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EXPERIENCE FROM INCIDENTS

From time to time incidents occur, usually in aircraft operations, which, in the opinion of the DCA, reflect the need for a general awareness of possible hazard resulting from practices which may have a wide general application. The purpose of this Notice is to advise all concerned, particularly design and engineering staff engaged in aircraft construction or operation, of such incidents from experience which have come to the notice of the DCA, and where necessary to prescribe action to be taken in appendix such as, ;

Appendix 1- SOFT METAL SHIMS

1. An incident involving a transport aircraft resulted from the failure of a power control bracket fitting to the elevator.
2. A subsequent investigation revealed that soft metal shims were embodied between the bracket and the elevator, apparently for assembly alignment and adjustment. Small diameter special tapered bolts were embodied in shear and set bolts in tension, but effect of these was quickly lost after initial tightening due to setting or extrusion of the soft metal shims.
3 In this type of assembly it is important that the initial torque loading at construction should be maintained throughout the life of the assembly. This object was defeated by the use of soft metal shims and this design feature, which has been proved by experience to be undesirable, was repeated and created a serious hazard.

Appendix 2- CROWDED BALL RACES

1. An incident occurred as a result of a control shaft becoming completely jammed.
2. Crowded ball races have no cage, and the balls are placed in position by forcing them through assembly slots in the inner and outer races. Only a small amount of interference between the ball and the slot is possible during assembly, with the result that excessive wear (which can be caused by rusting) or faulty manufacture can leave the balls free to re-enter the assembly slot. The inner race can then become locked to the outer race and, in addition, loose balls may drop out and possibly create a further hazard.
3. Cases have arisen with such bearings in which the clearances became sufficiently large for a ball to move from its proper track into the assembly slot and yet not escape completely because of the configuration of the bearing on the shaft. In this position, the ball completely jammed the control shaft on which it was used.
4. Among many ways of preventing this kind of hazard is the use of shaped washers alongside the bearing to prevent the balls moving sideways far enough to re-enter the slot.

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Appendix 3- OXYGEN FIRE RISK

1. Serious fire damage has been caused where fires (which would probably otherwise have been insignificant) have been fed by oxygen from the aircraft's piped oxygen system. In some cases an oxygen leak contributed to the outbreak of fire, in others the oxygen was liberated by the fire, which as a result then became much more severe.
2. Although the increased flammability and heat of combustion of many materials in the presence of oxygen is well known, it appears that due regard for this fact is not always paid in the design of aircraft, particularly in the consideration of minor modifications after original construction.
3. Precautions should be taken to ensure that an oxygen leak would not create a fire hazard where none previously existed and that a minor overheat or an electrical fire condition cannot damage the oxygen system, thus promoting far more serious consequences.

Appendix 4- FLUTTER OF FLYING CONTROL SURFACES

1. Incidents of in -flight vibration on certain light aircraft, believed to be flutter of the manually controlled stabilator, have emphasized the need to give close attention to mass balance and rigidity characteristics of flying control surfaces.
2. Control surfaces on aircraft are designed to a degree of balance necessary to prevent the occurrence of control surface flutter in flight. In some cases, balance weight is added forward of the hinge line to achieve this. As it is important that this degree of balance should be retained, work on control surfaces, such as repair or repainting, should be carefully controlled.
3. As a general rule, any repair to a control surface should be made in such a manner that the structure remains essentially identical to the original. Alternatively the surfaces may be repaired in accordance with a scheme approved by the manufacturer.
4. The cumulative effects of repainting and use of paint fillers may seriously affect the balance of a control surface, and any manufacturer's recommendations regarding this should be followed. In the absence of such recommendations, the DCA Airworthiness Section should be consulted.
5. The balance of control surfaces should be checked after repair or repainting to ensure that the manufacturer's tolerances have not been exceeded. When it is necessary to adjust balance in order to bring the control surface balance within the tolerances, the manufacturer's procedures should be carefully followed.
6. Another cause of control surface flutter is slackness in hinges and linkages of the main control surfaces or tabs, and particular attention should therefore be paid to these points during routine maintenance, to ensure that any free play remains within the manufacturer's tolerances.

