum of a 2 mil surface profile. If coatings, oil or bituminous materials are present they must be removed prior to the blast operation. If the surface to be blasted is chemically contaminated, it may be necessary to wash it or neutralize it before blasting. See [Paragraph 3.3.2.1](#) for abrasive blasting requirements.

3.16.4.9 Surface Profile After Blasting/Preparation Process. The proper surface profile is critical for MWAS coating adhesion performance. Surface shall be blasted to a near-white metal finish as defined by The Society for Protective Coatings standard SSPC-SP 10. A near-white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than 5 percent of the examined area of surface and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. The prepared surface profile shall be 0.002 to 0.004 inch (0.038 millimeters (mm) to 0.100 mm) anchor-tooth profile and shall be inspected using replica tape and micrometer, or profilometer as stated in [Paragraph 3.16.4.1.2](#).

3.16.4.9.1 Surface Profile Inspection. Inspect substrate after blasting to ensure no contaminants remain. If oil grease etc., are present after blasting, clean surface in accordance with [Chapter 2](#). Allowed cleaning processes are listed below:

- Vapor degreasing preferred where possible.
- The solvent wipe method, utilizing materials in accordance with TO 1-1-8, Wipe Solvents, can be utilized providing it does not attack the substrate or leave a surface residue.

3.16.4.10 MWAS Application Process. An approved wire arc spray system is required for the MWAS application process. Organizations shall follow the thermal spray equipment manufacturer's instructions for use. The MWAS coating shall be applied to a minimum thickness of 6 mils and maximum of 8 mils.

WARNING

The MWAS process produces high localized noise levels and ultraviolet radiation emissions from the arc region. Prior to commencing initial MWAS operations consult with the local BEF for approval. Proper hearing, eye protection, and respiratory Personal Protective Equipment (PPE) will be designated by the local BEF.

3.16.4.10.1 Approved materials for the MWAS application process shall be in accordance with [Table 3-7](#), along with cool, dry compressed air.

CAUTION

Ensure wire stock is free from contaminants such as dirt, oil residue metal shavings and corrosion. Failure to remove contaminants will result in wire feed faults and substrate adhesion failures.

3.16.4.10.2 Any surface, which shows visible moisture, rust, scale or other contamination shall be re-blasted before spraying. The surface shall be completely coated to the specified thickness within six hours of abrasive blasting.

NOTE

If anchor-tooth prepared surface has come into contact with oils or greases, including bare hands or soiled gloves, it shall be solvent cleaned, and abrasive blasted again to restore surface profiling.

3.16.4.10.3 Details for MWAS application process are as follows:

- a. MWAS application shall occur as soon as practical after abrasive blasting, not to exceed 6 hours, and following visual inspection for flash rust.
- b. Application shall occur only when substrate temperature is at least 5 °F (3 °C) above the measured dew point and ambient relative humidity does not exceed 85 percent. These conditions shall be maintained throughout the coating process.
- c. Equipment start up and spray gun adjustments shall be made off the work piece (scrap metal sheet).
- d. Maintain a spray angle that is as perpendicular as possible and within 33° to the substrate.
- e. Standoff distance shall be 6 to 8 inches (150 to 200 mm).
- f. MWAS application shall be applied in several perpendicular passes with 40 percent overlap per pass.
- g. MWAS coating shall be applied to a minimum thickness of 6 mils and maximum thickness of 8 mils. The coating is typically applied at 2-4 mils per pass.
- h. MWAS thickness shall be inspected intermittently to ensure proper MWAS application and spray gun set up.
- i. For best results, MWAS application process should be a continuous, uninterrupted process except to change material, check temperature or thickness, or to allow cooling.



SEALER, THERMAL SPRAY SURFACES, METCOSEAL SA

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The correct thickness of thermal spray coating in this application is critical. A coating that is too thin will not provide corrosion protection while a coating that is too thick will chip and flake off.

3.16.4.10.4 On high temperature components metallized with aluminum, METCOSEAL SA silicone aluminum sealer shall be utilized to prevent any rust staining that may occur. This sealer is available from Oerlikon Metco, Inc., 1101 Prospect Ave, Westbury, NY 11590.

3.16.4.11 **MWAS Post-Application Inspection.** The equipment required for the MWAS inspection process is a 10x magnifying glass used for close visual inspection. In process inspection of each sprayed component shall ensure no moisture, oil, grit contamination, blisters, cracks, chips, pits, or coating separation. Spot check coating thickness per pass. Final inspection of the component using 10x magnification shall ensure the surface is free of defects (cracks, blisters, chips, etc.) and there is no oil or other contaminants, which can bleed through the coating. Also ensure there are no pits exposing the undercoat or substrate and no coating separation.

3.16.4.11.1 The metallized coating shall be inspected for thickness utilizing a multi-metal DFT gauge (see [Table 3-6](#)) to ensure correct surface thickness is achieved. Any damaged, thin or uncoated areas must be roughened with a mechanical grinder with a minimum of a 25-grit disc to apply a **cross-hatch** pattern to the substrate. Apply the thermal spray coating to reach the proper coating thickness within six hours.

3.17 FIELD LEVEL MAINTENANCE PAINTING REQUIREMENTS.

Field level maintenance-painting requirements for SE with polyurethane are divided into two types, touch-up painting and general maintenance painting.

3.17.1 **Touch-Up Painting.** Touch-up painting is defined as minor touch-up and/or sectionalized painting of equipment using authorized coating to prevent corrosion. When spot painting, the amount of coatings used should be enough to cover the affected area plus a one-inch overlap to seal the area's edges. Treat scratched areas that are 1/2 inch wide x 3 inches long or less, or chips one inch in diameter or less will be protected with CPC (temporary repair), or touched-up approved primers and topcoats preloaded in items such as but not limited to: SEMPENs, Preval® sprayers, Clip-Paks®, brush and roller, or two-component MIL-PRF-85285, Type IV, Class H, aerosol cans. Single component aerosols, including enamels, lacquers or polyurethanes, are not authorized coatings and shall not be used. Larger scratches/chips in the coatings or damaged areas will be grounds to repaint the complete section in accordance with [Paragraph 3.3](#).

3.17.2 Maintenance Painting.

3.17.2.1 **Maintenance Painting Restrictions.** Although it is not recommended, it is a common field level practice during maintenance painting to repeatedly overcoat the entire exterior surface. Under no circumstance should the total number of layers of paint ever exceed six (6). The number of layers can be determined during the featheredge sanding of damaged areas. Count each layer of primer as one and each layer of topcoat as one, the total of which should never exceed six.

3.17.2.2 Equipment exceeding this maximum number of paint layers should be scheduled for complete coating removal and repainting.



Excessive numbers of paint layers will result in hidden corrosion going unnoticed or interlaminar failure of the coatings at one of the coating boundaries. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

3.17.2.3 Powder coated equipment shall be touched up using MIL-PRF-85285, Type IV, Class H. A touch-up kit should be used on small areas less than one square foot. All damaged areas shall be feather-edge sanded along the edge damaged area to allow the repair coating to blend in the surrounding areas. The remaining areas to be touched-up shall be scuff sanded with 180 or 240 grit abrasive paper. All bare aluminum areas resulting from coating failure shall be pretreated with a chromate conversion coating prior to priming. The bare areas shall be primed and topcoated with the applicable authorized coating systems listed in [Table 3-4](#).

3.17.3 Prepackaged Coating Touch-Up Kits. For minor primer and paint touch-up such as scratches and other small repair, the use of prepackaged touch-up kits manufactured with the compatible the authorized conversion coatings, primers and topcoats are encouraged.

3.17.3.1 Use of the prepackaged touch-up kits minimizes material waste and personnel exposure to paints and solvents while allowing for the use of the proper coating system for the repair.

3.17.3.2 SEMPENs, Preval® sprayers, Clip-Paks®, brush and roller, or two-component MIL-PRF-85285, Type IV, Class H, aerosol cans. Single component aerosols, including enamels, lacquers or polyurethanes, are not authorized coatings and shall not be used.

3.17.4 Radiators Coatings.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, TRANSPARENT, MIL-DTL-85054

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Radiator coatings are pre-applied at the OEM. Field repair is limited to touch-up of the body and attach points of the radiator but not the radiator vanes/core. For touch-up, use the appropriate color of polyurethane from Appendix A. A thin layer of water displacing, hard film CPC, MIL-DTL-85054, may be fogged into the radiator vanes for added protection or for temporary repair. Do not use soft film CPC materials as the coating may collect dirt and debris on the cooling vanes reducing the efficiency of the radiator. An aerosol extension kit such as the Formit® 90-degree applicator, or equivalent, may be used to fog the CPC into recessed areas of the radiator. Heavy buildup of coatings and/or CPC is to be avoided. To prevent CPC buildup, remove and reapply the CPC, MIL-DTL-85054 during normal wash cycles.

3.18 LIQUID OXYGEN AND LIQUID NITROGEN SERVICING CARTS AND STORAGE TANKS.

Liquid nitrogen and liquid oxygen servicing carts and storage tanks will be drained and purged in accordance with the applicable equipment technical order prior to cleaning and painting.

3.18.1 Authorized Materials for Liquid Oxygen and Nitrogen Tanks.



All valves and instrumentation shall be masked after draining and purging to prevent contamination and explosion hazard during cleaning and painting. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

The colors for liquid nitrogen and oxygen servicing carts, and storage tanks shall be in accordance with [Table 3-4](#) and [Paragraph 3.5.1.1](#).

3.19 WALKWAYS AND STEPPING SURFACE COATINGS.



COATING, WALKWAY COMPOUND, NON-SLIP, A-A-59166

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The stepping, standing and/or walking surfaces of stands, metal ladders, platforms, tops of deicing-decontamination unit tanks, etc., shall be coated with walkway coating, A-A-59166. Expanded metal, grating and other anti-skid plates are exempted as long as they are safe from slippage. Adhesive backed, non-slip material MIL-PRF-17951 may be used as an alternate. Follow the non-slip material manufacturers' application instructions.

