CHAPTER 11 — SOLVENTS

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TABLES

SOLVENTS

11-1. SOLVENTS — GENERAL

The correct use of solvents during maintenance and overhaul of parts and components is very important. Metallic and non-metallic materials, used in all Bell Helicopter models of helicopter, are sensitive to solvents. The solvent is a fluid that dissolves solids and liquids. Therefore, safety and non-safety related precautions must be followed to prevent injuries to persons and/or damage to these materials.

When these materials are in contact with specific solvents, damage from immediate destruction to a delayed deterioration can result. When delayed, the damage may not be readily apparent at the time of the solvent usage. For that reason, it is imperative to follow the guidelines and restrictions on the usage of solvents, provided in Table 11-1. Because solvents are commonly used as cleaning agents, refer to Chapter 5 for additional information on cleaning procedures.

11-2. SOLVENTS — PRECAUTIONS

WARNING

MAKE SURE YOU OBEY ALL OF THE SAFETY PRECAUTIONS WHEN YOU USE SOLVENTS. FAILURE TO DO SO MAY RESULT IN INJURIES TO PERSONS AND/OR DAMAGE TO COMPONENTS.

1. Do not ingest or inhale solvents. Ingestion of solvent may have the following chronic health effects:

- Solvents can be carcinogenic (Benzene, Chloroform, etc.)
- Solvents can cause damage to internal organs (liver, kidneys, etc.)

Refer to the Material Safety Data Sheet (MSDS) of the solvent or to the container label for additional safety information.

2. Each time you use solvent, make sure to follow all the safety precautions given hereafter:

- Avoid contact of the solvent with the skin. Absorption of solvent through the skin is possible, and can cause sores and wounds. Always wear gloves.
- If possible, prevent the solvent from making vapors (fume hood, etc.). Otherwise, make sure the work area has good ventilation, keep the solvent container tightly closed, and avoid the breathing of solvent vapors.
- Never use flammable solvents near open flame (refer to Table 11-2 for properties of solvents).

3. Some materials are extremely sensitive to solvents. Whenever you use solvent, make sure of the following:

- Always protect transparent areas (including coated glass windshields) from solvent splash, fumes, and overspray.
- Always protect parts made of elastomeric material (seals, boots, mounts, springs, etc.) from solvent splash, fumes, and overspray.
- Solvents may soften or dull materials. If you are not sure about the effects, test the solvent on an insignificant area of the material.

11-3. SOLVENTS — COMMON SOLVENTS FOR MAINTENANCE AND OVERHAUL

The following provides information on the solvents that are commonly used in maintenance and overhaul of parts and components. These are organic solvents, or solvents that contain carbon. Additional information on properties, applications, and nomenclatures is given in Table 11-2 in order to clarify the usage of the solvents.

11-4. CHLORINATED HYDROCARBONS

NOTE

1,1,1-Trichloroethane (Methyl chloroform, chlorothene, tri-ethane, solvent 111) and trichloroethylene (triclene, Tri, trilene) are no longer authorized for use on Bell Helicopter Parts. Use perchloroethylene (C-563) (tetrachloroethylene, perclene, perc) instead.

Chlorinated hydrocarbons are organic solvents that contain chlorine. Some of the most commonly used are:

1. Perchloroethylene (C-563) (tetrachloroethylene, perclene, Perc).

Perchloroethylene (C-563) is not flammable at room temperature and evaporates easily into air. It is widely used for dry cleaning and metal-degreasing. It is also currently in use at Bell Helicopter for vapor degreasing. The boiling point is 248 to 252°F (120 to 122°C).

2. Methylene chloride (methylene dichloride, dichloromethane) (ASTM D4079).

Occasionally specified for cleaning and degreasing. Used in some paint removers. The boiling point is 103 to 104°F (39.4 to 40°C). Not flammable.

11-5. FLUORINATED SOLVENTS

These are normally supplied under trade names such as:

- FREON — Dupont
- GENESOLV — Allied Chemical

A number of commercial “degreasers” are mixtures of fluorinated materials and other solvents such as alcohol, methylene chloride or ketones. The principal restriction on the use of fluorinated solvents is that it could lead to corrosion problems when used to clean hydraulic assemblies. However, care must be exercised to ensure that mixtures do not contain solvents which may damage the parts being cleaned. Many of the “cleaners” for electrical and electronic equipment contain fluorinated solvents.

These materials are not flammable but can break down when exposed to hot surfaces or flame.

11-6. PETROLEUM SOLVENTS

These are by far the most common solvents available.

