CHAPTER 2 — DAMAGE EVALUATION AND ASSESSMENT

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DAMAGE EVALUATION AND ASSESSMENT

2-1. DAMAGE EVALUATION

The term "damage" is used to describe the degradation of a part or assembly from the intended or new condition. Damage may result from any range of events from normal operations to crashes involving single or multiple causes such as mechanical wear, exposure to the elements, incident/accident, or modification.

Before one can determine how to repair the damage, a thorough understanding of the damage must be achieved. This involves accessing the affected area and understanding the full extent of the damage. Visual and/or additional NDI special inspection processes are normally required. This may involve removing the damaged portion of the structure or the components to investigate further.

2-2. DAMAGE CLASSIFICATION

The damage classification determines the urgency and nature of the repair. The damage classification indicates whether immediate action is needed, or whether the helicopter may remain in operation until repair is convenient.

2-2-1. DAMAGE CLASSIFICATION — NEGLIGIBLE

Negligible damage can remain as is, or be made acceptable by a simple procedure, such as polishing, smoothing nicks, or primer/paint touch up, without placing restrictions on flight safety. The negligible damage limits are often found as part of the Instructions for Continuing Airworthiness (ICA) or in the model-specific Maintenance Manual.

2-2-2. DAMAGE CLASSIFICATION — REPAIRABLE

Repairable damage normally exceeds the limits specified for negligible damage, but is not severe enough to warrant replacement of the part or component.

2-2-3. DAMAGE CLASSIFICATION —NON-REPAIRABLE

Non-repairable damage falls beyond the repairable damage limits. The part or the component must be replaced.

2-3. IN-SERVICE DAMAGE

In-service damage can result from impact damage with a stationary or moving object, from various types of corrosion that go unnoticed and develop over a short or long period of time, or simply from a crack found in a structural component or part.

2-4. MECHANICAL/FRETTING DAMAGE

Mechanical or fretting damage is the result of abnormal wear induced to a structural component or part by adjacent installation or from improper use of mechanical tools or equipment. The Chafing Control Guide (CSSD-PSE-90-001) provides information on how to prevent mechanical/fretting damage to the helicopter structure.

2-5. INCIDENT/ACCIDENT DAMAGE

In view of the many possible combinations of damage resulting from incident/accident mishap, it is not possible for Bell Helicopter Textron to include specific repair schemes for this category. Incident/accident damage must be evaluated on a case-by-case basis and suitable repairs must be defined in accordance with the degree of damage to the specific part, and carried out with appropriate repair instructions. Repair data in this manual can be used, where applicable. Repair for damage beyond the scope of this manual may be found in the model-specific SRM manual or other publications from Bell Helicopter Textron, or with Product Support Engineering.

2-6. HAIL DAMAGE

Bonded (sandwich) panels with thin skins sustain heavier damage from hail than most other structural external sections of the airframe. Hail damage affects large surface areas of airframe structural components. In most cases, Bell Helicopter recommends replacement of part(s) showing hail damage.

2-7. LIGHTNING STRIKE DAMAGE

During a lightning strike incident, metallic and carbon fiber parts may serve as electrical conductors. Operators involved with a lightning strike should search for a visible point of entry and point of exit of the lightning strike on the helicopter. They normally appear as dark or melted spots on the airframe or drivetrain components.

Maintenance personnel should pay attention during inspection to the interface joints between airframe, drivetrain, and landing gear components. The interface should be inspected to detect any visible sign indicating that the airframe served as a conductor for the lightning. All attachment bolts and hardware should be removed, and all faying surfaces between major airframe components inspected for possible arcing signs. Composite parts should also be inspected for evidence of delamination, or of damage to the embedded copper wire mesh, particularly where they interface with other composite or metal parts.

Refer to the conditional inspection described in the model-specific Maintenance Manual.

2-8. FIRE DAMAGE AND EXPOSURE TO EXTREME HEAT

CAUTION

OVERHEATED CADMIUM PLATING ON STEEL AND TITANIUM CAN CAUSE EMBRITTLEMENT.

NOTE

Epoxy polyamide primer used on helicopters will not discolor below 450°F (232.2°C). Heat in excess of 200 to 250°F (93.3 to 121.1°C) may affect the bonded joints of structural components or structural panels causing permanent deterioration and delamination under static or dynamic stress.

It may be hard to evaluate the full extent of the damage after a section of the fuselage, a component, or a part is exposed to fire or extreme heat. Prolonged exposure to high temperatures can affect the heat treatment of all types of aluminum alloys, or cause annealing on parts treated by a cadmium plating process. A component or a part suspected of exposure to extreme heat should be considered non-repairable and removed from service.

2-9. RECOVERY FOLLOWING INCIDENT/ACCIDENT DAMAGE

In view of the many possible scenarios and extents of damage involved with incidents or accidents, Bell Helicopter Textron has no written helicopter recovery procedures for its models.

Depending on the severity of the damage, you must determine the best way to recover the helicopter, and move it to a suitable repair station without causing further damage to the structure. Product Support Engineering can offer assistance in determining the best way to recover your helicopter, on a case-by-case basis.

2-10. INSPECTIONS

NOTE

This manual does not intend to detail the inspections for all structural parts or components installed on the helicopter. Inspection of fuselage parts and structural components are covered by the scheduled inspection given in the model-specific Maintenance Manual.

The following different types of inspection methods may be used individually, or as a group, to validate the full extent of damage.

2-10-1. INSPECTIONS — GENERAL VISUAL

This is the primary type of inspection to perform when damage is found or suspected. Visually inspect the interior or exterior area of the installation, assembly, or part to detect obvious damage, failure, or irregularity. This inspection is performed within touching distance of the affected part or component, unless otherwise specified. A mirror is a useful tool to ensure visual access to all surfaces of the inspection area. This inspection is made under available lighting conditions such as daylight, hangar lighting, flashlight, or drop-light and may require the removal or opening of access panels or doors. Stands, ladders, or platforms may be required to gain proximity to the area being inspected.

The objective of this inspection is to obtain a general view of the affected area. It can also help determine if cutting away some material and getting into the damaged portion of the structure is necessary for further inspection of the area. This is primarily a failure-finding task. This visual inspection may or may not be quantitative at this time.

2-10-2. INSPECTIONS — DETAILED VISUAL

This is an intensive examination of a specific installation, an assembly, or a part to detect damage, failure, or irregularity. Available lighting is normally supplemented with an additional source of light with an intensity deemed sufficient to render the part or suspected defect clearly visible. Inspection aids such as mirrors, magnifying lenses, etc. may be necessary. Surface cleaning and elaborate access procedures, such as cutting away damaged material, may be required. This type of inspection may or may not be quantitative at this time.

2-10-3. INSPECTIONS — SPECIAL DETAILED

This is an intensive examination of a specific item, installation, assembly, or part to detect damage, failure, or irregularity. The examination will likely use specialized inspection techniques and/or NDI equipment, such as a tapping hammer or coin technique, fluorescent penetrant, ultrasonic, eddy current, X-ray, etc. Intricate cleaning and substantial access or a disassembly procedure may be required. This type of inspection has to be quantitive at this time for all affected parts or components.

2-11. AIRFRAME CONDITIONAL INSPECTIONS

Helicopters that have been subjected to one or more of the following events must be inspected in accordance with the appropriate special inspection procedure in Chapter 5 of the model-specific Maintenance Manual.

- Hard landing
- Sudden stoppage
- Overspeed or overtorque
- Lightning strike

2-12. METALLIC STRUCTURE INSPECTION

NOTE

Paint is more elastic than metallic materials and may mask cracks and loose fasteners. If in doubt, remove the paint and/or primer coating to inspect.

Signs of obvious damage to the metallic structure can take the form of wrinkling, buckling, or crack(s). Access panels, doors, skins, and webs that show evidence of distortion, misalignments, wrinkles, buckling, or crack(s) are cause to inspect the adjacent and internal structure. Chips or crack(s) in the paint on a component, part, fastener, or rivet head may also be signs of structural damage not visible from the exterior. Blisters or bubbles in the paint or primer may also be a sign that corrosion is taking place under the organic coating.