3.20 COLORS FOR WASTE CONTAINERS.

Containers (Bowsers) used for holding explosive or highly flammable materials will be painted and marked in accordance with TO 42B-1-23.

3.21 SE UNDERCOATING.



CORROSION PREVENTIVE COMPOUNDS, COLD APPLICATION, A-A-59295

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CID A-A-59295 undercoating is authorized for use by field units. The undercoating is intended for use in one thick coat (1/8 inch) on the underside of fenders, floors, etc., to deaden noise, to act as a seal against fumes and to protect the metal from corrosion.

3.21.1 SE Undercoating Considerations. The undercoat may be applied to a primed surface. Topcoating in this area prior to undercoating is not required. Ensure the undercarriage of the equipment is clean prior to application of the undercoating. Do not apply over corrosion.

NOTE

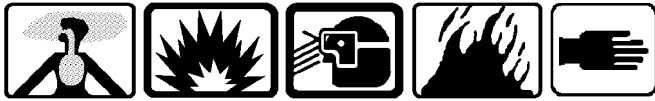
For maximum corrosion protection, undercoating should be applied by the original equipment manufacturer during production.

3.21.1.1 The undercoat is not fluid resistant and fuels/fluids/solvents will readily cause deterioration of the coating. Undercoat should not be used in an area subjected to fluid spills.

3.21.1.2 The undercoat should never be applied over a component (such as a transmission) where the coating would result in the undesired retention of heat.

3.21.1.3 Undercoating is not resistant to temperatures in excess of 325 °F (163 °C) and should not be used in such areas.

3.22 STORAGE COMPARTMENTS.



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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Storage compartments for ducts or hoses, which use a pad, or matting for abrasion resistance are highly susceptible to corrosion due to the water absorbing characteristics of those materials. Units should remove the pads/matting and replace the mat with an abrasion resistant floor covering, followed by using one of the following coating techniques after removal of all corrosion and the surface is completely prepared:

- a. Apply MIL-PRF-81733 sealant 1/8 inch thick over a clean primed and painted surface.
- b. Apply 3M™ Polyurethane Protective Tape (3M 8561) over a clean primed and painted surface. The film is available in four-inch-wide rolls and can be easily trimmed to fit any contour or shape. The surface must be clean to permit the adhesive backing to bond properly.
- c. Apply 85/15 percent zinc/aluminum metallization 4-6 mils thick on bare, abrasive blasted steel surfaces.
- d. Apply a sprayable polyurethane truck bed liner type coatings, on high wear areas and storage compartment interiors. Colors shall be black or consistent with the existing color utilized on the equipment. The coating shall be applied over the existing primer and topcoat.

3.23 SPLIT WHEEL ASSEMBLIES.

3.23.1 Split Wheel Coating Requirements.



ADHESIVE-SEALANTS, SILICONE, RTV, NON-CORROSIVE, MIL-A-46146

1



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

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PRIMER, METAL-RICH, MIL-PRF-32550

14

To prevent corrosion on the mounting flanges of the split wheels accomplish the following:

- a. Remove all corrosion and clean the flanges.
- b. For mechanically cleaned carbon steel wheels, the split wheel assemblies shall have metal-rich primer, MIL-PRF-32550, Type I, Form A, Class S, applied to a dry filming thickness of 2.5 to 3.5 mils. Allow primer to completely dry in accordance with manufacturer's instructions prior to assembly.
- c. MIL-DTL-53022, Type IV, Class L, applied to a DFT of 1.5 (± 0.2) mils, is an acceptable alternate for metal-rich coatings on split wheel assemblies. Allow primer to completely dry in accordance with manufacturer's instructions prior to assembly.
- d. Reassemble in accordance with applicable technical order and apply a bead of sealant RTV MIL-A-46146 around the inflation valve stem to prevent water entry. Tires will be treated with a commercial tire dressing, and all valve stem caps will be plastic.

3.24 MUFFLERS.

To reduce corrosion problems on muffler components a thermal sprayed aluminum coating may be used in accordance with [Paragraph 3.16.4](#). The effectiveness of the coating is dependent upon the particular component and the environment (temperature, time at temperature, and time to reach temperature). The effectiveness will also be dependent upon the condition of the component prior to thermal spraying, the coating will be more effective on a new component than on a reconditioned component that had already rusted.

3.25 MISCELLANEOUS CLEANING, SEALING, AND CORROSION PREVENTIVE COMPOUND REQUIREMENTS.

3.25.1 Sealing of Addressograph or Dash-A Plates.



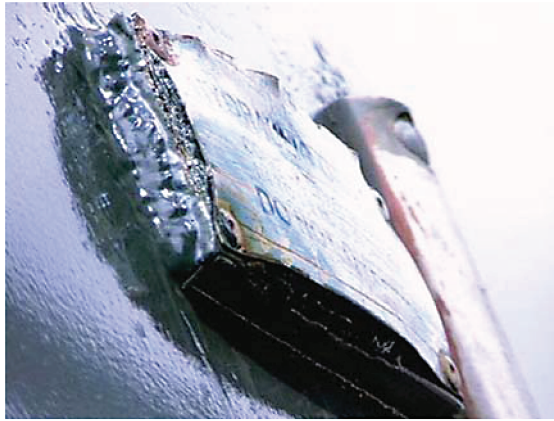
SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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NOTE

Do not apply thermal spray pure zinc, 85/15 percent zinc/aluminum or pure aluminum to stainless steel muffler components.

Whenever an Addressograph or Dash-A-Plate is used in lieu of die cut vinyl markings or stencils as data plates, they should be installed wet with corrosion inhibiting sealant, MIL-PRF-81733. The requirement for wet installation also includes the fasteners used for installation. Using the sealant will prevent corrosion from occurring between the data plate and SE. (See [Figure 3-9](#).)



TO-35-1-3-018

Figure 3-9. Corrosion Under Data Plate

3.25.2 Electrical Hardware and Terminals.



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

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PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377

13



TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285

17



PETROLATUM, TECHNICAL VV-P-236

18

NOTE

Clean corrosion on terminal studs with a wire brush or terminal stud-cleaning tool.

3.25.2.1 For cables and terminal posts, brush on a light coat of petrolatum, VV-P-236 Grease.

3.25.2.2 For battery frames and holders, apply one coat of primer, MIL-DTL-53022, Type IV, Class L, or MIL-PRF-23377, Type I, Class N, primer, and one coat of MIL-PRF-85285, Type IV, Class H, topcoat. DFT for MIL-DTL-53022 shall be 1.5 (± 0.2) mils, MIL-PRF-23377 shall be 0.6 to 0.8 mils, and MIL-PRF-85285 shall be 1.6 to 2.4 mils.

3.25.3 Light Assemblies.

CLEANER, NON-AQUEOUS, LOW-VOC, HAP-FREE, MIL-PRF-32295

3



DEGREASING SOLVENT, MIL-PRF-680

8



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10



CLEANING AND CLEANING-LUBRICATING COMPOUNDS, ELECTRICAL CONTACT, MIL-PRF-29608

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Instructions for cleaning the light assemblies are as follows:

- a. Remove corrosion with abrasive mat, A-A-58054 wetted with MIL-PRF-680, Type II or III, or MIL-PRF-32295, Type II, wipe off residue and allow to air dry.



Solvent will cause softening and deterioration of rubber gaskets, seals, and insulation. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

- b. Clean electrical contacts with MIL-PRF-29608, Type I, or equivalent, electrical contact cleaner.
- c. Apply a thin layer of CPC, MIL-DTL-87177, Grade B, to the contacts.

3.25.4 Internal Electrical Components: Circuit Breakers, Relays, etc. Instructions for removing and cleaning internal electrical components are as follows:



Do not remove thin plating on electrical components. Always use the mildest method of corrosion removal. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

- a. Remove heavy corrosion by rubbing contact surfaces with an abrasive typewriter eraser. Remove light to medium corrosion by rubbing contact surface with ruby red eraser.
- b. Clean contacts with MIL-PRF-29608, Type I, or equivalent, electrical contact cleaner. Clean relay or circuit breaker assembly with acid brush, CID A-A-289. Remove foreign matter with a soft brush.

CAUTION

- Do not apply MIL-PRF-81309 CPC to printed circuit boards. Contact points must be clean for CPC to function properly. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.
- Care must be taken to avoid removing thin plating. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

c. Apply a thin coat of MIL-DTL-87177, Grade B, CPC to relays and contacts.

3.25.5 Electrical Connectors.



CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD-APPLICATION, MIL-PRF-16173

6



ISOPROPYL ALCOHOL, TT-I-735

9



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

10



CLEANING AND CLEANING-LUBRICATING COMPOUNDS, ELECTRICAL CONTACT, MIL-PRF-29608

19

CAUTION

Replace all connectors that show moderate to severe corrosion damage. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

Remove light corrosion by soaking in solvent, TT-I-735, isopropyl alcohol, followed by scrubbing with toothbrush, CID A-A-59 or A-A-123.

3.25.5.1 Apply CPC MIL-DTL-87177, Grade B, to internal surfaces. Preserve outer shell with MIL-PRF-16173, Grade 4. Wipe off excess with a clean cloth.

3.25.5.2 For equipment operating, deploying to, or based in, severe corrosion prone locations, the use of Av-DEC STRETCHSEAL®, Dual Tape Connector Wrap Kit is authorized for use around mated electrical connectors, coaxial connectors, and electrical quick disconnect fittings.

3.25.6 Switches. Cleaning instructions for the switches are as follows:

- Scrub switch with isopropyl alcohol, TT-I-735, and toothbrush, CID A-A-59 or A-A-123. Wipe with clean cloth, CCC-C-46. Allow component to air dry.
- Apply a thin coat of CPC MIL-DTL-87177, Grade B, to the electrical contact points.
- Wipe all sliding contacts, cams, and contact points with a clean cloth, CCC-C-46, Class 4 or pipe cleaner to remove CPC.