Appendix 5- FLUIDS USED IN AIRCRAFT

1. Aircraft are replenished with many fluids for their operation. Accidents and incidents draw attention to the need to avoid the use of incorrect fluids. In addition to the obvious risks associated with damage to systems and failure to function if they are filled with the incorrect fluids, there is a risk that the damage may not become apparent until the aircraft is in flight with possible catastrophic results. Use of incorrect fluids may result from:
   (a) incorrectly establishing the fluid required;
   (b) incorrect identification of the fluid available.
2. To avoid incorrectly establishing the fluid required, the following should be observed:
   (a) Filling points are required to be clearly marked to indicate the fluid to be used and these markings should be maintained in legible condition.
   (b) Where it is critical that the fluid to be used is to a particular specification, the marking may either indicate the specification or provide sufficient information to permit servicing staff to determine which specification is applicable. Where neither is indicated, operators should ensure that the servicing staff, whether their own or an agent's, follow a procedure that will ensure that the required specification is correctly established.
3. To avoid incorrect identification of the fluid available, the following should be observed:
   (a) Containers and dispensing apparatus should be clearly marked with the identity of the fluid.
   (b) If a 'used' container has to be re-used to contain a fluid other than that corresponding to the original identification, then, the identification should be removed or permanently obscured and the identification of the new fluid be clearly marked on the container.
   (c) Fluids should only be obtained from sources whose integrity in respect of the contents of a container, is beyond doubt.
4. Additionally hazards apply when servicing fluids are carried on board the aircraft and used to replenish systems when transiting overseas stations. Where foreign handling agents are used, language problems may compound potential problems. Operators should ensure that:
   (a) Ideally all fluids are in sealed manufacturer's cans.
   (b) Purpose-designed stowages are provided for each fluid type, arranged where possible, to give physical separation between different types.
   (c) The stowages are clearly identified as to the contents and that these markings correspond to those on the aircraft filler points.
   (d) Procedures on use and replacement are contained in an appropriate company manual.
   (e) Scheduled checks are made to check the identity and stowage of on-board fluids.

Appendix 6- INSPECTION IN RELATION TO SPILLAGE OR COLLECTION OF FLUID

1. Fluid spillage and accumulation of fluids resulting from inadequate drainage can cause serious corrosion in aircraft structures, and can affect the correct operation of electrical control and distribution service Since the type and extent of corrosion or other damage will depend on the type of fluid, it is important for the fluid to be identified and the extent of contamination assessed, so that corrective action may be taken.
2. In some instances the fact that fluids had been present may not have been appreciated because the affected areas had been cleaned out before being seen by an inspector. If fluid spillage or accumulation of fluids are reported or found these should be made known to an inspector before the area is cleaned. Accidental fluid spillage, which is known to have occurred during flight, should be recorded in the technical log, and particular attention should be paid to the regions below the floor when inspecting for the effects of such spillage.
3. Cleanliness of the aircraft internal structure is also important because dirt and dust may act as a sponge and retain fluids, thus increasing the risk of corrosion.
4. To prevent corrosion, it is essential to ensure the proper functioning of drains and drain holes. Inspectors should be aware of all the drainage means in the areas for which they are responsible and should check that these are free from obstruction.

Appendix 7- FOREIGN OBJECTS AND LOOSE ARTCLES - DANGER OF JAMMING

1. Jamming of aircraft flight control systems by foreign objects and loose articles such as those identified below continues to be a major threat to aircraft safety. Approved Organizations, Aircraft Owners and Licensed Aircraft Engineers must remain alert to the hazards of entrapment of such items and ensure that adequate precautions are taken to prevent items falling or being left in critical areas. Good design, high standards of cleanliness and the implementation of standard practices can reduce the risks of such incidents. However, the awareness of personnel involved in all aspects of aircraft operation is one of the most important elements in preventing such potentially dangerous incidents.
2. As the presence of foreign objects and loose articles can cause jamming or restriction of engine and flight control systems, organizations involved in the manufacture, operation and maintenance of aircraft, should establish standard practices to address foreign object and loose article control. Such practices should require personnel to check that all equipment, tools, rags or any loose objects/articles, which could impede the free

movement and safe operation of a system(s), have been removed and that the system(s) and installation in the work area are clean and unobstructed.

3. In particular maintenance personnel are the front line of defence against such problems. As such they should remain vigilant of the need to remove foreign objects and loose articles during and after any scheduled or non-scheduled maintenance. Consideration should also be given to the potential to introduce loose articles into control systems from adjoining structure e.g. loose or incorrectly torque fasteners. While a structure may remain safe with one fastener missing, the aircraft safety may be severely compromised if that fastener jams a control system.