2-12-1. DAMAGE TO METALLIC PARTS — DEFINITIONS

Table 2-1. Metallic Part Damage — Definitions

DAMAGE	DEFINITION
Abrasion	The wearing away of a portion of the surface by either natural (rain, wind, etc.), mechanical (misfit, etc.), or man-made (oversanding, etc.) means.
Adhesive failure	Rupture of an adhesive bond such that the separation appears to be at the adhesive-adherent interface.
Blister	The raised portion of a surface, caused by separation of layers of material.
Breaking edge	Hole condition where only a portion of the circumference is drilled in the material.
Buckling	Large scale deformation of a part from the original shape, usually caused by a high compressive load (e.g. hard landing), excessive localized heating, or a combination of both.
Bulge	A protuberance on the surface of a part.
Bump	Local outward mark or protrusion with no material removal.
Burn	Discoloration resulting from exposure to excessive heat.
Burr	A thin ridge or area of roughness produced in cutting, drilling, machining, or shaping metal.
Chafing	Wearing away of surface material caused by a repetitive motion of adjacent surfaces.
Corrosion	The deterioration of a metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals, or other agents. Can be observed as discoloration of the surface, a layer of oxide, or in advanced stages, the transformation of metal layers or surfaces.
Crack	A fissure or break in material. A crack may or may not go all the way through the parent material.

Table 2-1. Metallic Part Damage — Definitions (Cont)

DAMAGE	DEFINITION
Crazing	Small fissure appearing on the surface of a material.
Delamination	A partial or complete separation of one or many layers from the other layers of a part. Also known as inter-laminar delamination.
Dent	A depression in a skin. A smooth dent is defined as a round bottomed depression with a diameter at least 20 times larger than its depth, while a sharp dent is any depression that is not a smooth dent.
Disbond	A partial or complete separation of a part from the part it is bonded to.
Distortion	A change from the intended or original shape.
Double holes	Two holes side by side in one part, with no material in between.
Elongated hole	An oversized hole that is longer in one direction than the other.
Flaking	Loose or partially detached particles or layers of metal on a surface with evidence of corrosion.
Flat spot	A flat area on a curved surface.
Fretting	Repetitive motion between mating or adjacent surfaces, wearing away surface material.
Gap	An opening between two parts.
Gouge	Removal of metal from a surface metal typified by rough and deep depressions.
Indentation	Local depression on a surface with no material removal.
Knife-edge	A reduction in thickness to a sharp edge.
Low edge distance	Distance between the center of a hole to the edge of a part that is below the defined requirement.
Mismatch	Lack of alignment between adjacent or mating parts, edges, or superimposed holes.
Nick	A sharp-bottomed dent typified by rough and deep depression.
Notch	Cut or damage on the edge of a part.
Oil canning	A condition for thin sheet metal where the application of palm hand pressure produces a popping metallic sound, leaving a shallow concave or convex indentation.
Oversized hole	Hole diameter above the defined requirements or as defined by paragraph 3-3 of this manual.
Oxidation	Metal deterioration on a part caused by the deposit of a powdery corrosive product.
Pinhole	An extremely small hole on the surface of a part.

Table 2-1. Metallic Part Damage — Definitions (Cont)

DAMAGE	DEFINITION
Pitting	A surface condition identified by minute holes or cavities caused by corrosion. Pits may occur in such profusion as to be similar to spalling.
Porosity	A condition of trapped pockets of air or gases creating voids within a solid material.
Puncture	A break in thin sheet material, typically caused by a foreign object contacting the surface of the material.
Sharp edge	Abrupt change of the surface of a part that has not been de-burred.
Scoring	A form of wear characterized by a scratched, scuffed or dragged appearance with marking in the direction of sliding.
Scratch	Narrow, shallow marks or lines resulting from the movement of a metallic particle or sharp pointed object across a surface.
Scuffing	A dulling or moderate wear of a surface resulting from a slight amount of rubbing.
Spalling	A surface or subsurface defect characterized by chips of metal detached from a material, leaving cavities of various sizes and depth.
Stress failure	Material failure due to excessive compression, tension, shear, torsion, or shock.
Swart	Material removed by a grinding or cutting tool.
Tear	A sharp linear rupture in sheet material, typically with the sheet bent away from its original shape.
Waviness	Undulating change in the contour or shape of a part.
Wear	A condition resulting from a relatively slow removal of parent material.

2-13. COMPOSITE LAMINATES AND HONEYCOMB PANELS — INSPECTION

NOTE

The extent of damage in fiber-reinforced composite laminate and honeycomb panel may be greater than the appearance on the surface.

Damage to glass or carbon fiber composites are different from those experienced in metallic materials. Composites are more brittle than most metals and do not exhibit plastic deformation before rupture. Glass or carbon fiber composites either resist impact loads with, in most cases, a spring back effect or rupture. Even if the composites resist the impact loads with possibly non-apparent damage, matrix cracks, plies delaminating, skins disbonding from the core, core crushing, and/or broken fibers may be induced in the material. It is not uncommon to see sub-surface damage, such as a crushed core, to be twice as large as any visible surface damage.

NOTE

Hidden structural features such as local reinforcements, phenolic blocks, adhesive fills, etc., must be considered in order to avoid misinterpretation during delamination or disbonding detection by the tapping technique.

Damaged laminates and composite honeycomb panels shall be inspected for defect, corrosion, delamination, disbonding, crushed core, mechanical damage, and core contamination. The presence of delamination or disbonding can be detected by a tapping technique. To perform this technique, slightly tap the surface of the part at the suspected area with a coin or a tapping hammer and listen for a change of sound (dead or flat sound) where bond separation (delamination or disbonding) exists. When a coin is used, it should be allowed to bounce on the suspected surface while holding it between the thumb and forefinger. Outline the disbonded area with a grease pencil or masking tape.

When voids are detected in the skin(s) of honeycomb panels, the condition of the inner core becomes suspect. The core shall be inspected. The inspection could be done by exposing the core under the void area by drilling/cutting a 0.50 inch (12.7 mm) diameter hole through the metallic skin with a hole saw. For panels with glass or carbon composite skins, the inspection hole shall have a 0.25 inch (6.4 mm) diameter. Inspect the core for corrosion, crushing, and contamination.

NOTE

When internal corrosion, crushing, or contamination (fuel, oil, water, etc.) is discovered, the affected skin or core shall be completely cut out from the panel. The opposite panel skin must also be inspected for additional damage. Failure to comply with this requirement may result in failure of the repair and/or progressive core degradation.

2-13-1. LAMINATES AND HONEYCOMB PANELS — DAMAGE DEFINITIONS

Table 2-2. Laminate and Honeycomb Panel Damage — Definitions

DAMAGE	DEFINITION
Breakout	Fiber separation or break on surface plies at drilled or machined edges.
Blister	A raised portion of a surface, generally caused by ply delamination.

Table 2-2. Laminate and Honeycomb Panel Damage — Definitions (Cont)

DAMAGE	DEFINITION
Buckling	Crimping of fibers in a composite material, often occurring in glass-reinforced thermoset due to resin shrinkage during cure.
Contamination	Introduction of undesirable elements into the core of a panel, making a bonded panel unfit for use.
Core bevel damage	Core crushing or penetration in the angled portion of the panel core.
Core crush	A collapse, distortion, or compression of the core.
Core depression	A localized indentation or gouge in the core.
Corrosion	The deterioration of a metal by chemical or electrochemical reaction resulting from exposure to weathering, moisture, chemicals, or other agents. Can be observed as discoloration of the surface, a layer of oxide, or in advanced stages, the transformation of metal layers or surfaces.
Crack (general)	Fissure or break in the external layer(s) of a laminate or panel.
Crack (laminate)	Fractures in either matrix or both matrix and fibers. An actual separation of material. Does not necessarily extend through the thickness of the composite, but can be stopped by differently oriented plies.
Crazing	Region of ultra fine cracks that may extend in a network on or under the surface of a resin or plastic material. May appear as a white band. Crazing appears as cracking to the naked eye.
Debond	A separation of a bonded joint or interface between mating parts. Also describing a disbonded or non-adhered region; a separation at the fiber-matrix interface due to strain incompatibility. The term often refers to accidental damage. Also see disbond and delamination.
Degradation	A change in the chemical structure, physical properties, or appearance of a polymeric adhesive or any other material.
Delamination	Separation of the layers of material in a laminate, either local or covering a wide area.
Dent	A depression in a skin. A smooth dent is defined as a round bottomed depression with a diameter at least 20 times larger than its depth, while a sharp dent is any depression that is not a smooth dent.
Deterioration	A permanent change in the physical properties of a plastic, evidenced by impairment of these properties.