3.25.7 Wire Harness and Cables. Instructions for cleaning the wire harness and cables are as follows:

NOTE

- Contact points must be clean of CPC to function properly.
- Cleaning solvents and compounds may adversely react with plastics such as harness tubing, gaskets, seals, etc. Test a small area for softening or reaction prior to general use.

3.25.7.1 Scrub corroded area with MIL-PRF-29608, Type I, or equivalent, electrical contact cleaner. Flush area with cleaning compound. Shake excess solvent from wire harness. Remove residue with a clean cloth, CCC-C-46 and allow component to air dry.

3.25.8 Heli-Coil Insert Replacement.



PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377

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Steps for removal of the insert are as follows:

- a. Remove the defective insert.
- b. Clean and dry the female thread from which the defective insert was removed.
- c. Apply MIL-PRF-23377, Type I, Class N primer sparingly to the cleaned female thread.
- d. Before the primer dries, install new insert and remove the insert driving tag.

CHAPTER 4

MARKING OF SUPPORT EQUIPMENT (SE)

4.1 SE MARKINGS CROSS-REFERENCE.

SE marking requirements have been removed from this technical order. Reference Technical Order (TO) 35-1-18, Marking of USAF General SE, for all common SE markings.

CHAPTER 5

CORROSION PREVENTION AND CONTROL OF HUSH HOUSES

5.1 MATERIALS.

There are three basic materials used in the construction of Hush Houses. The primary material being galvanized steel, with the galvanizing offering improved corrosion protection over plain carbon steel. The second material used is carbon steel, which is susceptible to a corrosive environment. The third material used are Types 321 and 409 stainless steel that may be specified for use in the hot section of the hush house. Types 321 and 409 stainless steel are weldable and will offer adequate corrosion protection.

5.1.1 Fastener Replacement. Any fastener replacement should be accomplished using either stainless steel fasteners or hot dip galvanized fasteners.

5.2 REPAIR.



To prevent dissimilar metal related problems, do not use zinc plated or hot dipped zinc fasteners on stainless or corrosion resistant steel parts. Failure to comply could result in damage to, or destruction of, equipment or loss of mission effectiveness.

5.2.1 Galvanized Steel. The amount of corrosion present will determine what is required for repair. If the corrosion is minor, then either abrasively grind the corrosion and chemically treat with pretreatment compound. If the corrosion is severe or widespread, abrasive blasting may be required.

5.2.1.1 If an entire galvanized steel component is replaced, then every side of that component must be primed prior to installation. If any part of the installation process, such as welding, damages the coatings, the exposed damaged area will be cleaned and repainted with thinned metal-rich primer.

5.2.1.2 Hush House galvanized sheet should be hot dip galvanized in accordance with ASTM A653, CS Type C, Coating Designation G210.

5.2.2 Carbon Steel. All accessible carbon steel items require abrasive blasting prior to application of the respective metalrich primers. The abrasive blasting and subsequent painting of an assembled structure will provide protection to the exposed portion of the structure. See [Paragraph 5.2.2.2](#) if corrosion is found in a seam or joint.



Failure to prime faying surfaces of carbon steel will result in corrosion that cannot be treated without extensive repair or disassembly.

5.2.2.1 If an entire component (panel, plate, beam, support) is replaced. Then every side of that component must be primed prior to installation. If any part of the installation process, such as welding, damages the coatings, the exposed damage area will be cleaned and repainted with thinned metal-rich primer.



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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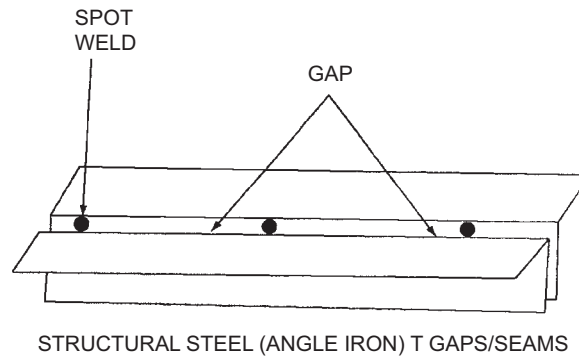
5.2.2.2 Carbon steel (angle iron) seams, such as a T-angle, having corrosion, will require the following procedure to remove and treat corrosion.

- a. Apply phosphoric acid corrosion removing compound. Allow the material to dwell on the surface for 30-45 minutes, adding additional material to keep the surface wet. Agitate with thin bristled steel brush, if necessary, to remove heavier rust.

- b. Rinse area and check for rust; metal condition if necessary.
- c. Allow area to dry.
- d. Mask gaps at lower sides of angle iron T's with masking tape that complies with SAE AMS-T-23397.

NOTE

- Use of sealant gun is recommended for injecting sealant into entire gap.
 - Above procedure should only be accomplished for treating existing corrosion problems in this area.
- e. Fill entire gap using sealant MIL-PRF-81733, Type IV.



TO-35-1-3-125

Figure 5-1. Angle Iron Sealant Application

5.2.3 Stainless Steel. Characteristics of stainless steel are as follows.

5.2.3.1 Type 321 Stainless Steel. Type 321 stainless steel has good corrosion resistance to oxidation and corrosion. Because of a small amount of alloyed titanium, Type 321 stainless steel does not harden during welding and therefore, does not require a post weld relief. Normally, this steel has a shiny surface with areas of dull gray streaks. The streaking is caused by the titanium content and is not harmful. Type 321 has the following weld properties:

5.2.3.1.1 Type 321 has the following weld properties:

- Gas Metal-Arc. When welding Type 321 to itself, use ER347 or ER321 wire electrode shielded by 98/2 argon/CO₂ gas.
- Shielded Metal-Arc (covered electrodes). E347-16 filler shall be used.
- Gas Tungsten-Arc. This procedure should be used when welding Type 321 to mild steel. ER309L filler shall be used. Argon gas shall be used for shielding.

5.2.3.1.2 Do not coat Type 321 stainless steel with any of the zinc-rich coatings. The zinc in the coatings can embrittle the stainless steel under certain conditions. The use of Type 321 that is in contact with zinc-rich coated carbon steel (as in the Hot Section) is acceptable.

5.2.3.2 American Iron and Steel Institute (AISI) 409 Stainless Steel. AISI 409 Stainless Steel is the lowest cost of all stainless steels yet it has good resistance to oxidation and corrosion. Because of a small amount of titanium, the AISI 409 does not harden during welding and, therefore, does not require a post weld relief. Normally the steel has a shiny surface with areas of dull gray streaks. The streaking is caused by the titanium content and is not harmful.

5.2.3.2.1 The AISI 409 has the following weld properties:

- Gas Metal-Arc. The electrode wire should be ER309L filler when welding AISI 409 to mild steel. When welding AISI 409 to itself, use ER409Nb filler. Both shall be shielded by 98/2 argon/CO₂ gas.

- Shielded Metal-Arc (covered electrodes). ER409Nb filler shall be used.
- Gas Tungsten-Arc. When fillers are required, ER409Nb filler shall be used. Argon gas shall be used for shielding.

5.2.3.2.2 Do not coat Type 409 stainless steel with any of the zinc-rich coatings. The zinc in the coatings can embrittle the stainless steel under certain conditions. The use of Type 409 that is in contact with zinc-rich coated carbon steel (as in the Hot Section) is acceptable.

5.2.3.3 Sealing.



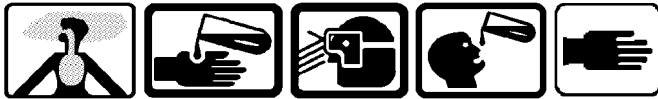
SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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Mating surfaces where moisture could enter from the top or horizontal will be sealed with sealant MIL-PRF-81733 (Cold Section) and sealant SAE AMS3374, Type I (Hot Section), after primer application and before topcoat application.

5.3 PRETREATMENT COMPOUNDS.

5.3.1 Loctite Naval Jelly Rust Dissolver.



REMOVER, RUST, LOCTITE NAVAL JELLY

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WARNING

Rust remover Loctite Naval Jelly Rust Dissolver contains phosphoric and sulfuric acid. Use with adequate ventilation. Consult with the local Bioenvironmental Engineering Flight (BEF) for approved personal protective equipment. In event of skin or eye contact, flush immediately with plenty of water. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

NOTE

Loctite Naval Jelly Rust Dissolver is a biodegradable rust remover and pretreatment compound for galvanized steel.

5.3.1.1 Follow the manufacturer's application instructions for corrosion removal. Repeat the process until all corrosion is removed. Allow to air dry prior to the application of a protective coating.

5.4 PRIMERS.



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

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COATING KIT, EPOXY, FOR INTERIOR OF STEEL FUEL TANKS, MIL-PRF-23236

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WARNING

Respirator with organic vapor cartridges is required for all painting/priming operations unless the BEF has approved the workplace for no respirator protection. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

5.4.1 Metal-Rich Primer. The primer shall be MIL-DTL-53022, Type IV, Class L. No alternate coatings are authorized.

5.4.1.1 Dry Film Thickness (DFT) of applied primer shall be of 1.5 (± 0.2) mils unless applied to a galvanized surface. (See [Paragraph 5.7.](#))

5.4.1.2 This primer requires top coating when used on exterior surfaces. (See [Table 5-1.](#))

5.4.2 MIL-PRF-23236, Type VII, Class 13. MIL-PRF-23236, Type VII, Class 13 is a coating system that is usually furnished as two or three components. In this use case, it will be considered a primer.

5.4.2.1 Follow the manufacturer's instructions for mixing, thinning, and application.

5.4.2.2 Only those products listed for this specification on the Qualified Product List/Qualified Products Database (QPL/QPD) located at <https://qpldocs.dla.mil/default.aspx> are authorized.