Note: The Duplicate Inspection is intended to ensure the correct operation and assembly of controls, it will not prevent loose articles or foreign objects from becoming a hazard to their continued safe operation. Some of the reported incidents are:

(a) Throttle movement found to be stiff due to a broken plastic spoon, lodged between throttle levers and adjacent components in throttle pedestal.

(b) A bolt lodged between a flying control hydraulic-booster jack and its chasis.

(c) Hydraulic fluid top-up cans and meal trays fouling primary control runs.

(d) A spare control rod left in a fin by the constructor, causing intermittent jamming of rudder and not found during twelve months of operation.

(e) A nut left on a control chain adjacent to the sprocket, causing the chain to fail and jamming one flap surface.

(f) A ring spanner which had remained undiscovered for two and a half years in a wing bay which had been opened several times for control systems inspection.

(g) An incorrectly fitted screw on a fin leading edge which rolled across the top of the fin and jammed the elevator during the take off climb.

(h) A rudder pedal control jammed during taxi checks due to a coat hanger in a foot well.

(i) An investigation of an accident involving a jammed elevator, found numerous foreign objects which potentially may have restricted control system movement.

Appendix 8- BRAKE AND ANTI - SKID SYSTEMS

1. Instances have occurred in which wheel brake systems incorporating anti-skid protection have not functioned in a fully effective manner. Subsequently, in most instances, a fault has been discovered in the braking system, which has prevented the brakes from operating efficiently on all wheels. Loss of efficiency can result from a variety of causes, e.g. incorrect assembly or failure of components, in either an electrical or hydro mechanical antiskid system. In one instance a cross connection of units in combination with a dormant fault contributed to an accident.

2. Experience has shown that dormant faults, which reduce the maximum energy absorption

capability for the brakes, can exist without being detected during normal energy stops. These only become apparent when the full effectiveness of the brakes is called into use such as during rejected take-off. In order, therefore, to guard against such troubles, it will be necessary to institute checks, at agreed periodic intervals and also after any disturbance or replacement of the brake or parts of the anti-skid system, to ensure that:

(a) operation of each anti-skid sensor controls the brake on the wheel with which is associated,

(b) operation of the whole braking system, including anti-skid, is normal and satisfactory.

3. If functional checks carried out in accordance with the relevant maintenance manuals would not achieve the objectives stated in 2(a) and (b), the aircraft constructor should be consulted in order to agree to suitable amendments to the manuals to include tests which will verify the functional integrity of the system.
4. Additionally, operators having maintenance schedules approved by the DCA should review these schedules, and if necessary forward suitable amendments which will ensure that functional checks prescribed in the schedule will cover the particular matters stated in 2(a) and (b), and that any necessary cross references to the maintenance manual are amended or added.
5. In the event of difficulty in obtaining agreement with constructors, the Airworthiness Section should be consulted.

Appendix 9- INSPECTION OF CRITICAL PARTS OF HELICOPTER GEARBOXES

1. A fatal accident to a helicopter was caused by break-up of the main gearbox. The break-up was caused by fatigue failure of a planetary gear which was initiated by craze cracking as a result of overheating.
2. There was no evidence of the overheating having occurred since the previous inspection of the gearbox, at which, however, copper dust contamination was found, and the planetary gear spacer washers were found to be worn below the minimum allowable thickness and were replaced. Although it is presumed that they may have been present, no signs of overheating or craze cracking of the planetary gears were found during the visual inspection made at the time.
3. The importance of determining the condition of highly stressed critical parts, particularly where unusual wear or failure of an adjacent part has occurred, is emphasized. Crack detection techniques and visual examination using high magnification, may reveal damage not discernible by the naked eye, and should be used in such cases.

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Appendix 10 - UNAUTHORISED ALTERATION OF PARTS

1. Fatal accidents to civil aircraft have occurred after the unauthorized alteration of parts in such a way as to enable their incorrect assembly and functioning. No part which could affect the safety of an aircraft may be altered other than in accordance with drawings or instructions from the constructor or an appropriately approved organization.
2. In the assembly of all parts, particularly when any change which could affect interchangeability has been made, care must be taken to ensure that the correct part for the particular purpose is fitted, that it is fitted correctly, the right way round and, if a working part, that it, and the system of which it is a part, works in the correct sense and throughout the correct range.
3. No alteration may be made to nullify a feature provided to prevent wrong assembly.