Table 2-2. Laminate and Honeycomb Panel Damage — Definitions (Cont)

DAMAGE	DEFINITION
Disbond	An area within a bonded interface between two adherends in which an adhesion failure or separation has occurred. It may occur at any time during the life of the structure, and may arise from a wide variety of causes. Also, an area of separation between two laminates in the finished laminate (in this case, the term delamination is normally preferred). See also debond.
Edge delamination	A separation of the detail parts along an edge.
Face wrinkling	Buckling of the compressive facing into, or away from, the core.
Failure	An event that occurs when a component or a part ceases to perform its intended function acceptably.
Fluid intrusion	This damage occurs if a leak path develops in a sandwich panel, which allows contaminating fluid to enter the honeycomb cells.
FOD	Foreign Object Damage.
Fracture	The complete or partial separation or rupture of a body.
Galvanic corrosion	Corrosion associated with the current of a galvanic cell resulting from the contact of dissimilar metals. Refer to Appendix A-6 for a table listing material compatibility.
Gouge	A removal of surface material typified by a rough and deep depression.
Impact damage	Damage from a foreign object (other than ballistic).
Interlaminar damage	Descriptive term pertaining to an object (void, etc.), event (fracture, etc.), or potential field (shear stress, etc.), referenced as existing or occurring between two or more adjacent laminates.
Microcracking	Cracks formed in composites when thermal or mechanical stresses locally exceed the strength of the matrix. Since most microcracks do not penetrate the reinforcing fibers, microcracks in a cross-plied tape laminate or in a laminate made from fabric prepreg are usually limited to the thickness of a single ply.
Nick	A sharp bottomed depression with rough edges.
Partial thickness damage	Damage affecting a percentage of the thickness of a laminate or composite sandwich panel.
Penetration	A surface discontinuity that penetrates one or both skins and core, where the width is the same magnitude as the length (i.e., a hole, ballistic damage).
Perforated skin	The facing of a panel that has a hole or pattern of several holes.
Pin hole(s)	Small cavity(ies) that penetrate the surface of a cured part.

Table 2-2. Laminate and Honeycomb Panel Damage — Definitions (Cont)

DAMAGE	DEFINITION
Plastic deformation	(Bonded panel with aluminum skin(s) only.) Change in dimension of an object under a load that is not recovered when the load is removed, as opposed to elastic deformation.
Porosity	A condition of trapped pockets of air, gas, or vacuum within a solid material. Usually expressed as a percentage of the total non-solid volume to the total volume (solid plus non-solid) of a unit quantity of material.
Puncture	Damage that extends through a laminate, or through one or both skins and the core material of a panel.
Plies delamination	A separation between layers of composite material.
Resin damage	Typical resin damage is caused by exposure to excessive heat, moisture, ultra-violet radiation, or chemicals.
Rupture	A cleavage or break resulting from physical stress.
Scoring	A type of wear in which the working face acquires grooves, axial or circumferential, according to whether the motion is reciprocating or rotary. Also applies to a similar effect on the rigid, non-moving member. A groove that is smooth and has significant width compared to depth. A blunt scratch.
Scratch	An elongated surface discontinuity that is small in width compared to length. Shallow mark, groove, furrow, or channel normally caused by improper handling or storage. Narrow, shallow mark or line resulting from the movement of a sharp pointed object across the surface penetrating into the glass or carbon fabrics.
Scuffing	Moderate wear of a surface resulting from rubbing, limited to the first ply only.
Tear	Rip or fracture in material facing.
Unbond	An area within a bonded interface between two adherends in which the intended bonding action failed to take place, or where two layers in a cured component do not adhere to each other.
Void	Air or gas pockets trapped into a laminate. A bond separation between the facing sheet (skin) and core in a laminated structure or composite honeycomb structure. Voids are essentially incapable of transferring loads.
Weeping	Slow leakage manifested by the appearance of a fluid on a surface.
Wrinkle	A surface imperfection that has the appearance of a crease or fold in one or more outer sheets of a laminate or the outer skin of a panel.

2-14. CORROSION DAMAGE

Damage assessment and corrosion removal are usually carried out simultaneously. A full assessment of damage requires complete removal of corrosion, but the method of corrosion removal used depends on a preliminary assessment of damage to determine if an affected area can be restored by repair or by replacement.

The maximum amount of material (removal limit) that can be removed from a damaged surface must take into consideration previous rework. To ensure that the allowable limits are not exceeded, an accurate measurement shall be made of the cross sectional area of material removed, or material remaining after rework. This can be accomplished by the use of a dial indicator, micrometer, or by a more sophisticated method such as ultrasonic equipment. When an area is inaccessible, an accurate means such as impression shall be used. If allowable negligible damage limits are exceeded, the area or the part shall be repaired or the part replaced.

NOTE

Allowable limits can be found throughout this manual, in the model-specific Structural Repair Manual (SRM), applicable Maintenance Manual (MM) or Component Repair and Overhaul Manual (CR&O), Standard Practices Manual (BHT-ALL-SPM), or in the Corrosion Control Guide (CSSD-PSE-87-001).

CAUTION

WHENEVER CORROSION REMOVAL IS PLANNED, THE THICKNESS OF MATERIAL TO BE REMOVED SHALL BE TWICE THE DEPTH OF THE CORROSION. THIS WILL ENSURE THAT ALL OF THE CORROSION IS REMOVED.

2-15. CORROSION TYPES AND IDENTIFICATIONS — DEFINITIONS

Routine preventive maintenance and inspections are designed to help prevent corrosion and component failure.

There are various forms of corrosion that attack metal and metallic materials, causing early part failure. The following are the most common types of corrosion.

Direct Surface Attack:

This form of corrosion is generally the least serious. It is the result of the direct reaction of metal surfaces with the oxygen in the air, and occurs more readily when metal surfaces are exposed to salt spray or salt air. Sulphur and chlorine compounds that may be present in smoke stack gases and aircraft exhaust gases also cause direct surface attacks. Etching may be noticed on the surface when corrosion deposits are removed. If the metal is aluminum alloy with a coating of pure aluminum (ALCLAD), the effect on strength or ductilibility of metal is negligible; however, corrosion of a similar degree on non-clad metal may be considered serious. Cracks that are critical in fatigue may develop from pits in such parts.

Exfoliation:

This type of corrosion often occurs in aluminum parts made from plate, bar, tube, and extrusion stock that has long, thin grains. Exfoliation corrosion is recognized by the long thin leafs of material that delaminate from the surface of a part. This type of corrosion looks like a blister on the surface of a part. This is caused by the corrosion effect between the grains, which force the grain apart, causing a bulge on the surface. Exfoliation corrosion is a form of intergranular corrosion.

Fatigue Corrosion:

This type of corrosive attack is closely related to stress corrosion. It appears in metal under cyclic stress and in corrosive surroundings. A jet turbine blade is an example of a part subjected to fatigue corrosion. Corrosion causes sharp, deep pits, which in turn become the origin of cracks that may result in failure of the part. It is difficult to detect this type of attack ahead of time, except as cracking develops.

Fretting Corrosion:

This type of corrosion attack develops when two heavily loaded surfaces in contact with each other are subject to slight vibratory motion. The rubbing contact removes small particles of virgin metal from the surface, which will oxidize to form abrasive materials. The continuing motion prevents formation of any protective oxide film, and in conjunction with the abrasive formed, creates a prime area for further corrosion to occur. Fretting is evident at any early stage by surface discoloration and the presence of corrosion by-products. Continued fretting will ruin bearing surfaces, destroy critical dimensions, and may be serious enough to eventually cause cracking and fatigue failure. Fretting may be controlled by preventing slippage of the two surfaces.

Galvanic or Dissimilar Metal Corrosion:

This type of corrosion is caused by dissimilar metal contact in the presence of a liquid such as salt spray or condensate; a true chemical cell is formed.

Hygroscopic Material Corrosion:

This is caused by an absorbent material such as sponge, rubber, felt, cork, etc., being held in contact with the part. As a result, surface or galvanic corrosion may develop.

Intergranular Corrosion:

This type of corrosion progresses along the grain boundaries of metal alloys. Aluminum alloys, which contain appreciable amounts of copper and zinc (2024 and 7075) and some stainless steel (17-4PH), are vulnerable to intergranular corrosion. Hinges are an example of aluminum alloy extrusions that are vulnerable. Lack of uniformity in alloy structure caused by heat treating procedures or localized overheating may result in intergranular corrosion. The corrosion may exist without visible evidence on exterior surfaces and serious structural weakening may occur without detection.

Pitting:

A pitting attack is a special kind of galvanic reaction and is usually localized. It can occur at a point where a lack of homogeneity in the alloy surface will react due to breakdown of the surface protection. The area becomes anodic to the rest of the surface, and corrosion product formation accentuates the anodic characteristics of the pitted area. A deep penetrating attack develops, rather than a general surface attack.

Stress Corrosion:

This type of corrosion affects metal that is highly stressed under corrosive conditions. Shrink fit parts and parts subjected to cold forming are susceptible to stress corrosion cracking. Stressed metal tends to become anodic when in contact with stress free metals. Galvanic corrosion occurs along the lines of stress.

2-16. CORROSION TREATMENT

When found, any corrosion condition must be isolated and addressed with proper treatment before the allowable limits are exceeded.