Table 5-1. Hush House Coating Chart

Area	Material	Primer	Topcoat
Hot Section (Exterior)	Carbon Steel	100 percent Aluminum Metallization Process Metal Wire Arc Spray (MWAS), or MIL-PRF-23236, Type VII, Class 13	MIL-PRF-85285, Type IV
Door Structure	Carbon Steel	85/15 percent Zinc/Aluminum MWAS, or Metal-Rich Primer MIL-DTL-53022, Type IV, Class L	MIL-PRF-85285, Type IV
Cold Section	Galvanized Steel	MIL-DTL-53022, Type IV, Class L, primer or 85/15 percent Zinc/Aluminum MWAS	MIL-PRF-85285, Type IV

5.5 TOPCOATS.**WARNING**

Respirator with organic vapor cartridges is required for all painting/priming operations unless the Bioenvironmental Engineering Flight (BEF) has approved the workplace for no respirator protection. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

5.5.1 Structural Corrosion Protection.

NOTE

Prior to total repaint of Hush House, accomplish corrosion repair procedures in accordance with [Paragraph 5.2.](#)

Corrosion protection for the Hush House consists of MIL-PRF-23236 primed steel (door frame beams, support beams, exhaust tube) and ASTM A653, Coating G210 galvanized panels (roof, walls, door). This corrosion protection system should be adequate in all but extremely severe corrosion environments.

5.5.2 Camouflage Requirements. The selection of colors for an exterior camouflage pattern should be restricted to those readily available for MIL-PRF-85285. MAJCOM will determine the need and color requirements for the operating locations requesting the application of a camouflage pattern to the Hush House.

5.6 METAL-RICH PRIMED SURFACES.

NOTE

- To prevent streaking and other problems, it is necessary to work from the bottom to the top and not allow previously worked surfaces to dry.
- The amount of surface area to be worked at any time should not exceed the surface area that can be epoxy primed and polyurethane topcoated in one day.

5.6.1 Primer Requirements on the Door Frame Beams, Support Beams, and Exhaust Tube.



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

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PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

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PRIMER, EPOXY, HIGH-SOLIDS, NON-CHROMATED, MIL-PRF-23377

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TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285

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ACETONE, ASTM-D329

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CLEANING COMPOUNDS, AIRCRAFT SURFACE, A-A-59921

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Primer requirements are as follows:

NOTE

Examine the primed surface prior to cleaning. If the surface appears to be dirty (not oily), then MIL-PRF-87937, Type IV soap should be sufficient to clean the surface. If the surface is oily, it will be necessary to use one of the cleaners (CID A-A-59921 or MIL-PRF-87937, Type I), which contain solvent. In either case, it is absolutely necessary that the surface be scrubbed while the soap is being applied. A clean water break free surface is necessary prior to additional treatment.

- a. Preferably on the day prior to painting, the surface to be coated the next day is to be cleaned. Use aircraft cleaning soap, MIL-PRF-87937, or CID A-A-59921, as appropriate. Always clean from the bottom to the top to prevent streaking and have one person applying rinse water to previously cleaned surfaces to also prevent streaking.
- b. Early on the second day, apply one coat of MIL-DTL-53022, Class L, Type IV, or MIL-PRF-23377, Type I, Class N primer, and one coat of MIL-PRF-85285, Type IV topcoat. Dry film thickness for MIL-DTL-53022 shall be 1.5 (± 0.2) mils, MIL-PRF-23377 shall be 0.6 to 0.8 mils.
- c. Apply two coats of MIL-PRF-85285, Type IV to a total dry film thickness of 1.6 to 2.4 mils.
- d. After the first topcoat has been allowed to dry a maximum of 4-6 hours, apply the desired camouflage pattern. If using polyurethane, lightly scuff sand the area to be overcoated, then solvent wipe with Acetone, (ASTM D329), prior to painting.

5.7 GALVANIZED SURFACES.

NOTE

- To prevent streaking and other problems, it is necessary to work from the bottom to the top and not allow previously worked surfaces to dry.
- The amount of surface area to be worked at any time should not exceed the surface area that can be zinc conversion coated epoxy primed and polyurethane topcoated in one day.

5.7.1 Roof.



CLEANING COMPOUND, AEROSPACE EQUIPMENT, MIL-PRF-87937

4



TOPCOAT, AIRCRAFT AND SUPPORT EQUIPMENT, MIL-PRF-85285

17



CLEANING COMPOUNDS, AIRCRAFT SURFACE, A-A-59921

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Drape a barrier of paint drop cloths, barrier paper or other suitable material on the walls directly below area of roof to be worked. The drape should be such to prevent fluids from contacting the wall.

NOTE

Examine the galvanized surface prior to cleaning. If the surface appears to be dirty (not oily), then MIL-PRF-87937, Type IV soap should be sufficient to clean the surface. If the surface is oily, it will be necessary to use one of the cleaners (CID A-A-59921, Type II or MIL-PRF-87937, Type I), which contain solvent. In either case, it is absolutely necessary that the surface be scrubbed while then soap is being applied. A clean water break free surface is necessary prior to additional treatment.

5.7.1.1 On the day prior to painting, the surface to be coated the next day is to be cleaned. Use aircraft cleaning soap MIL-PRF-87937 as appropriate. Always clean from the bottom to the top to prevent streaking and have one person applying rinse water to previously clean surfaces to also prevent streaking.

5.7.1.2 Early on the second day, apply the pretreatment compound. Again work from bottom to top applying the compound. Keep lower surfaces (even where the pretreatment compound was previously applied) flooded with water to prevent streaking.

5.7.1.3 As soon as the pretreatment compound has dried, apply one coat of metal-rich primer in accordance with [Table 5-1](#) to a dry film thickness of 2.0 to 3.0 mils.

5.7.1.4 Apply one heavy coat of polyurethane MIL-PRF-85285, Type IV, Class H, to a dry film thickness of 1.6 to 2.4 mils.

5.7.1.5 After the entire roof has been topcoated and allowed to dry a maximum of 4-6 hours, apply the desired camouflage pattern. Lightly scuff sand the area to be overcoated, then wipe with a Scotch-Brite™, or equivalent, pad (CID A-A-58054, Type I, Grade A), dampened with MIL-PRF-87937 diluted in accordance with manufacturer's instructions. After wiping with cleaner, rinse surface with clean cloth dampened with water and dry with clean cloth prior to painting.

5.7.2 **Walls and Doors.** The walls should be worked only after the roof painting is complete. Work on the door can be accomplished as desired. The air intake space in the wall formed by the screen wire and acoustical panels must be protected during repainting operations to prevent entry of chemicals and paints. Cut pieces of plywood (or other barrier type materials) and push the plywood against the screen wire from the interior side. Because of the difficulty in cleaning and painting the solid wall area formed by acoustical panels and screen wire, it is recommended that a galvanized panel equal in width and length be fabricated and attached to the solid wall areas by means of locally fabricated standoffs.

CHAPTER 6

CORROSION PREVENTION AND CONTROL OF NOISE SUPPRESSOR SYSTEMS (NSS)

6.1 GENERAL.

NSS are divided into the Cold Section (temperatures of less than 300 degrees Fahrenheit (°F) (149 degrees Celsius (°C)) and the Hot Section (temperatures of 300 °F (149 °C) or more). [Table 5-1](#) will identify the coating for a particular section based on the material and temperature. Earlier NSS were coated with alkyd enamels (TT-E-489, TT-E-527) and high temperature aluminum topcoat (TT-P-28) both of which are ineffective for corrosion prevention.

6.2 MATERIALS.

There are three basic materials used in the construction of NSS. The primary material being carbon steel this is extremely susceptible to the corrosive environment generated by the suppressor. The second material used is galvanized steel and the galvanizing will offer improved corrosion protection over the plain carbon steel, but can be used only in the Cold Section due to temperature limitations of the galvanizing. The third material used is American Iron and Steel Institute (AISI) 409 stainless steel and the material has been specified in numerous rework contracts for use in the Hot Section. AISI 409 is the least expensive of all stainless steel, is weldable and will offer adequate corrosion protection.

6.3 FASTENER REPLACEMENT.

Any fastener replacement should be accomplished using either stainless steel fasteners or hot dip galvanized fasteners that complies with ASTM A394, A3125, or A153 (as applicable).

6.4 STRUCTURAL REPAIR.

6.4.1 Structural Repair Carbon Steel.



PRIMER, EPOXY, CORROSION INHIBITING, LEAD AND CHROMATE FREE, MIL-DTL-53022

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CHEMICAL CONVERSION COATINGS AND PRETREATMENTS FOR METALLIC SUBSTRATES, TT-C-490

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Failure to prime faying surfaces of carbon steel will result in corrosion that cannot be treated without disassembly.

All carbon steel items require garnet blasting prior to application of the respective metal-rich primers. The garnet blasting and subsequent painting of an assembled structure will provide protection to the exposed portion of the structure, but if there is corrosion in a seam or joint, then disassembly will be required.

6.4.1.1 If an entire component (panel, plate, beam, support) is replaced, then every side of that component shall be primed in accordance with [Table 5-1](#) prior to installation. If any part of the installation process, such as welding, damages the coatings, the exposed damaged area will be cleaned and repainted after installation.

6.4.2 Galvanized Steel. The amount of corrosion present will determine what is required for repair. If the corrosion is minor, then grind the corrosion and recoat with the pretreatment TT-C-490, and epoxy primer, MIL-DTL-53022, Type IV, Class L. If the corrosion is severe or widespread, abrasive blasting may be required.

6.4.2.1 If an entire galvanized steel component is replaced, then every side of that component shall be primed in accordance with [Table 5-1](#) prior to installation. If any part of the installation process, such as welding, damages the coatings, the exposed damaged area will be cleaned and repainted after installation.

6.4.2.2 Any replacement galvanized sheet should be hot dip galvanized in accordance with ASTM A653, coating G210. All structural steel in the galvanized condition should be hot dip galvanized in accordance with ASTM A123.

6.4.3 AISI 409 Stainless Steel. Characteristics of AISI 409 Steel are as follows:

6.4.3.1 AISI 409 Stainless Steel is the lowest cost of all stainless steels yet it has good resistance to oxidation and corrosion. Because of a small amount of titanium, the AISI 409 does not harden during welding and; therefore, does not require a post weld relief. Normally the steel has a shiny surface with areas of dull gray streaks. The streaking is caused by the titanium content and is not harmful.