Appendix 11 - MAINTENANCE OF RADIO NAVIGATION EQUIPMENT COURSE AND ALARM SIGNAL CURRENT LIMITS

1. Following an aircraft accident, it is understood that investigation of the ILS Localizer and Glide Path systems revealed that the signal current settings were set too high. This could result both in the course indicator being over-sensitive and in the flag warnings failing to appear in fault conditions.
2. Engineers must ensure that the instructions contained in the relevant maintenance/ overhaul manuals are complied with, particularly those applicable to course deviation and alarm current settings.
3. Prior to installation in any aircraft, engineers must ensure that the current settings of units are compatible with the particular aircraft system.
4. Any adjustments found necessary must only be carried out in a workshop where the necessary test equipment and maintenance/overhaul manuals are available and by approved persons.
5. Most ramp test equipment, whilst capable of checking alarm circuits for some gross failures, is inadequate for checking their operation in other important cases. In particular, it will not reveal whether current settings are such as to prejudice proper flag operation.
6. It is good practice, which the DCA will expect operators and maintenance organizations to implement, that all units incorporating adjustments for variable loads, whether in aircraft or held as spares, have a label indicating the loads for which the unit has been adjusted fixed in a prominent position on the front of the unit. Aircraft using such units should have a similar label fixed to the unit mounting.

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Appendix 12- BONDING OF STROBE LIGHTS

1. An explosion, followed by a fire, occurred on an American light aircraft prior to take-off. This was caused by the ignition of spilt fuel by an electrical spark at an incorrectly bonded strobe light fitting.
2. Since this hazard could develop during service on any aircraft to which strobe lights are fitted, the attention of owners and operators is drawn to the need to ensure that such strobe light units are correctly bonded, as outlined in paragraphs 3, 4 and 5.
3. For all aircraft, it is recommended that all strobe lights installed in areas which may be subjected to either spilt or vented fuel, or to high concentrations of fuel vapour, should be inspected to ensure that a positive bond, not greater than 0.05ohm resistance, is provided between the airframe and light housing. The inspection and any necessary rectification action should be carried out as soon as is practical, but in any event not later than the next scheduled airframe maintenance inspection.
4. Wherever practical the bond should be a short, flexible, metal strap, attached between the light housing and the aircraft local structure, and with clean metal-to-metal contacts. After completion, the bonding attachments and surrounding areas should be adequately protected against corrosion.
5. Where the form of bonding described in paragraph 4 is impractical, a good metal-to-metal contact between the light housing and the aircraft structure, must be ensured. This contact area must be clean, and free from paint, dirt or corrosion.
6. The recommendations of this Notice are applicable to strobe lights which are fitted either during the initial build of the aircraft, or by subsequent modification action.

Appendix 13 – SECURITY OF RE-FUELLING POINT CAPS

1. An incident has occurred in which over wing fuel leakage occurred during flight, and an adjacent engine was shut down to minimize fire risk.
2. Subsequent investigation showed that on completion of re-fuelling the over wing re-fuelling point cap has been fitted with the retention chain trapped between the cap and the re-fuelling point sealing ring, thereby creating a gap through which fuel was drawn by airflow over the wing during flight.
3. Unless care is taken to ensure that the chain is not trapped when refitting re-fuelling point caps, the caps can be installed in the apparently secure and locked position, and yet be potentially hazardous.
4. It is essential that persons engaged on and responsible for, re-fuelling aircraft should ensure that re-fuelling point caps are correctly re-fitted.
5. Persons responsible for authorizing others to refit re-fuelling point caps must ensure that such persons are aware of the correct procedure, and will avoid the hazards resulting from non-compliance.