NOTE

Allowable limits can be found throughout this manual, in the model-specific Structural Repair Manual (SRM), the applicable Maintenance Manual (MM) and/or Component Repair and Overhaul Manual (CR&O), the Standard Practices Manual (BHT-ALL-SPM), or in the Corrosion Control Guide (CSSD-PSE-87-001).

For guidelines in corrosion preventive methods and treatments, refer to the Standard Practices Manual (BHT-ALL-SPM) and to the Corrosion Control Guide (CSSD-PSE-87-001).

2-17. WATER IMMERSION DAMAGE

Bell Helicopter Textron considers a helicopter submerged in water deeper than 12 feet, for longer than 24 hours to be unserviceable and not economically repairable, regardless if it was in fresh, contaminated, or salt water. The hydrostatic pressures beyond 12 feet deep will make it possible for water to infiltrate the bonded panels and systems, and after 24 hours the corrosion process will have begun and already rendered the helicopter beyond economical repair.

Helicopters are considered recoverable when they have been submerged in water less than 12 feet deep for less than 24 hours.

Helicopters that have been removed from the water, but have stood without a fresh-water wash for 12 hours or more, are considered non-repairable.

2-18. RECOVERY FOLLOWING IMMERSION

NOTE

The recovery procedure requires that the residual water and any contaminants be eliminated within 12 hours after removal from floodwater or water landings. A water sample should be analyzed to identify any contaminants that would promote corrosion. Knowledge of the contaminants is an important factor in the recoverability of the helicopter. The water may contain high levels of agricultural chemicals, insecticides, sewage, salt, and other biological and chemical compounds. Because of the vast array of different materials used in helicopters, corrosion damage could potentially destroy the helicopter as an assembly. Field reports indicate that helicopters recovered, as described herein, may reveal excessive and/or premature corrosion at various time periods following recovery.

After the removal of the submerged helicopter, the following clean-up procedure shall be performed within 12 hours.

1. Define the type of water in which the helicopter was immersed (salt, marsh, muddy). Contaminated water should be analyzed to identify agricultural chemicals, insecticides, sewage, salts, and other chemical compounds.

2. Remove all doors, access panels, interior trim panels, insulation blankets, carpets, seats, seat belts, and fuel cells.

3. Flush the helicopter fuselage with fresh water, then wash with soap (household dishwashing detergent mixed with 8 ounces (250 ml) to 5 gallons (18.9 L) of water) and flush with fresh water again. Repeat, as required, until all salt or water contaminants are rinsed away.

4. Remove engine(s), all drivetrain and rotor components, flight controls, and applicable system components.

5. Thoroughly dry all areas with lint-free cloths, and ventilate all areas until completely dry.

6. Coat all surfaces with water displacing preservative oil spray.

2-19. INSPECTION FOLLOWING IMMERSION

In addition to a search for the presence of contamination, the structural inspection shall include a search for the following:

- Corrosion and obvious damage that may have occurred prior to or during the immersion
- Voids, disbond, delamination, cracks, and bonded panel edge peeling
- Honeycomb panels with damaged finish on glass/carbon fiber facing or fiberglass edging
- Slight separation between faying surfaces of skins or bonded panel joints
- Chipped paint around fastener heads
- Signs of water or contaminant leakage

NOTE

Moisture can migrate deeply through any structural void or any separation in organic finish.

Any evidence (of corrosion, voids, chips, etc.) from the structural inspection is a sign of possible water ingress and shall be cause for further inspection due to water contamination.

All bolts and screws, loose rivets, and hardware such as bearings and similar parts are considered contaminated and shall be inspected or replaced.

All flight control bolts and hardware shall be replaced.

NOTE

Allowable limits can be found throughout this manual, in the model-specific Structural Repair Manual (SRM), the applicable Maintenance Manual (MM) and/or Component Repair and Overhaul Manual (CR&O), the Standard Practices Manual (BHT-ALL-SPM), or in the Corrosion Control Guide (CSSD-PSE-87-001).

All drivetrain components shall be overhauled. Components that cannot be repaired or show signs of premature corrosion shall be replaced.

NOTE

A continuous film of primer or organic finish over attaching fasteners, joints of web, skin, and bonded panel structural joints would indicate that the area is serviceable. Paint is more elastic than aluminum alloy and may mask cracks and loose fasteners. If in doubt, remove the coating to inspect.

All vents and drain lines should be inspected for contamination and freedom of obstruction, and flushed as required. All drain holes in the structure and fuselage or tailboom sections should be inspected for obstructions and cleaned as required.

The fuel system shall be inspected for contamination starting at the engine and working toward the fuel cells. The fuel cells shall be removed to allow for inspection of the airframe fuel cell cavities. The fuel cell bladders shall be inspected for trapped water, debris, or mud prior to reinstallation. Booster pumps, probes, and other related components shall be sent to overhaul.

Hoses, tubes, and fittings shall be inspected for contamination, for freedom of obstruction, and then internally flushed. They shall be discarded when:

- More than 10% of the tube wall thickness has been removed during the rework to remove external corrosion.

- Water is discovered in hard (aluminum or steel) tubing, unless the interior of the tube can be visually inspected for corrosion.

Avionics components such as radio, radar, autopilots, and instruments, and electrical components such as relays, switches, and circuits breakers shall be replaced; wire harnesses, connectors, and terminal junction modules shall require close inspection to determine serviceability.

Pitot/Static tubing and battery vent shall be purged to ensure that they are free from contamination and clear of obstruction.

Airframe components such as hydraulic systems, environmental control/defrost, drive train, and rotor system components shall be overhauled prior to return to service.

All flight control tubes, linkage, and other control assemblies shall be disassembled and inspected for contamination. Bearings with internal water contamination shall be replaced.

NOTE

Bell Helicopter Textron recommends to operators of helicopters affected by immersion and/or severe contamination to adopt shorter inspection intervals in order to detect premature corrosion.

Contact Product Support Engineering to define the shorter inspection schedules.

2-20. EXTINGUISHING AGENTS — REMOVAL

All areas exposed to fire extinguishing agents must be thoroughly cleaned to prevent corrosion and to permit inspection of the area. Cleaning shall be carried out within a few hours.

All affected electrical and electronic components must be removed from the helicopter, cleaned, dried, and prepared to be sent to overhaul. Tag each component, stating that the component was involved in a fire and note the type of fire extinguishing agent used. All wire harnesses must be loosened and thoroughly cleaned. Electrical connectors must be thoroughly examined for damage and contamination. If damage is found, remove and replace the electrical connector(s).

NOTE

If Halon comes in contact with water, the contaminated area must be rinsed with fresh water and thoroughly dried.

Halon 1301 and Halon 1211 power plant fire extinguishing agents evaporate quickly and do not require a clean-up procedure. However, in the presence of water these agents have a corrosive effect on magnesium and alloy that contains more than 2% magnesium. They also dissolve natural rubber. Therefore, if Halon comes in contact with water the contaminated area must be rinsed with fresh water and thoroughly dried.

WARNING

WEAR FACIAL PROTECTION.

Dry chemical powder fire extinguishing agents are strongly caustic, especially when mixed with water. The powder should be removed with a combination of brushing, vacuum cleaning, and/or careful use of dry compressed air.

When the powder is in solution with water, thorough rinsing is absolutely necessary to remove all pockets of solution from the helicopter.

When powdery residue adheres to oily or greasy surfaces, it shall be removed with drycleaning solvent (C-304), specification MIL-PRF-680, Type II.

Foam fire extinguishing agents shall be removed using a high velocity jet of fresh water, and scrubbing with a soft fiber brush. The area shall be thoroughly dried.

Carbon dioxide (CO_2) and carbon tetrachloride fire extinguishing agents evaporate rapidly, and no cleaning is required.

Chlorobromomethane fire extinguishing agents evaporate rapidly. However, they are highly corrosive. If any of this substance is trapped between structures, it must be purged or blown out using compressed dry nitrogen (gas) (C-315).

Methyl bromide fire extinguishing agents must be cleaned with drycleaning solvent (C-304), specification MIL-PRF-680, Type II.