6.4.3.1.1 The AISI 409 has the following weld properties:

- Gas Metal-Arc. The electrode wire should be ER309L filler when welding AISI 409 to mild steel. When welding AISI 409 to itself, use ER409Nb filler. Both shall be shielded by 98/2 argon/CO₂ gas.
- Shielded Metal-Arc (covered electrodes). ER409Nb filler shall be used.
- Gas Tungsten-Arc. When fillers are required, ER409Nb filler shall be used. Argon gas shall be used for shielding.

6.4.3.1.2 Do not coat the AISI 409 with any of the zinc-rich coatings. The zinc in the coatings can embrittle the stainless steel under certain conditions. The use of Type 409 that is in contact with zinc-rich coated carbon steel (as in the Hot Section) is acceptable.

6.5 SEALING.



SEALING AND COATING COMPOUND, CORROSION INHIBITIVE, MIL-PRF-81733

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Mating surfaces where moisture could enter from the top or horizontal will be sealed with MIL-PRF-81733 (Cold Section) or SAE AMS3374, Type I, (Hot Section) after primer application and before topcoat application.

6.6 COATINGS.



COATING KIT, EPOXY, FOR INTERIOR OF STEEL FUEL TANKS, MIL-PRF-23236

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WARNING

Respirators with organic vapor cartridges is required for all painting/priming operations unless the Bioenvironmental Engineering Flight (BEF) has approved the workplace for no respirator protection. Failure to comply could result in injury to, or death of, personnel or long-term health hazards.

6.6.1 Metal-Rich Primers. The primer shall be in accordance with [Table 5-1](#).

- Dry film thickness shall be 3.0 mils (approximately 5.0 mils wet).
- Prior to repainting, or initiating a contract for repaint of the exhaust area it is important to know the surface temperature of the exterior walls of the exhaust section. Approximate temperatures can be obtained with the use of Wahl Temp-Plate, Palmer Wahl Instruments, Inc., Asheville, NC, (800) 421-2853, or equivalent. If the temperature is below 300 °F (149 °C) this area shall be coated with Cold Section finishes.

6.6.2 MIL-PRF-23236, Type VII, Class 13. MIL-PRF-23236, Type VII, Class 13, is a coating system that is usually furnished as two or three components. In this use case, it will be considered a primer.

6.6.2.1 Follow the manufacturers' instructions for mixing, thinning, and application.

6.6.2.2 Only those products listed for this specification on the Qualified Product List/Qualified Products Database (QPL/QPD) located at <https://qpldocs.dla.mil/default.aspx> are authorized.

6.7 TOPCOAT.



TOPCOAT, SILICONE, HIGH TEMPERATURE, THURMALOX 270-18

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6.7.1 High Temperature Resistant Silicone Coating Thurmalox 270-18. Thurmalox 270-18 is low-sheen green, one-component, heat resistant coating of silicone resin. Instructions for applying Thurmalox 270-18 are as follows:

NOTE

Thurmalox 270-18 shall be used as a topcoat for MIL-PRF-23236, Type VII, Class 13.

- a. Mix to a uniform consistency by ordinary stirring.
- b. Thinning can be accomplished using Thurmalox 295 thinner. Do not use more than 1-1/2 pints per gallon.
- c. Apply Thurmalox 270-18 by airless, conventional, or electro-static spray equipment. The following equipment is recommended by the manufacturer as a guide:
 - Spray gun: DeVilbiss P-MBC or JGA
 - Air hose*: 5/16 inch inside diameter
 - Fluid hose*: 3/8 inch inside diameter
 - Air cap: 704
 - Fluid nozzle: FX (0.042 inch)
 - Pot pressure: 15-20 pounds
 - Atomizing pressure: 40-45 pounds
 - Needle adjustment: Half open
 - Distance from work: 8-10 inch

* Smaller hose diameters, or hose lengths greater than 25 feet, may require increased pressures.
- d. Drying time at 70 °F (21 °C), set to touch, is 30 minutes.
- e. Dry film thickness shall be 0.75 to 1.0 mils.

CHAPTER 7

SOUTHWEST ASIA (SWA) OPERATIONS AND ENVIRONMENTS

7.1 GENERAL.

The SWA Area of Responsibility (AOR) consists of various regions from Afghanistan to South Africa. (See [Figure 7-1.](#)) The environmental conditions range from seasonal high winds and high humidity to arid areas and low winds. In many locations, there are negatively charged ions called anions in soils which when combined with aggressive sand storms, can spread through SWA. The degree that sand and dust can penetrate equipment is dependent on many variables such as wind speed and direction, size of the dust/sand particles, protective shelter availability, and condition of the equipment, such as deteriorated seals/gaskets and bent doors.



TO-35-1-3-126

Figure 7-1. SWA AOR

7.1.1 Operating Environment. Extensive operations in a desert can result in very fine sand and dust intrusion into Support Equipment (SE). SE that is positioned in SWA for extended periods is more prone to exhibit significant corrosion problems. Sandstorms, which are usually seasonal, can cause sand/dust to penetrate equipment and become entrapped in inaccessible areas. During the periods of relative calm there are usually significant amounts of airborne dust, seen as a general haze, in the atmosphere.

7.1.1.1 Soils and Humidity. Soils exposed to high humidity in many of the operating SWA AOR locations will cause corrosion or accelerate existing corrosion growth if left in contact with metal surfaces. Even in arid areas, humidity is usually present. During daylight hours, SE stored outdoors will heat up causing expansion of panels which allows hot, moist air to migrate into enclosed areas (see [Figure 7-2](#)) or under non-permeable equipment covers. When the equipment cools, the moisture condenses and combines with the fine dust/sand particles, increasing the potential for corrosion. The soluble materials in the dust/sand form a crust as they dry (see [Figure 7-3](#)) making removal difficult. Anion-laden sand/dust entrapped in SE exposed to high humidity will gather in the available moisture, extract the soluble salts, and a corrosion cell could be established. These salts will appear as white streaks on SE after the water has evaporated off the units. (See [Figure 7-3.](#))



TO-35-1-3-127

Figure 7-2. Sand/Dust Intrusion

TO-35-1-3-128

Figure 7-3. Residue from Salts Caused by Condensation

7.2 SUPPORT EQUIPMENT CLEANING.

7.2.1 Support Equipment Wash. SE shall be washed in accordance with [Chapter 2](#). Wash intervals shall be determined by the deployment location as dictated by [Table 2-1](#). If the water source at the point of use is not potable, or if a closed-loop water source's quality does not meet criteria established in [Paragraph 2.1.7.6](#), it shall be reported to the Air Force Corrosion Prevention and Control Office (AFPCO) for waiver consideration.

7.3 PRE-DEPLOYMENT REQUIREMENTS.

Prior to deployment of SE to SWA AOR it is recommended that the following actions be taken to prevent sand/dust intrusion during deployment.

- a. Accomplish a complete SE wash prior to deployment in accordance with [Chapter 2](#).
- b. Inspect SE completely, including exterior/interior surfaces, for missing or deteriorated coatings.
- c. Touch-up all deficient areas with approved processes and materials in accordance with [Chapter 3](#).
- d. Remove all standing water in equipment.
- e. Inspect and clean all drain holes.
- f. Minimize lubrication by removing all excess greases/oils to limit sand/dust entrapment.

7.4 DEPLOYED LOCATION REQUIREMENTS.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, ULTRA-THIN FILM, MIL-PRF-81309

7



LUBRICANTS, CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, SYNTHETIC, MIL-DTL-87177

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Soils in SWA AOR locations should be considered suspect and removed on a regular basis. A constant regimen of vacuuming or brush removal of sand/dust accumulations is necessary to reduce potential corrosion problems. Some units require additional cleaning process due to air filters, exposed lubrication areas, and areas that may be more prone to sand/dust entrapment.

7.4.1 Radiators, Vanes, Filters and Coils. SE that have radiators, vanes, filters, and coils require additional cleaning to remove dust/sand that can block cooling ports and filters which are drawn into the units during operation. Clean using end item (Technical Order (TO) approved materials. Allow the units to dry in an enclosed area to prevent airborne sand/dust from adhering to wet surfaces.

7.4.2 Portable Hydraulic Test Stands/Mobile Air Compressors. These units typically have interior fluid leaks that will allow sand/dust to cling to the surfaces. Close inspection and wipe down of these units are necessary to maintain proper operation.

7.4.3 Aircraft Jacks and Tow Bars. Jackscrew bodies and adjustable arms should be kept free of sand/dust at all times. The use of locally manufactured permeable covers (see [Figure 7-4](#)) will assist in prevention of sand/dust intrusion. Lubricate units using corrosion preventive compound, MIL-DTL-87177, Type I, Grade B, to reduce corrosion problems.



TO-35-1-3-129

Figure 7-4. Locally Manufactured Permeable Covers

7.4.4 Open Circuit Boards/Cards. After cleaning open circuit boards/cards in accordance with TO 1-1-689-3, apply a thin coat of avionics grade corrosion preventive compound, MIL-PRF-81309, Type III, to the board to insulate the circuits from sand/dust intrusion.

7.4.5 Wire Bundles. Sharp angular sand/dust particles can migrate into wiring bundles where vibration caused by equipment operation can result in abrasive action that can cause chafing of the wiring. (See [Figure 7-5](#).) Remove trapped sand from around and between bundled wires to prevent electrical problems.

7.4.6 Felt-Soundproofing Insulation. Periodically inspect areas where felt-soundproofing insulation is present for moisture and/or sand/dust accumulations. Insulation found to be wet should be removed and allowed to dry before replacing or replaced with new clean, dry insulation. Inspect areas behind insulation for corrosion or deteriorated coatings. Repair areas as required prior to reinstalling installation.