1. Aliphatic naphtha (C-305).

Aliphatic naphtha (C-305) is the only naphtha considered to be safe for use on plastics and paints. The flash point is 20 to 50°F (–6.7 to 10.0°C) and it is extremely flammable. This solvent is normally used for removing grease and oil from painted surfaces and plastic parts.

2. Aromatic naphtha (C-388).

In some applications, aromatic naphtha (C-388) may be specified. Be careful not to substitute this solvent with aliphatic naphtha (C-305) because it will damage some plastics and painted parts. The flash point is usually about 100°F (37.8°C). This solvent is often specified for activation of rubber cements and for removal of grease from metal parts.

3. Stoddard solvent (C-389).

(Similar to dry cleaning solvent, white spirits, safety solvent, or high flash naphtha). The flash point is about 100 to 110°F (37.8 to 43.3°C). This solvent is often specified for degreasing metal parts and for cleaning assemblies. It may be used for wiping painted parts but should not be used on plastics.

4. Mineral spirits (petroleum distillate, heavy naphtha, turpentine substitute).

This solvent is usually used as a thinner for exterior house paints and for cleaning paint equipment. It should not be used on plastic or painted parts.

11-7. ALCOHOLS

NOTE

Alcohols are generally required for specific cleaning processes and the particular type required should be specified. Otherwise, any of those listed hereafter is suitable.

Methyl alcohol (C-302) (methanol, wood alcohol, wood spirit, carbinol) are no longer authorized for use on Bell Helicopter parts. Use ethyl alcohol (C-339) instead.

Alcohols are most often used for cleaning plastic surfaces or assemblies. There are two different alcohols which are specified for use during maintenance and overhaul operations. These are:

1. Ethyl alcohol (C-339) (ethanol, grain alcohol, spirits, denatured alcohol).

2. Isopropyl alcohol (C-385) (secondary propyl alcohol, isopropanol, Per-Spirit, petrohol). Common rubbing alcohol is a diluted isopropyl alcohol (C-385).

11-8. KETONES

The ketones are strong solvents that will dissolve many paints and plastics. The most common ketones used in aircraft maintenance are:

1. Acetone (C-316) (propanone, dimethyl ketone, 2-propanone).

Acetone (C-316) is a colorless and flammable solvent. It can be used to remove superglue and for thinning (dilution) and cleaning fiberglass resins and epoxies. Use acetone (C-316) only when specified in the procedure.

2. MEK (C-309) (methyl-ethyl-ketone, 2-butanone).

MEK (C-309) is a colorless and flammable solvent with a sharp and sweet odor. The solvent is widely used in paints and coatings because it evaporates quickly. It can dissolve many substances, therefore it should be used only when specified in the procedure.

11-9. AIRCRAFT PAINT AND PRIMER THINNERS

The newer paint materials (epoxy and urethane) use specific catalyst/thinner mixtures which are normally supplied as a “kit” with the base material, and these should not be used for any other purpose. However, there are a number of enamels and lacquers still in use which require dilution (thinning) prior to application.

1. Nitrate cellulose lacquer thinner (C-206).

Normally these are mixtures of solvents, such as toluene, alcohols and esters. In some cases, particular mixtures must be used with specific lacquer formulations or undesirable coatings may result. They should not be used for general cleaning of painted or plastic parts. They are flammable with a flash point around 50°F (10.0°C).

2. Toluene (C-306).

Normally used for thinning zinc chromate primers (alkyd type) and some other paints. This solvent should not be used for general cleaning of painted or plastic parts. The flash point is below 45°F (7.2°C).

Table 11-1. Solvents — Usage and Limitations

MATERIAL	SOLVENTS	TEMPERATURE	NOTES
Bare metal (except titanium) with no paint, adhesive, rubber, etc.	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Mineral spirits Paint thinners Perchloroethylene (C-563)	Ambient Ambient Ambient Ambient 248 to 252°F (120 to 122°C)	Vapor degrease
Metal with paint.	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Isopropyl alcohol (C-385) Mineral spirits	Ambient only Ambient only Ambient only Ambient only	△1 △2 △3
Metal with adhesive bonded joints.	Aliphatic Naphtha (C-305) Stoddard Solvent (C-389) Isopropyl Alcohol (C-385)	Ambient only Ambient only Ambient only	△1 △2
Metal with rubber (elastomeric bearings, grease and oil seals, boots, etc.).	Aliphatic naphtha (C-305) Stoddard solvent (C-389) Isopropyl alcohol (C-385)	Ambient Ambient Ambient	△2 △4 Use these solvents sparingly.