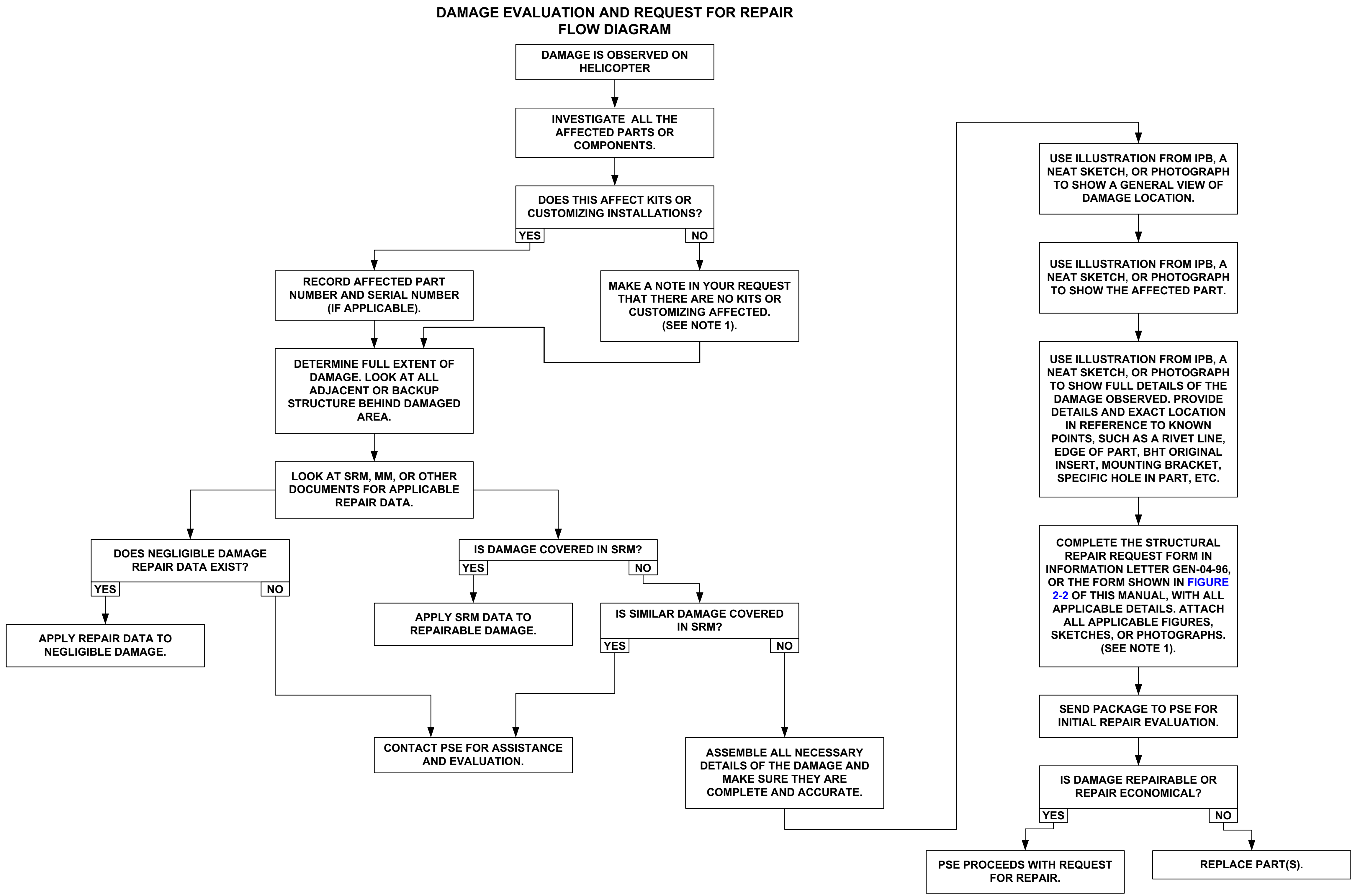
2-21. REQUESTING REPAIR PROCEDURE

These instructions emphasize the importance of providing sufficient and accurate information with your request for structural repair (Figure 2-2). Determine the full extent of damage and compare using the applicable chapter of this manual and the model-specific Structural Repair Manual (SRM). Damage falling within the limits and restrictions of this manual or the model-specific SRM may be repaired using the applicable repair procedure.

In cases where the damage to the helicopter is not covered or limits are exceeded, operators are invited to submit a request for an approved structural repair to Product Support Engineering who will perform an initial evaluation of the damage for admissibility. Several factors will be taken into consideration before Product Support Engineering initiates the repair design and approval process.

NOTE

Repair procedures are designed for unmodified production line helicopter configurations, and do not take into consideration kits installed under third party STCs. Since some of these repairs are approved on an adequate strength basis, Bell Helicopter Textron recommends that the STC holder be contacted to evaluate the impact that any repair performed on the part or in the area where the kit is installed may have.



NOTE

1. If there are no kits and customizing on your helicopter, make sure to mention it in the Structural Repair Request form.

ALL_SRM_02_0005

Figure 2-1. Damage Evaluation and Request for Repair Flow Diagram

Structural Repair Request Form

Date:	Number of pages (including this one):
Fax to:	☐ (817) 280-2635 (for Model 214, all variants) ☐ (450) 433-0272 (for all other commercial models)

Sender: ______________________________ Tel: ______________________________

E-mail Address: ________________________ Fax: ______________________________

Company: ____________________________ Repair Facility: _________________________

Owner /Operator: ______________________

Helicopter Information	
Model:	Serial Number:
Flight Time:	Registration:
Status: ☐ Routine ☐ Work Stoppage ☐ AOG	

Damage Description	
Part Number:	Serial Number:
Tailboom Part Number (if applicable):	
Tailboom Serial Number (if applicable):	
Description: (attach a sketch or send by e-mail with digital pictures)	

This form may also be scanned and e-mailed with the sketch and/or other attachments to the appropriate e-mail address.

pselight@bellhelicopter.textron.com for 206 and 407 (all variants)
psemedium@bellhelicopter.textron.com for 204, 205, 212, 412 (all variants)
pseinter@bellhelicopter.textron.com for 222, 230, 427, 429, 430 (all variants)
psemil214@bellhelicopter.textron.com for 214 (all variants)

Figure 2-2. Structural Repair Request Form

Initial Product Support Engineering Evaluation:

Once a request is received, Product Support Engineering carries out an initial evaluation of the damage. Factors such as the cost of a replacement part, availability of parts and material required for a repair, restoration of the structural integrity of a damaged component, and requirement for a specific workaid or a BHT-approved fixture are just a few factors that serve to determine the admissibility of the request for a repair scheme. The factors may simply justify replacement of the affected component or assembly. If the request is admissible, an approved repair procedure will be issued only for damage affecting original Bell Helicopter parts that are deemed repairable.

NOTE

Bell Helicopter Textron does not offer a service of customized modifications to the helicopter, and cannot approve repairs previously accomplished on the helicopter, or repairs to parts not procured through approved sources.

To help expedite the process of initial evaluation, we invite you to provide all of the following information.

NOTE

Refer to Information Letter GEN-04-96 for additional information. Complete the attached form and send it to Product Support Engineering.

Group Information:

- Clearly identify the Product Support Engineering group responsible for the request (e.g., Light, Intermediate, Medium).

Helicopter Information:

- Provide the model designation and BHT production serial number.
- Provide the current airframe total time (TTAF) of the helicopter.
- Provide the helicopter location, nationality, and registration number.
- Provide the part number, serial number, and total time since new (TTSN) of all components (such as tailboom, vertical fin, auxiliary fin, horizontal stabilizer, etc.) affected by the repair.
- Provide the status of the helicopter (e.g., scheduled maintenance or inspection, major rework, work stoppage, ship grounded, etc.).
- Confirm if your helicopter was ever involved in an incident/accident such as a hard landing, dynamic rollover, etc., that has caused structural damage. If so, provide the name of the structural repair facility that was involved with repairing and returning this helicopter to service.

Contact Name:

- Provide the name of the owner and/or the operator of the helicopter and the name of the repair facility that will do the repair.
- Provide the name, telephone, fax number, and/or e-mail address of the person responsible for the repair. This person shall be Product Support Engineering's point of contact to get additional information on the damage/repair of the helicopter.

Damage Description:

- Be as concise and accurate as possible while describing the damage that you see. Keep in mind that you are physically seeing the damage but BHT is not. Refer to the examples of damage description in Table 2-3.

- Specify if any repairs were done previously in the immediate area of or on the component for which you are requesting repair(s). If a previous repair exists, describe it. If BHT was involved with that repair, provide the repair number or a reference to the SRM.

- Specify any kit, modification, or customized installation that would be affected by or will affect the repair.

- Provide the cause of the damage (e.g., incident/accident, wear, corrosion, mechanical damage, etc.).

- State the origin of the component that needs repair (e.g., BHT original factory installation, BHT spare unit, PMA part, repaired unit by non BHT-approved repair facility, etc.).

- Specify any BHT-approved field modifications such as compliance with Technical Bulletins, Alert Service Bulletins, or modification drawings.

Sketches or Pictures of Damage:

NOTE

Do not fax pictures as those will not be received in a visible format. Take pictures in a digital format and send them by e-mail to Product Support Engineering.