7.5 MAINTENANCE TOUCH-UP PAINTING.

Maintenance touch-up painting of small areas should be accomplished when bare metal surfaces are exposed to prevent further deterioration and protect against corrosion. Touch-up painting shall only be accomplished using approved touch-up materials listed in [Chapter 3](#).



TO-35-1-3-130

Figure 7-5. Wire Bundle Sand/Dust Accumulation

7.5.1 Temporary Coating Repair.



CORROSION PREVENTIVE COMPOUND, WATER DISPLACING, TRANSPARENT, MIL-DTL-85054

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Temporary coatings are to be used to protect the surfaces until the SE can be permanently repaired as required. CPC, MIL-DTL-85054 is a water displacing CPC that forms a clear, dry, flexible film on the surface. This is temporary and will require reapplication as needed. See [Chapter 3](#) for application and removal instructions.

7.5.2 Permanent Authorized Touch-Ups. For permanent touch-up of small areas use only authorized coating systems listed in [Table 3-4](#). The use of primer and topcoat are required for permanent touch-ups.

7.6 EQUIPMENT STORAGE.

In the harsh environments of SWA it is recommended that SE be stored indoors or under covers. Permeable fabric covers are recommended for short and long-term storage of equipment. These covers can be purchased or locally manufactured. They allow for airflow to prevent condensation and sand/dust buildup on/in the equipment.

7.7 POST-DEPLOYMENT REQUIREMENTS.

The following shall be completed NLT 30 days after SE arrives back to home station:

- Inspect SE completely, including exterior/interior surfaces, for contaminants.
- Remove as much entrapped contaminants as practical with dry cleaning processes such as vacuum, or brush.
- Perform SE wash in accordance with [Chapter 2](#).
- Remove all standing water in equipment.
- Inspect and clean all drain holes.

- f. Inspect SE completely, including exterior/interior surfaces, for missing or deteriorated coatings.
- g. Touch-up all deficient areas with approved processes and materials in accordance with [Chapter 3](#).
- h. Apply CPCs as required in accordance with [Chapter 3](#) and the end item technical order(s).

CHAPTER 8

INDO-PACIFIC (INDOPACOM) OPERATIONS AND ENVIRONMENTS

8.1 INTRODUCTION.

The INDOPACOM Area of Responsibility (AOR) consists of various conditions ranging from seasonal high winds and high humidity/precipitation to arid and oppressively high temperatures. (See [Figure 8-1.](#)) In many locations near bodies of salt water, there is often salt spray carried in the air from the ocean inland.



TO-35-1-3-131

Figure 8-1. INDOPACOM AOR

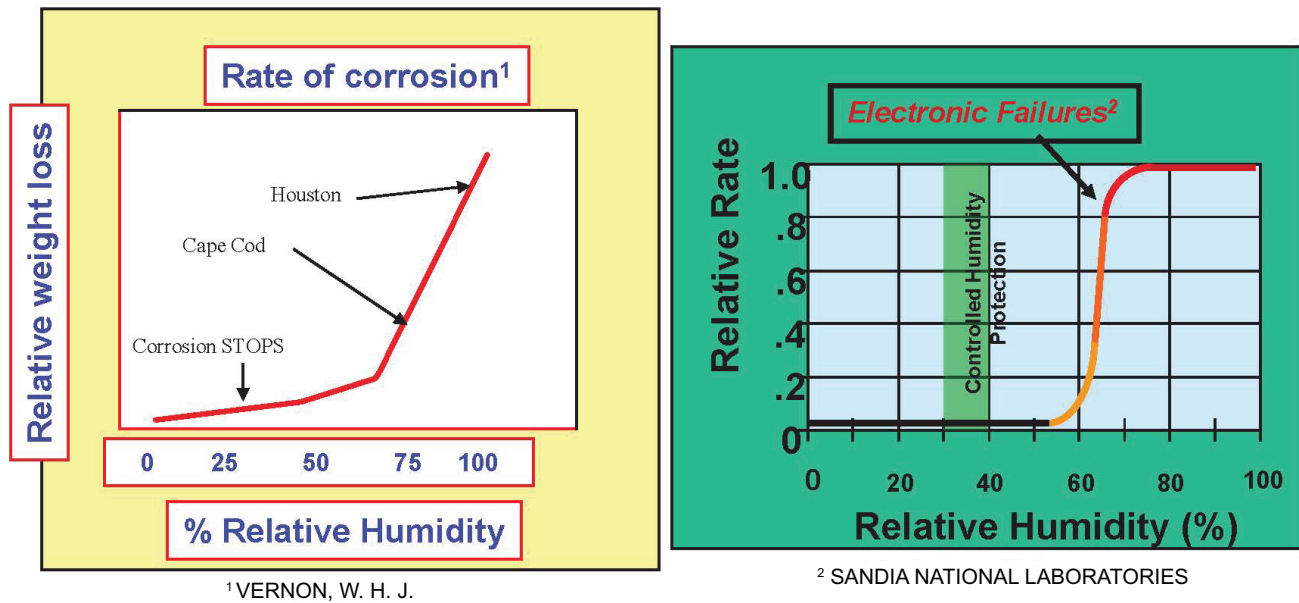
8.1.1 Operating Environment. INDOPACOM contains varied climatic and environmental conditions which increase the probability and severity of corrosion. A tropical environment is largely typical of INDOPACOM with the exception of high altitude mountains/volcanic areas. Typical operating environment(s) conditions include those shown in [Figure 8-2.](#) Relative Humidity (RH), salt, and temperature are the dominating factors responsible for corrosion, with RH the dominant corrosion variable.



TO-35-1-3-132

Figure 8-2. INDOPACOM Operating Environments

8.1.1.1 Relative Humidity. When the RH level is above 50 percent, corrosion begins to accelerate and above 60 percent, the rate of corrosion increases rapidly. For avionics components, studies have shown the same effects, significantly impacting component Mean Time Between Failure (MTBF) rates as seen in [Figure 8-3](#).



TO-35-1-3-133

Figure 8-3. Rate of Corrosion and MTBF Impacts from High RH O₂

8.1.1.2 Salt Contamination. Normal sea breezes can carry from 10 to 100 pounds of salt per cubic mile of air. Although the salt-laden air may travel inland for distances of up to 12 miles, the major amount of salt fallout occurs within the first half mile from the shoreline. Beyond about 10 miles inland, the fallout is insignificant. Due to reduced evaporation, salt content tends to be much lower in northern, cooler latitudes, than in temperate and equatorial regions. Salt is also much more concentrated in air at lower altitudes than at higher altitudes. The heaviest concentrations are below 3,000 feet over the water in areas of trade winds.

8.1.1.3 Rainfall. Rainfall provides some benefit in corrosion prevention by washing away some contaminants. During periods of highly acidic rain activity, the beneficial effect of rain will be somewhat diminished. In either case, improperly sealed joints, open cavities, and entrapment areas will allow corrosion initiation within these areas. However, daily rain showers should not be construed as an alternative or

replacement to required clear water rinsing. Rain showers will dilute some soluble contaminants that will then flow to the lowest points in that area and can become concentrated through evaporation. Other areas such as under wing and the underside of the horizontal stabilizer may not be exposed to any benefits derived from rain showers. Collection areas should be regularly drained of any standing water.

8.1.1.4 Solar Radiation. Solar radiation (sunlight) causes chalking of coatings; hydrolysis of chlorinated organics; and degrades exposed plastics and elastomers. Degradation of these materials allows an electrolyte, usually in the form of moisture with its dissolved corrosive contaminants, free access to the underlying metallic surfaces.

8.1.1.5 Sulfur Oxides. Sulfuric oxides are normally associated with industrial and large urban areas. In the past, sulfurcontaining fuels, such as coal, produced enormous quantities of byproducts. Automobiles and volcanoes also emitted some of these same contaminants. Acid rain presents numerous problems related to corrosion. Acid rain can initiate corrosion on contact with susceptible metal. As a strong oxidizer, acid rain can break down protective coatings over time, rendering large portions of the aircraft vulnerable. Acid rain also attacks nonmetallic components, resulting in their rapid failure. Rubber products, such as seals and hoses, are most vulnerable.

8.1.1.6 Sand and Dust. Blowing sand and dust can cause erosion of leading edges and settle into all accessible areas of the airplane, impeding the function of oil and air filters and contaminating electrical and avionics equipment. When dampened, poultice is formed on the structure, resulting in corrosion. Furthermore, even though the climate may otherwise be acceptable in some island regions, many are the sites of ancient seabed, and the sand often contains a significant amount of soluble salt. It is essential to remove sand and dust as soon as practical to prevent corrosion and wear damage. Removing sand and dust by vacuuming with a HEPA filter vacuum cleaner effectively removes the majority of sand and dust. Conversely, the use of pressurized air to blow the sand and dust actually disperses much of the material and redeposits it back into corners and crevices and other surfaces. Rinsing allows the soluble anions to flow and concentrate in lower, hard to reach areas. Removal of sand, dust, and standing water is necessary in any effective corrosion prevention and control effort.

8.2 SUPPORT EQUIPMENT (SE) CLEANING.

8.2.1 SE Wash. SE shall be washed in accordance with [Chapter 2](#). Wash intervals shall be determined by the deployment location as dictated by [Table 2-1](#). If the water source at the point of use is not potable, or if a closed-loop water source's quality does not meet criteria established in [Paragraph 2.1.7.6](#), it shall be reported to the Air Force Corrosion Prevention and Control Office (AFCPCO) for waiver consideration.

8.3 PRE-DEPLOYMENT REQUIREMENTS.

NOTE

Recommend the SE and Vehicles Program Office (PO), in conjunction with the respective MAJCOM Fabrication and Aerospace Ground Equipment (AGE) Functional Managers, develop a detailed checklist for SE. Standardized checklists for each phase of a deployment for SE will greatly improve the overall condition when operating in INDOPACOM environments and increase equipment survivability and serviceability. Some general requirements in the absence of PO guidance are included below. This list may not be inclusive of all tasks.