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Appendix 14- EMERGENCY ESCAPE PROVISIONS - DOORS AND ESCAPE CHUTES

1. During an emergency evacuation following a collision on the ground, considerable difficulty was experienced in opening two of the aircraft doors and in deploying the associated inflatable escape chutes. Subsequent investigation showed that the difficulty was caused by inorrect stowage of the chutes and their release aprons, and, in the case of one door, by the fitment of an incorrect part. Enquiries have revealed that similar difficulties have also been experienced on various types of aircraft.
2. In addition to routine inspection, it is normal practice to remove inflatable chutes from aircraft at intervals of approximately 18 months and to inflate and check them. However, it is now known that this procedure does not give an indication of any deterioration of the installation, which could result in an inability to open the door or to deploy and inflate the chute. Such deterioration has been shown to be the more common cause of failure in the past. It is considered, therefore, that rather than the removal of chutes from the aircraft, they should be tested by opening the door with the chutes in the "armed" condition, and checking that they deploy and inflate correctly. It is appreciated that this alone will not guarantee correct future operation of all chutes on any particular aircraft, but it will provide a running check on the adequacy of chute and door operation.
3. For all aircraft fitted with inflatable escape chutes which are automatically deployed by the opening of doors, each chute/door combination on the aircraft shall be tested by the automatic release and inflation of the chute at intervals not exceeding 18 months. The testing should be continued until a satisfactory standard of reliability is achieved, after which progressive reduction in the testing, on a sampling basis could be applied, in consultation with the DCA. In order not to lose valuable experience, it is desirable that the release should be made by cabin staff.
4. Where release and inflation tests, on a sampling basis, are already being performed as part of an agreed maintenance reliability programme, the program of tests may continue, provided that on each aircraft type the sample is such that 10 or 10% whichever is the greater, of all the exits in the fleet at which automatically deployed inflatable chutes are installed, will have been tested within an elapsed period of not more than 2 years. The sampling may continue to be random but must be such as to ensure a reasonably uniform distribution of the exits on that aircraft type.
5. In addition to any prescribed mandatory defect reporting, a record should be kept of failure of doors to open or chutes to deploy and inflate, and should be made available to the DCA on request.
6. Operators shall forward to the DCA amendments to their approved maintenance schedules such as will take account of the tests required under paragraph 3 of this Notice.

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Appendix 15- SELF-LOCKING FASTENERS

1. Past incidents on helicopters have highlighted a continuing hazard where self-locking fasteners on control system linkages have become detached, allowing control linkages to separate. Similar instances have been recorded on fixed-wing aircraft.
2. Maintenance personnel are reminded that careful attention must be given to the security and tightness of all self-locking fasteners on control system linkages, and to such fasteners used to secure components which are frequently removed.
3. In every case the manufacturer's guidance should be adhered to in relation to the use and reuse of self-locking fasteners. Such fasteners must not be re-used unless the user is satisfied that the self-locking characteristics have not deteriorated. Where no guidance is available from the manufacturer, it is recommended that the advice not to re-use certain fasteners should be followed.

Appendix 16- GROUND HANDLING OF TRANSPORT AIRCRAFT

1. In recent years there have been a number of occurrences involving nose undercarriage failure in the older types of transport aircraft. These failures can be attributed, at least in part, to loads induced during towing or push-back. Such loads have, in a number of cases, resulted in the initiation of fatigue cracking, leading to subsequent failure under operational loads.
2. Aircraft constructors specify suitable ground handling equipment, compatible with the aircraft type, designed to avoid overloading e.g. employing shear pins which fail at predetermined loads. However, it is possible to induce overloading by rapid acceleration or braking, especially when employing large powerful tractors to move the smaller types of aircraft. Furthermore, certain maneuvers now commonly employed such as push-back were not anticipated in the design of some older aircraft.
3. Operators, especially those of the older types of aircraft, should ensure that the correct ground handling equipment is always employed that it is adequately and regularly maintained, and that particular care is taken when using large powerful tractors. Also operators should check with the constructor that their ground handling procedures are compatible with the aircraft design.

Appendix 17- ELECTRICAL POWER SUPPLIES – LIGHT AIRCRAFT, CARE AND MAINTENANCE

1. Investigations into incidents involving total loss of electrical power supplies on light aircraft have shown that insufficient care was taken in the maintenance of the major components of the electrical system.
2. It would appear that not everybody is sufficiently aware that a single fault, of a single fault

plus a dormant fault, may cause the loss of electrical supplies. For example:

(a) If the battery becomes disconnected from a generation system using "commercial" type alternations and result in the aircraft becoming electrically "dead".

(b) On a twin-engine aircraft a slack drive belt may operate quite adequately when both generators/ alternators are sharing the load, but may slip should the other generator fail, with the resultant loss of output from both; leaving the electrical supplies dependent on the battery. On a single-engine aircraft the belt may slip with increasing electrical load on the system with similar results.