1. Determine the full extent of the damage and provide accurate sketch(es) or picture(s). Be precise. If necessary, remove as much of the damage as needed to investigate the full extent of the damage. Where bonded panel assemblies are affected, proceed as follows:

a. Define the damage type, depth, and size by visual inspection and/or tap testing.

b. When needed, remove the damaged material to investigate further (e.g., skin, core, internal doubler, etc.) until sound structure or material is reached.

c. Inspect for core contamination such as water, oil, or any other type of fluid. Re-evaluate the damage as necessary.

d. Look for edge delamination, disbonded skins or doublers, and corrosion in laminates and bonded panels.

When Sketches are Used:

NOTE

Remember that Product Support Engineering will rely on the sketches to understand where the damage is located and what it consists of.

2. Use clean sheet(s) of paper to produce accurate sketch(es) illustrating a wide and general view of where the damage is located on the airframe, assembly, or component of the fuselage. Figures from the applicable Illustrated Parts Breakdown (IPB) or blank sketches provided in the model-specific SRM appendix can be used for this purpose.

a. Add one or more additional sketch(es), fusing wide and/or close-up view(s) to clearly indicate where the damage is, and its precise location.

b. Show the exact location and size of the damage on your sketch(es) by referring to known features of the fuselage structure such as an edge of a part, inserts, rivet lines, or the vertical/perpendicular face of a bulkhead. Location can also be from the edge of the damage to a known fuselage station (FS), Waterline (WL), or Buttock Line (BL) as referenced in the helicopter line drawings provided in the model-specific SRM, but dimensions from known features are preferable.

c. Refer to Figure 2-3 through Figure 2-6 for examples of sketches to provide.

NOTE

Clarity and accuracy will limit requests for additional information and speed up the design of approved structural field repairs.

d. Provide all dimensions (length, width, depth, and orientation) in inches and decimal points. If dimensions are given in international units, please specify clearly. Define if dimensions are to the edge or center of the damage. Mark distances directly on the sketch(es) to those known features showing size of the damage (two or more dimensions needed such as width, length, and depth) and location (a minimum of two dimensions such as horizontal distance, lateral distance, or vertical distance) from the reference points (e.g., 3 inches center to center (C to C) or 3 inches to the edge of part (EOP)).

e. Clear digital pictures are an effective way of communicating information but will not replace a sketch, unless all the dimensions are visible in the picture. At least one of the pictures should show a wider view of the area surrounding the reported damage in order to locate the damage on the helicopter and help identify the damaged part. Whenever possible, the pictures should be sent as an e-mail attachment rather than faxed, to preserve the quality of the images. Avoid sending out-of-focus, underexposed, or overexposed pictures.

Damage Extent:

In order to verify applicability of a repair procedure, the extent of damage shall be determined using the following guidelines.

- Outline the damaged area for each affected section of the part or component.
- If two or more damage layouts are less than 5 inches apart, consider both as a single damage, and lay out a new outline accordingly.
- A correct damage outline includes the entire damaged area and a minimum amount of good material, while maintaining the minimum required cut out radius.
- For non-circular damage, draw straight lines to form a regular shape that encompasses the damaged area. Connect the lines using 0.50 inch (12.7 mm) minimum radius.
- The length and width of the damaged area is determined using the maximum outline as defined in Figure 2-4.

Adjacent Damage in Same Area:

If there are two or more adjacent damages in the same area, measure the distance between them as shown in Figure 2-6. The minimum distance between damages (edge to edge) must be measured.

When outlines of adjacent damages are too close to perform individual repairs (less than 5 inches (127 mm) apart), they must be considered as one damage. The repair must be performed using the restriction of the most severe damage, or using the most severe restriction(s).

Restricted Areas:

The restrictions on damage repairability may differ from area to area within a specific component. Areas with the same restrictions (zones) are clearly defined in zone maps for individual parts in the model-specific SRM. Some zones have been defined as "restricted area, no repair allowed". If damage is located within a restricted area, contact Product Support Engineering for an evaluation of the repairability of the part and/or to request an approved structural field repair.

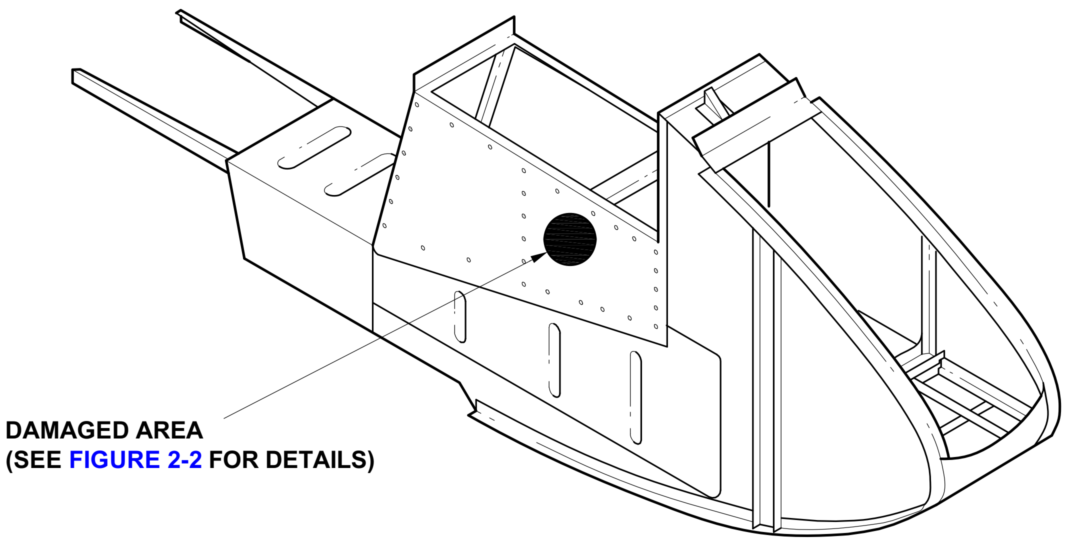
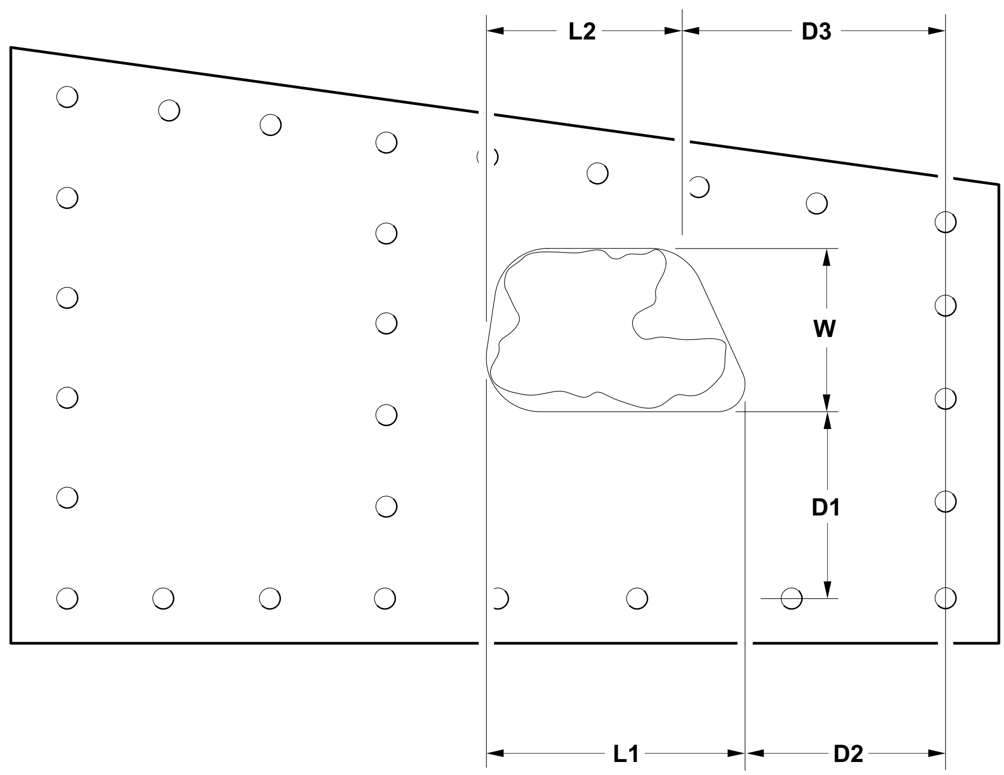


Figure 2-3. Example of General View



Dx: Distance of damage layout to reference points
W: Width of damage
L: Length of damage

NOTE
Example of additional close-up view showing exact location on affected part.