The following shall be completed prior to deployment of SE:

- a. Accomplish a complete SE wash prior to deployment in accordance with [Chapter 2](#).
- b. Inspect SE completely, including exterior/interior surfaces, for missing or deteriorated coatings.
- c. Touch-up all deficient areas with approved processes and materials in accordance with [Chapter 3](#).
- d. Remove all standing water in equipment.
- e. Inspect and clean all drain holes.
- f. Apply CPCs as required in accordance with [Chapter 3](#) and the end item technical order(s) (TO).

8.4 DEPLOYED LOCATION REQUIREMENTS.

Operating locations in INDOPACOM experience high levels of humidity, salt and UV exposure. A constant regimen of washing in accordance with [Chapter 2](#), and application of protective coatings and CPCs in accordance with [Chapter 3](#) is necessary to reduce persistent corrosion problems. Limit the use of compressed air to areas that will not cause sand, and salt-laden dust and liquid to migrate into inaccessible areas.

8.4.1 Areas Requiring Additional Cleaning and Protection. Areas listed in [Paragraph 7.4](#) shall be monitored, cleaned and protected as directed while SE is deployed into the INDOPACOM AOR.

NOTE

If contamination is hard and crusted on SE surfaces, gently break up with nonmetallic tool and remove residue with a vacuum.

8.5 POST DEPLOYMENT REQUIREMENTS.

The following shall be completed NLT 30 days after SE arrives back to home station:

- a. Inspect SE completely, including exterior/interior surfaces, for contaminants.
- b. Remove as much entrapped contaminants as practical with dry cleaning processes such as vacuum, or brush.
- c. Perform SE wash in accordance with [Chapter 2](#).
- d. Remove all standing water in equipment.
- e. Inspect and clean all drain holes.
- f. Inspect SE completely, including exterior/interior surfaces, for missing or deteriorated coatings.
- g. Touch-up all deficient areas with approved processes and materials in accordance with [Chapter 3](#).
- h. Apply CPCs as required in accordance with [Chapter 3](#) and the end item technical order(s).

APPENDIX A

EQUIPMENT AND CONSUMABLE MATERIALS USED FOR CORROSION CONTROL

A.1 EQUIPMENT AND CONSUMABLE MATERIALS.

Table A-1. Equipment and Consumable Materials List

Nomenclature/Description	Specification	Stock Number	Unit of Issue
 CAUTION - The following Room Temperature Vulcanizing (RTV) silicone sealants are corrosive and will not be used on ground Support Equipment (SE): DC Silastic RTV 730, RTV 732, RTV 734, RTV 736, RTV 784, RTV 1890; DC RTV 781, RTV 4-2817, RTV 90406, RTV 93-006, RTV 96-081, GE RTV 102, RTV 103, RTV 106, RTV 108, RTV 109, RTV 112, RTV 116, RTV 118, RTV 157, RTV 159, RTV 1502, RTV 1503, RTV 1508. - The following RTV silicone sealants are corrosive and have been discontinued but may be remaining in the supply system. These sealants will not be used on ground SE: DC Silastic RTV 140, RTV 142, RTV 731, RTV 785, RTV 891; DC RTV 236, RTV 780, RTV 3144, RTV 20-046, RTV 20-078, RTV 30-079, RTV 30-121, RTV 90-092, RTV 92-005, RTV 92-007, RTV 92-009, RTV 92-018, RTV 92-024, RTV 92-048, RTV 92-055, RTV 93-043, RTV 94-002, RTV 94-003, RTV 94-009, RTV 94-034, RTV 96-005, RTV 96-080, RTV Q3-6069, GE RTV 154, RTV 156, RTV 158, RTV 192, RTV 198.			
Abrasive Mats, Non-Woven, Non-Metallic	A-A-58054, Type I, Class 1 Grade A (Very Fine)	5350-00-967-5089	Package (PG) (10 sheets)
	Grade B (Fine)	5350-00-967-5093	PG (10 sheets)
	Grade C (Medium)	5350-00-967-5092	PG (10 sheets)
Adhesion Promoter, Coatings, Aerosol	Part Number (PN): Sur-Prep® AP-1	8010-01-600-1533	Box (BX) (24 each x 4 ounces)
		6850-01-719-2762	Case (CS) (12 each x 16 ounces)
Adhesives-Sealants, Silicone, RTV, Noncorrosive	MIL-A-46146 Group I, Type I (White)	8040-00-118-2695	Tube (TU) (3 ounces)
		8030-00-938-1535	TU (12 ounces)
	Group II, Type I (Clear)	8040-01-394-3735	TU (3 ounces)
	Group II, Type I (Gray)	8040-01-375-4805	TU (3 ounces)
		8040-00-144-9774	Cartridge (CA) (12 ounces)
	Group III, Type I (Gray)	8040-01-450-6545	TU (3 ounces)
Applicator, Corrosion Preventive Compound (CPC), Formit® Extension Wands	PN: Formit-18-360	6850-01-492-2942	PG (12 each)
	PN: Formit-18-F	4730-01-612-9914	PG (12 each)
	PN: Formit-18-STD-FOG	4730-01-632-0156	PG (12 each)
	PN: Formit-18-90-FOG	6850-01-517-0963	PG (12 each)

Table A-1. Equipment and Consumable Materials List - Continued

Nomenclature/Description	Specification	Stock Number	Unit of Issue
The Formit spray wands are described with the middle number being the length of the spray can wand. The second designator is the type of spray pattern issuing from the wand such as 360 is a full circle, F is a fan, and FOG is a fine mist; STD-FOG signifies the fogging spray comes from the center and the 90-FOG signifies the spray comes from the side.	PN: Formit-48-F	4730-01-632-0157	PG (12 each)
	PN: Formit-48-360 (with metal sleeve)	1560-01-658-8943	PG (12 each)
	PN: Formit-48-360 (without metal sleeve)	4730-01-659-5461	PG (12 each)
Barrier Materials, Greaseproof, Waterproof, Flexible, Heat-Sealable	MIL-PRF-121, Type I	8135-00-753-4661	Roll (RL) (3 foot W x 300 foot L)
Barrier Materials, Water vapor-proof, Greaseproof, Flexible, Heat-Sealable	MIL-PRF-131, Class 1	8135-00-282-0565	RL (3 foot W x 600 foot L)
Cleaner, Pipe	PN: 840507	9920-00-292-9946	PG (32 each)
Cleaner, Lubricant, and Preservative for Weapons and Weapon Systems	MIL-PRF-63460	9150-01-663-4623	LI
Cleaner, Non-Aqueous, Low-VOC, HAP-Free	MIL-PRF-32295, Type II	6850-01-606-8357	Can (CN) (5-gallon)
		6850-01-606-8358	Drum (DR) (55-gallon)
Cleaning Compound, Aerospace Equipment	MIL-PRF-87937 Type I	6850-01-390-7808	Gallon (GL)
		6850-01-390-7811	CN (5-gallon)
		6850-01-390-7816	DR (55-gallon)
	Type III	6850-01-390-9530	CN (5-gallon)
		6850-01-390-9453	DR (55-gallon)
	Type IV	6850-01-429-2368	GL
		6850-01-433-0873	CN (5-gallon)
		6850-01-429-2371	DR (55-gallon)
Cleaning Compound, Aircraft, Exterior	MIL-PRF-85570 Type I	6850-01-237-7482	CN (5-gallon)
		6850-01-237-8003	DR (15-gallon)
		6850-01-237-8004	DR (55-gallon)
	Type II	6850-01-239-0571	GL
		6850-01-235-0872	CN (5-gallon)
		6850-01-248-9828	DR (15-gallon)
	Type III	6850-01-236-0128	DR (55-gallon)
		6850-01-232-9164	CN (5-gallon)
		6850-01-248-9829	DR (15-gallon)
	Type IV	6850-01-248-9830	DR (55-gallon)
		6850-01-234-0219	CN (5-gallon)
		6850-01-248-9831	DR (15-gallon)
	Type V	6850-01-235-7458	DR (55-gallon)

Table A-1. Equipment and Consumable Materials List - Continued

Nomenclature/Description	Specification	Stock Number	Unit of Issue
Coating, Walkway Compound, Nonslip	A-A-59166		
	36231, Dark Gray, Flat 37038, Black, Flat	5610-00-641-0426 5610-00-641-0427	GL GL
CPC, Solvent Cutback, Cold-Application	MIL-PRF-16173		
	Class 1, Grade 2 Class 1, Grade 4	8030-00-118-0666 8030-00-142-9281	CN CN
CPC, Water Displacing, Ultra-Thin Film	MIL-PRF-81309		
	Type II, Class 2 Type III, Class 2	8030-00-938-1947 8030-00-546-8637	CN CN
CPC, Water-Displacing, Transparent	MIL-DTL-85054		
	Type I	6850-01-492-2932	BX (12 each x 12 ounces)
		8030-01-531-7358	BX (12 each x 16 ounces)
		8030-01-347-0980	CN
	Type II	8030-01-615-4737	BX (12 each x 1-quart)
		8030-01-531-7360	CN (5-gallon)
		8030-01-615-4740	BX (4 each x 1-gallon)
		8030-01-347-0981	Quart (QT)
	Type II (Undyed)	8030-01-615-4749	BX (12 each x 1-quart)
Degreasing Solvent	MIL-PRF-680		
	Type II	6850-00-110-4498	Pint (PT)
		6850-00-637-6135	GL
		6850-00-274-5421	CN (5-gallon)
	Type III	6850-00-285-8011	DR (55-gallon)
		6850-01-331-3349	CN (5-gallon)
	Type V	6850-01-331-3350	DR (55-gallon)
		Not Stock Listed (NSL)	
Disc, Rubber Wheel, 4-inch	PN: 07498	5345-01-549-0264	CS (5 each)
Dispenser, Sealant, Av-DEC	PN: UG981108-01	5120-01-494-7678	50 milliliters (mL)
	PN: UG981108-02	5120-01-573-3559	200 mL
Eraser, Rubber Rectangular		7510-00-223-7046	Dozen (DZ)
Isopropyl Alcohol	TT-I-735, Grade A	6810-00-753-4993	CN (8 ounces)
		6810-00-983-8551	QT
		6810-00-286-5435	GL
Lubricants, CPC, Water Displacing, Synthetic	MIL-DTL-87177, Type I, Grade B	6850-01-528-0653	CN
Paper, Abrasive, Aluminum Oxide, Non-Waterproof	ANSI-B74.18		
	280 Grit 320 Grit	5350-00-224-7205 5350-00-246-0330	PG (50 sheets) PG (50 sheets)
Paper, Abrasive, Silicon Carbide, Waterproof	ANSI-B74.18 320 Grit	5350-00-867-7665	PG
Paper, Abrasive, Silicon Carbide, Disc, Pressure Sensitive Backing	180 Grit		
	PN: 7000119245)	5345-01-074-9404	RO
	280 Grit PN: 058144-01466)	5345-01-074-9406	RO
Pretreatment, Aluminum, Chromate Conversion Coating	MIL-DTL-81706, Type I, Class 1A, Form 6, Method D	8030-01-460-0246	CS (12 each)