Table 11-1. Solvents — Usage and Limitations (Cont)

MATERIAL	SOLVENTS	TEMPERATURE	NOTES
Titanium metal (nodal beam retention bolts, etc.)	Isopropyl alcohol (C-385) Aliphatic naphtha (C-305) Mineral spirits Stoddard solvent (C-389) Toluene (C-306)	Ambient Ambient Ambient Ambient Ambient	2 5

NOTES:

1. Do not use ketones, lacquer thinner (C-206), and other strong solvents on painted surface.
2. Do not use alcohol to clean hydraulic components. A sticky acrylic resin will form and can prevent correct operation of equipment.
3. If paint needs to be removed, use solvents for bare metals.
4. Do not soak, vapor degrease, or clean with chlorinated solvents.
5. If paint or solid film lubricant needs to be removed, use MEK (C-309) or a non-chlorinated paint remover.

Table 11-2. Solvents — Characteristics

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
CHLORINATED HYDROCARBONS			
Perchloroethylene (C-563)	Not flammable Boiling point 248 to 252°F (120 to 122°C) Melting point -2.2°F (-19°C)	Dry cleaning Vapor degreasing	Tetrachloroethylene Tetrachloroethene Perclene Perc
Methylene chloride	Not flammable Boiling point 103 to 104°F (39.4 to 40.0°C) Melting point -142°F (-96.7°C)	Cleaning Degreasing Used in some paint removers.	Methylene dichloride Dichloride methane Dichloromethane
FLUORINATED SOLVENTS			
Fluorinated solvents	Not flammable Sensitive to extreme heat	Normally combined in a mixture with other cleaning agents such as alcohol, methylene chloride, or MEK to impart degreasing properties.	Freon Genesolv

Table 11-2. Solvents — Characteristics (Cont)

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
PETROLEUM SOLVENTS			
Aliphatic naphtha (C-305)	Extremely flammable Flash point 20 to 50°F (-6.7 to 10.0°C)	Removal of grease and/or oil from painted and plastic surfaces.	Naphtha Type II naphtha
Aromatic naphtha (C-388)	Flammable Flash point 100°F (37.8°C)	Specified for activation of rubber cements. Removal of grease from metal parts. Will damage plastic parts and painted surfaces. May not be substituted for aliphatic naphtha.	Type I naphtha
Drycleaning solvent (C-304)	Flammable Flash point 100 to 110°F (37.8 to 43.0°C)	Cleaning of metals Degreasing of metals Wiping of painted parts. Should not be used on plastics.	Dry cleaning solution White spirits High flash naphtha
Mineral spirits	Flammable	Paint thinner Cleaning of paint equipment. Should not be used on plastics.	Petroleum distillate Heavy naphtha Turpentine substitute White spirit (Europe) Petroleum spirit (Europe)
ALCOHOLS			
Ethyl alcohol (C-339)	Highly flammable	Cleaning of plastic surfaces. Removal of tack glues. Special cases as specified.	Ethanol Grain alcohol Denatured alcohol
Isopropyl alcohol (C-385)	Highly flammable	Cleaning of plastics or as specified.	Isopropanol Petrohol Rubbing alcohol (dilute)
KETONES			
Acetone (C-316)	Extremely flammable. Flash point –20 to 20°F (–28.9 to –6.6°C)	Use only as specified in procedures. Will dissolve most paints and plastics.	Propanone Dimethyl ketone 2-Propanone

Table 11-2. Solvents — Characteristics (Cont)

SOLVENTS AND SOLVENT TYPES	PROPERTIES	APPLICATIONS	COMMON, SYSTEMATIC, OR TRADE NAMES
KEYTONES (CONT)			
MEK (C-309)	Extremely flammable. Flash point –20 to 20°F (–28.9 to –6.6°C)	Use only as specified in procedures. Will dissolve most paints and plastics.	Methyl-ethyl-ketone 2-butanone
AIRCRAFT PAINT AND PRIMER THINNERS			
Epoxy and urethane	Two component mixtures	These paint materials are specific catalyst/ thinner mixtures which are normally supplied as a “kit” and should not be used separately for any other purpose.	
Lacquer thinner (C-206)	Mixtures of solvents such as toulene, alcohols and esters. Flammable. Flash point approximately 50°F (10.0°C)	Normally used with specific lacquer formulation to produce desired results. Not to be used on paints or plastics.	Thinner
Toluene (C-306)	Highly flammable Flash point 45°F (7.22°C)	Normally used for thinning zinc chromate primers (alkyd types) and other paints. Not to be used on paints or plastics.	Methylbenzene Phenylmethane