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Figure 2-4. Close-up View — Example

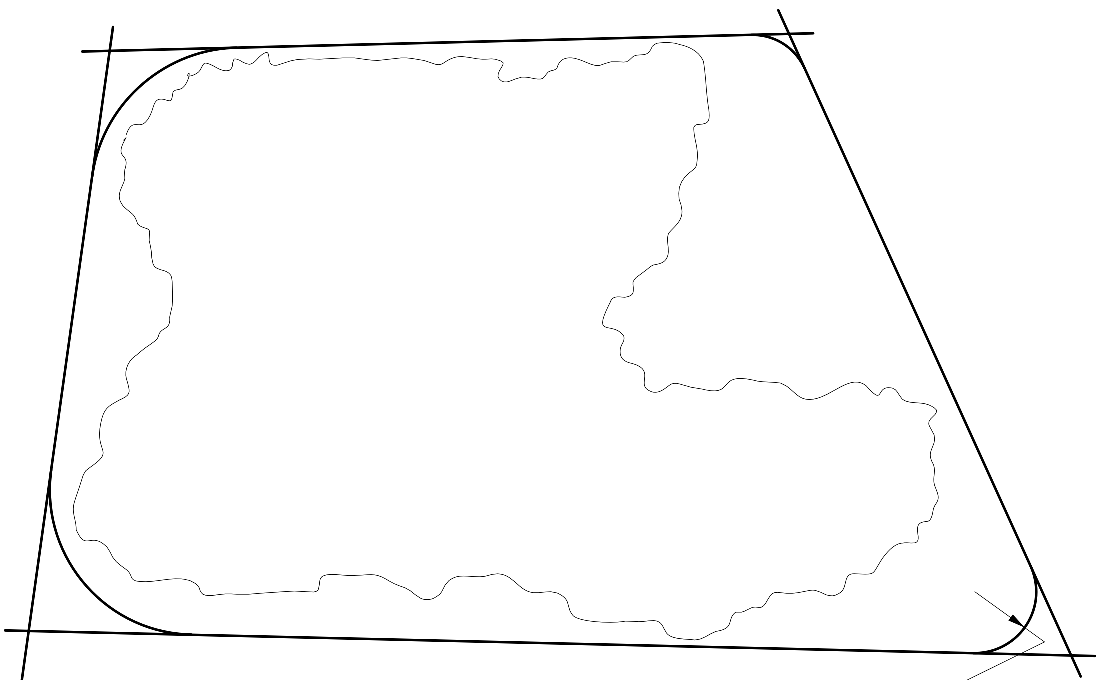
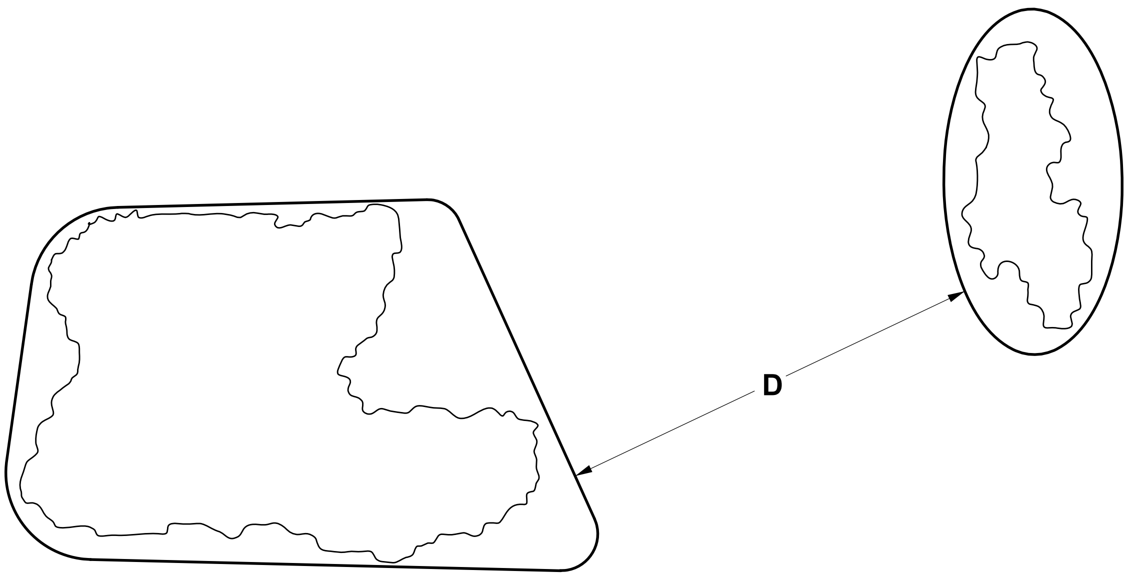


Figure 2-5. Example of Damage Outlining



NOTE

If distance D is less than 5.0 inches (127.0 mm), consider both as a single damaged area and layout outline accordingly.

ALL_SRM_02_0004

Figure 2-6. Example of Outlining and Measuring Distance Between Adjacent Damage

Maximum Damage Allowance:

The maximum damage allowed on a part is the limit beyond which the part is not repairable using procedures provided in the model-specific SRM. These limits are clearly defined in the repair procedures for each individual part. In the case where damage goes beyond the maximum allowable limit, the part has to be replaced or a special repair procedure has to be defined.

2-22. DAMAGE DESCRIPTION — EXAMPLES

NOTE

The following table provides operators/customers of Bell Helicopter Textron with a list of damage terms, their definitions, and examples of damage descriptions to help in the reporting of damage(s) observed on the helicopter.

Table 2-3. Damage Description Examples

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Abrasion	An area on the surface of a part that has been roughened by rubbing.	"…abraded area is 3.0 inch (76 mm) long x 2.0 inch (51 mm) wide x 0.010 inch (0.25 mm) deep…"
Bend	A straight or even condition changed by bending out of original contour or shape.	"…bent by 4° downwards over 4.0 inches (102 mm) starting from the aft end of the part…"
Blister	On a surface, a dome, or bubble shaped elevation.	"…has a 1.00 inch (25.4 mm) diameter x 0.060 inch (1.52 mm) high blister..."
Buckling	On a part, large-scale deformation from the original shape caused by high compressive loading, excessive localized heating, or a combination of these loads.	"…buckled area of 8.0 inches (203 mm) long x 6.0 inches (152 mm) wide exists on…" "…buckled area of 12.0 square inches (77.4 cm^2) exists on…"
Bulge	A protuberance on the surface of a part.	"...bulge of 1.50 inch (38.1 mm) long x 0.30 inch (7.6 mm) wide x 0.015 inch (0.38 mm) high exists on…"
Bump	Local outward step on a surface with no material removal.	"…has a 0.60 inch (1.5 mm) diameter x 0.020 inch (0.51 mm) high bump…"
Burn	Discoloration resulting from exposure to excessive heat.	"…burned area of 8.0 inches (203 mm) long x 6.0 inches (152 mm) wide exists on…"
Burr	A thin ridge or area of roughness produced in cutting or shaping metal.	"…not deburred…"
Chipped	Parts with pieces cut, struck, or flaked off.	"…chipped area is 20.0 inches (508 mm) long x 0.010 inch (0.25 mm) wide x 0.005 inch (0.13 mm) deep…"
Contaminated	Made unfit for use by introduction of undesirable elements.	"…internal core is contaminated with…"

Table 2-3. Damage Description Examples (Cont)

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Corrosion	A deterioration of metal caused by chemical or electrochemical attack. Corrosion appears as roughening, etching, or pitting accompanied by powdery deposits or corrosive products.	"…corroded area is 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide x 0.020 inch (0.51 mm) deep…" "…corroded area is 12.0 square inches (77.4 cm^2) x 0.020 inch (0.51 mm) deep…" "…corrosion on 5% of the surface x 0.020 inch (0.51 mm) deep…"
Crack	A fissure or a break in surface of material.	"…has a 0.75 inch (19.0 mm) long crack at…"
Crazing	Concentrated section of small fissures appearing on the surface of a solid material.	"…crazed area is 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide on…" "…crazed area is 12.0 square inches (77.4 cm^2)…" "…crazing on 5% of the surface of…"
Crushed	A mesh of fine cracks on the surface of a glossy material.	"…crushed area is 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide…" "…crushed area is 12.0 square inches (77.4 cm^2)…" "...crushing on 5% of the surface…"
Delamination	Separation of layers of material in a laminate.	"…delaminated area is 12.0 inches (305 mm) long x 0.50 inch (12.7 mm) wide…"
Dent	Local inward depression on a surface with no material removal.	"…has a 0.50 inch (1.3 mm) diameter x 0.020 inch (0.51 mm) deep dent…"
Depression	An inward change in the normal contour of a surface.	"…has a 5.0 inches (127 mm) long x 4.0 inches (102 mm) wide depression…"
Ding	Small dent.	"…has a 0.05 inch (1.3 mm) diameter x 0.005 inch (0.13 mm) deep ding…"
Disbond	Lack of proper adhesion in a bonded joint of a laminate or composite panel.	"…disbonded area is 12.0 inches (305 mm) long x 0.50 inch (12.7 mm) wide…"
Distortion	A twist out of natural, normal, or original shape or condition.	"…distorted area is 12.0 inches (305 mm) long x 0.50 inch (12.7 mm) wide…"
Double hole	Two holes side by side in one part with no material in between.	"…has a 0.180 inch (4.57 mm) long x 0.125 inch (3.17 mm) wide double hole in… common to…"
Edge distance	Distance between the center of a hole and the edge of a part.	"…low edge distance (low ED) 0.180 inch (4.57 mm) exists in… for fastener…"
Elongated hole	A hole that is long in proportion to its width (with oblong shape).	"…hole elongated to 0.185 inch (4.70 m) long x 0.160 inch (4.06 mm) wide in… common to…"