Table A-1. Equipment and Consumable Materials List - Continued

Nomenclature/Description	Specification	Stock Number	Unit of Issue
Primer, Epoxy, Corrosion Inhibiting, Lead and Chromate Free	MIL-DTL-53022, Type IV, Class L	8010-01-610-7328 8010-01-589-7077 8010-01-588-4312	Kit (KT) (Quart) KT (Gallon) KT (5-gallon)
Primer, Epoxy, High Solids, Corrosion Inhibiting, Chrome-Free	PN: 02GN093	8010-01-592-7871 8010-01-592-7873	KT (Quart) KT (Gallon)
Primer, Epoxy, High Solids, Non-Chromated	MIL-PRF-23377, Type I, Class N	8010-01-592-7874 8010-01-555-3386 8010-01-555-3381	KT (Pint) KT (Quart) KT (Gallon)
Primer, Epoxy, High Solids, Non-Chromated, Touch-up Brush	MIL-PRF-23377, Type I, Class N	8010-01-651-1507	BX (24 pens)
Primer, Epoxy, High Solids, Non-Chromated, 2-Component Aerosol	MIL-PRF-23377, Type I, Class N	8010-01-671-5122	BX (6 each)
Primer, Epoxy, High Solids, Non-Chromated, 2-Ounce Kit	MIL-PRF-23377, Type I, Class N	8010-01-671-2313	KT
Primer, Epoxy, Water Based, Lead and Chromate Free	MIL-DTL-53030, Type II	8010-01-603-2126 8010-01-603-2127	KT (1.25 Quarts) KT (1.25 Gallons)
Primer, Metal-Rich	MIL-PRF-32550, Type I, Form A, Class S	8010-01-467-4551	KT (Gallon)
Sealant Removal Kit, Pneumatic Vibrogun (Includes: 1 each Ingersoll Rand 1,000 Revolutions Per Minute (RPM) Right Angle Drive, 1/4 inch Threaded Chuck Pneumatic Drill Motor; 1 Tube with 5 each No. 8 SR Cutters; and 1 Tube with 5 each No. 3 SR Cutters)	PN: 8400K	5130-01-514-0853	EACH
Sealant Removal System (Aerowing Rapid Desealing System. Includes: 0.5 inch/inches removal tip (Pack of 10), 2 inch/inches Shaft, Shaft removal Tool, Operator's Manual)	PN: RDS001, CAGE Code No. 3FM31	6635-01-572-5251	EACH
Sealant Remover, Chemical	PN: SkyKleen® 1000	6850-01-442-0527	BX (16 each x 1-pint)
Sealing Compound, Polysulfide, Non-Chromated, Low Adhesion	PN: PR-1773 B-1/2 B-1/2 B-2	6850-01-418-5414 6850-01-418-5418 6850-01-418-5417 6850-01-104-5396	CA (2.5 ounces) CA (3.5 ounces) CA (3.5 ounces) KT (1-quart)
Sealing Compound, Av-DEC Self Leveling™ Green	PN: HT3326-5-50 PN: HT3326-5-200	6850-01-494-9650 6850-01-521-9865	CA (50 mL) CA (200 mL)
Sealing Compound, Av-DEC Thixoflex™ Black	PN: TG3212-50 PN: TG3212-200	8030-01-661-4927 8030-01-661-4923	EACH (50 mL) EACH (200 mL)
Sealing Compound, Av-DEC Thixoflex™ Grey	PN: TG8498-50 PN: TG8498-200	8030-01-494-9651 8030-01-572-5219	CA (50 mL) CA (200 mL)
Sealing Compound, Fuel-Resistant, Integral Fuel Tanks and Fuel Cell Cavities	SAE AMS-S-8802, Type II, Class A-2	8030-00-723-5344	KT (1-quart)

Table A-1. Equipment and Consumable Materials List - Continued

Nomenclature/Description	Specification	Stock Number	Unit of Issue
Sprayer, Paint (Preval Compressed Gas Canister with Glass Bottle)	PN: 267-1	8020-01-501-3127	EACH
Sprayer, Paint (Preval Compressed Gas Canister Only)	PN: 268-1	8020-01-496-2473	EACH
Tape, Pressure Sensitive Adhesive, for General Purpose Masking	ASTM-D6123		
	1/2-inch x 60 yards	7510-00-266-6714	RO
	1-inch x 60 yards	7510-00-266-6712	RO
	2-inch x 60 yards	7510-00-266-6710	RO
	CID A-A-1689, Type I, Class 2		
	Blue (2 inch x 36 yards)	7510-00-634-3295	RO
	Orange (2 inch x 36 yards)	7510-00-634-3331	RO
Tape, Pressure Sensitive Adhesive, for Masking During Paint Stripping Operations	Red (2 inch x 36 yards)	7510-00-634-3329	RO
	Yellow (2 inch x 36 yards)	7510-00-634-3330	RO
	SAE AMS-T-23397, Type II		
	1/2-inch x 60 yards	7510-00-806-4669	RO
	1-inch x 60 yards	7510-00-473-9855	RO
	2-inch x 60 yards	7510-00-684-8803	RO
Tape, Av-DEC STRETCHSEAL®, Dual Tape Connector Wrap Kit	PN: AD28500-36-36-8	8030-01-501-5351	KT
Tie-Coat, Non-Chromated	PN: Aeroglaze 9741	8010-01-482-8620	KT (Gallon)
	PN: Aeroglaze 9743	8010-01-483-4363	KT (Gallon)
	PN: Aeroglaze 9744	8010-01-483-4365	KT (Gallon)
Topcoat, Aircraft and SE, Bulk	MIL-PRF-85285, Type IV, Class H (Color in accordance with SAE AMS-STD-595)		
	11136, Insignia Red, Gloss	8010-01-583-4778	KT (2-quart)
		8010-01-583-6588	KT (2-gallon)
	14187, Oxygen Tank Green, Gloss	8010-01-583-4774	KT (2-quart)
		8010-01-583-4801	KT (2-gallon)
	16187, Nitrogen Tank Gray, Gloss	NSL	
	17925, White, Gloss	8010-01-520-4041	KT (Quart)
		8010-01-502-5202	KT (Gallon)
	24052, Marine Green, Semi-Gloss	8010-01-520-4042	KT (Quart)
		8010-01-621-3045	KT (2-gallon)
	26173, Ocean Gray, Semi-Gloss	8010-01-621-3102	KT (2-quart)
		8010-01-621-3056	KT (2-gallon)
	37038, Black, Camouflage	8010-01-520-4055	KT (Quart)
		8010-01-583-4823	KT (2-gallon)
Topcoat, Aircraft and SE, Touch-up Brush	MIL-PRF-85285, Type I, Class H (Color in accordance with SAE AMS-STD-595)		
	24052, Marine Green, Semi-Gloss	8010-01-441-6006	BX (24 each)
	26173, Ocean Gray, Semi-Gloss	8010-01-532-5336	BX (24 each)

Table A-1. Equipment and Consumable Materials List - Continued

Nomenclature/Description	Specification	Stock Number	Unit of Issue
Topcoat, Aircraft and SE, Touch-Up Brush	MIL-PRF-85285, Type IV, Class H (Color in accordance with SAE AMS-STD-595) 11136, Insignia Red, Gloss 13538, Yellow, Gloss 17038, Black, Gloss 17925, Insignia White, Gloss 37038, Black, Camouflage	8010-01-583-1754 8010-01-583-1746 8010-01-583-1750 8010-01-583-1753 8010-01-583-1744	BX (24 each) BX (24 each) BX (24 each) BX (24 each) BX (24 each)
Topcoat, Aircraft and SE, 2-Component Aerosol	MIL-PRF-85285, Type I, Class H (Color in accordance with SAE AMS-STD-595) 11136, Red, Gloss 24052, Marine Green, Semi-Gloss 26173, Ocean Gray, Semi-Gloss 37038, Black, Camouflage	8010-01-528-4840 8010-01-528-4849 8010-01-538-9341 8010-01-528-4866	BX (6 each) BX (6 each) BX (6 each) BX (6 each)
Topcoat, Aircraft and SE, 2-Ounce Kit	MIL-PRF-85285, Type I, Class H (Color in accordance with SAE AMS-STD-595) 26173, Ocean Gray, Semi-Gloss	8010-01-532-5337	KT

NOTE

- Touch-up pens (SEMPEN) are approved for touch-up of polyurethane coating systems. Respirator use is not normally required. However, organizations shall gain approval from the local Bioenvironmental Engineering Flight (BEF) prior to using the SEMPEN without an approved respirator.
- Preval Spray System/Power Pack Spray Systems are atomizing coating touch-up spray systems. Personal Protective Equipment (PPE) approved by local BEF shall be worn when spraying polyurethane and epoxy primer.
- Single component aerosols are not authorized for use on any SE.