Table 2-3. Damage Description Examples (Cont)

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Flaking	Loose particles of material on a surface or evidence of removal of surface covering.	"…flaking appears on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…" "…flaking on 12.0 square inches (77.4 cm^2) of…" "…flakes appear on 5% of the surface…"
Flash	Excess material formed at the parting line of a mold or die, or extruded from a closed mold.	"…has a flash 0.50 inch (12.7 mm) long x 0.012 inch (.30 mm) high…"
Flat spot	A flat area on a curved surface.	"…has 3.0 inches (76.2 mm) x 1.0 inch (25.4 mm) flat spot…"
Flaw	Hidden defect in a part that causes failure under stress.	"…casting has a 0.25 inch (6.3 mm) diameter flaw on…"
Fretting	From the action of oscillatory loading, oxidized parent metal grinds surrounding pure metal, wearing away the surface.	"...crack 0.4 inch (10 mm) long due to fretting in…" "…fretting occurred on 5% of the surface…" "…fretting occurred on 12.0 square inches (77.4 cm^2)…" "…fretting occurred on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Gap	An opening between two parts.	"…gap of 3.0 inches (76 mm) long x 0.60 inch (15.2 mm) wide x 0.040 inch (1.02 mm) high exists between… and…" "…excessive gap 0.120 inch (3.05 mm) high exists between lower edge… and… upper edge of…"
Gas hole	A trapped pocket of gas within a solid material.	"…qty (3) gas holes of 0.060 inch (1.52 mm) diameter exist in…"
Gouge	A large groove scooped out of material surface.	"…has a 0.35 inch (.9 mm) long x 0.15 inch (3.8 mm) wide x 0.030 inch (0.76 mm) deep gouge in… or on…"
Gouging	A removal of surface typified by rough and deep depression.	"…gouges on 5% of the surface…" "…gouges on 12.0 square inches (77.4 cm^2) …" "…gouges on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Hairline scratch	Very fine scratch on the surface of a part.	"…has a 3.0 inches (76 mm) long hairline scratch…"
Inclusion	A gaseous liquid or solid foreign body enclosed in a mass.	"…have qty (4) inclusions of 0.05 inch (1.3 mm) diameter…"

Table 2-3. Damage Description Examples (Cont)

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Indentation	Local depression on a surface with no material removal.	"…has a 0.50 inch (12.7 mm) diameter x 0.020 inch (.51 mm) deep indentation…"
Knife edge	A reduction in thickness to a sharp edge.	"...knife edge condition exists in…"
Misalignment	Lack of alignment between parts, edges, or holes.	"…misalignment of 0.020 inch (0.51 mm) exists between…"
Mismatch	Lack of alignment between adjacent parts or superimposed holes.	"…mismatch of 0.05 inch (1.3 mm) exists between…"
Nick	A small groove scooped out of the material surface.	"…has a 0.10 inch (2.5 mm) long x 0.030 inch (0.76 mm) wide x 0.006 inch (0.15 mm) deep nick…"
Notch	Damage cut on the edge of a part.	"…a 0.30 inch (7.6 mm) long x 0.10 inch (2.5 mm) wide notch exists on the edge of…"
Oil can	Excess material, which produces popping metallic sound, when pressure is applied or removed on the surface with the palm of the hand.	"…approximately 3.0 inches (76 mm) diameter oil can condition exists on…"
Oxidation	Metal deterioration on a part caused by the deposit of a powdery corrosive product.	"…oxidation on 5% of the surface…" "…oxidation on 12.0 square inches (77.4 cm^2)" "…oxidation appears on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Pin hole	A small hole on the surface of a part.	"…pin holes exist on 5% of the surface of…" "…pin holes exist on 12.0 square inches (77.4 cm^2)…" "…pin holes exist on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Pitting	A corroded condition characterized by minute holes or cavities in a surface.	"…pitting on 5% of the surface of…" "…pitting on 12.0 square inches (77.4 cm^2) …." "…pitting on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Porosity	A condition of trapped pockets of air, gases, or voids within a solid material.	"…porosity on 5% of the surface of…" "…porosity on 12.0 square inches (77.4 cm^2)…" "…porosity on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Puncture	A hole or perforation through a part made with a sharp or pointed object.	"…has a 0.120 inch (3.05 mm) diameter puncture…"

Table 2-3. Damage Description Examples (Cont)

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Redundant	Exceeding the requirements.	"…qty (1) 3/32 inch (2.4 mm) diameter redundant hole exists in… at 0.50 inch (13 mm) center to center from adjacent 5/32 inch (3.9 mm) diameter hole…"
Scouring	Wear marks characterized by a scratched, scuffed, or dragged appearance in the direction of the sliding.	"…scouring has occurred on 5.0 square inches (77.4 cm^2)…" "…scouring has occurred on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Scratch	A mark on a surface made with a sharp or pointy object, producing material removal.	"…has a 3.0 inches (76 mm) long x 0.003 inch (0.08 mm) deep scratch…"
Scuffing	A dulling or moderate wear of a surface resulting from rubbing.	"…scuff marks have occurred on 5% of the surface of…" "…scuffing has occurred on 12.0 square inches (77.4 cm^2)…" "…scuffing has occurred on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Seize	To cohere to a moving part through excessive pressure, temperature, or friction.	"…seize to excessive friction…"
Sharp edge	Abrupt change on the surface of a part that has not been deburred.	"…sharp edge not deburred…"
Spalling	A surface or sub-surface defect characterized by chips of material that flake out, leaving cavities of varying sizes and depths.	"…spalling has occurred on 5% of the surface of…" "…spalling has occurred on 12.0 square inches (77.4 cm^2)..." "…spalling has occurred on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Step	Height difference between two adjacent surfaces.	"…step of 0.070 inch (1.78 mm) exists between…"
Swart	Material removed by a grinding or cutting tool.	"…swart exists on 5% of the surface of…" "…swart exists on 12.0 square inches (77.4 cm^2)…" "…swart exists on a 4.0 inches (102 mm) long x 3.0 inches (76 mm) wide area…"
Taper	Gradual reduction of thickness, diameter, or width.	"…tapering from 0.25 inch (6.35 mm) down to 0.23 inch (5.82 mm)…"
Tear out	Distance between the edge of a part and the edge of a hole.	"…tear out distance is 0.10 inch (2.54 mm)…"

Table 2-3. Damage Description Examples (Cont)

DAMAGE	DEFINITION	DESCRIPTION EXAMPLE
Twisted	Altered by torsion.	"…is twisted over 6.0 inches (152 mm) long…"
Void	An area that is not bonded.	"…has a 3.0 inches (76 mm) long x 2.0 inches (50 mm) wide void..." "…has 1.0 square inch (77.4 cm^2) void..."
Warp	A twist or curve that has developed in something originally flat or straight.	"…is warped over 3.0 inches (76 mm) long x 0.05 inch (1.3 mm) wide…"
Waviness	An undulating change in the contour or shape of a part.	"…waviness up to 0.030 inch (0.76 mm) high x 5.0 inches (127 mm) long x 0.60 inch (15.2 mm) wide exists on…"

2-23. REQUEST PROCESSING

NOTE

Failure to provide all necessary information with your initial request may result in delays in designing an applicable repair scheme.

Upon receipt, your request (if admissible) will be evaluated and placed in queue for repair design and approval. Requests for repair are taken on a first-come first-serve basis. Response time will vary depending on the workload and repair complexity. Allow three to seven working days from the time Bell Helicopter Textron receives all the necessary information for the preparation of an approved field repair procedure.

Send your request for evaluation of the structural damage to the following:

Bell Helicopter Textron
Product Support Engineering

Fax:

1-450-433-0272
1-817-280-2635 (Model 214 only)

E-mail:

Models 206 Series (including TH-57/TH-67 U.S. army designation) and 407
pselight@bellhelicopter.textron.com

Models 204, 205, 212, and 412
psemedium@bellhelicopter.textron.com

Models 222, 230, 427, 429, and 430
pseinter@bellhelicopter.textron.com

Models 214, 210, and Military Surplus Series
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