(c) Faults in the load-sharing system may affect both generators, possibly to such an extent as to result in the loss of output from them both,

3. While there are, obviously, many other faults, which may result in generation system failures, these examples are quoted since they have occur a number of times in service.

4. It is useful to remember that should both generators fail and difficulty be experienced in resetting, it may be possible to reset one of them by reducing the electrical load to a minimum. Having reset one, it is advisable not to attempt to reset the other since this may cause permanent loss of the output of both.

5. The attention of owners and operators is drawn to the necessity for ensuring that the following items are checked periodically:

(a) The battery and its control relay must be correctly installed, and the battery terminals must be free from corrosion and correctly tightened.

(b) Voltage settings and load-sharing adjustment (where applicable) must be correct.

(c) All cable connections must be secure with locking devices in place and with end fittings showing no signs of fatigue fracture or corrosion. Earth connections are equally as important as the positive connections.

(d) Drive belts for generators must be checked to ensure that they are in good condition and correctly tensioned.

6. It is recommended that these checks should be carried out approximately every 100 FH or three months whichever is the sooner. The appropriate maintenance schedules should be reviewed and where necessary adjusted to take account of these recommendations.

7. The operation of the appropriate indicators and failure warning device should be checked daily or during the pre-flight drill.

8. Whilst the DCA considers that to require mandatory modification action is not justified and that the situation should be contained by the diligent application of maintenance procedures, owners and operators may nevertheless wish to consider modifications to improve the reliability of their own particular aircraft by, for example, the introduction of an emergency battery to act as a power source for vital services should the main system fail.

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Appendix 18 - PAINTING OF AIRCRAFT

Incidents have been reported of damage to aircraft structure and equipment as a result of the use of unsuitable materials and techniques during paint stripping and re-painting operations. Damage and potential hazards can arise from such reasons as:

(a) Use of incorrect stripping agents resulting in damage to non-metallic structural materials, sealants and transparencies.

(b) Ingress of stripping agents affecting internal protective treatments.

(c) Contamination of systems such as pivot/static and fuel venting.

(d) Restriction of movement between adjacent parts because of paint build-up.

(e) Weight of finish affecting control surface balance.

(f) Removal of lubricant as a result of the washing action of cleaning agents.

(g) Incomplete removal of masking and blanking material after painting.

(h) Aircraft weight and centre of gravity may be significantly affected by a strip and re-paint. Painting of aircraft shall be performed by authorized persons using approved or recommended data or instructions.

Appendix 19- TYRE MAINTENANCE AND RELIABILITY

1. Multiple tyre failures have become more significant with the growth in aircraft size and weight and have resulted in serious accidents and incidents. Inadequate maintenance of tyres directly affects their performance and reliability. This is particularly so for the high pressure and/or high speed rating tyres, i.e. marked in excess of 160mph, used on multi-wheel landing gear.
2. A marked reduction or loss of inflation of one tyre can, through over-deflection, result in the failure of other tyres on the same axle, or in marked reduction in its own ability to carry the increased load after another tyre failure. The risk of such failures is likely to be greater during take-off when wheel loads and/or speeds are highest or during extended taxiing. Braking performance may also be affected to the extent that stopping distances are increased or the remaining effective brakes are over-heated. Tyre and wheel debris may damage hydraulic and anti-skid systems. One large aircraft was completely destroyed by fire and other serious fires have occurred. In some accidents, aircraft have left the runway during rejected take -offs associated with tyre problems during the take-off run.
3. Adequate inflation pressure levels and leakage checks are necessary if adequate tyre performance is to be achieved. The maximum permissible inflation pressure improves a tyre's capability to sustain abnormal loads. Tyre pressures should be accurately checked on at least a daily basis; visual inspection is totally inadequate. Tyres should be inspected for external condition at every available opportunity bearing in mind that fitted stationary tyres cannot be entirely inspected.

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4. Tyre removal criteria should be adhered to, and particular attention should be paid to tyres which have been over-deflected or under-inflated or subjected to excessive brake heat.
5. The possibility of tyre carcass and tread failures which may damage structure, systems and engines and thus jeopardize safety can be directly reduced by timely attention to, and adequate maintenance of, tyre and wheel assemblies.

Appendix 20- STOWAGE AND ACCESSIBILITY OF LIFEJACKETS

1. An enquiry into an accident to a UK passenger transport aircraft revealed that some passengers experienced difficulty in obtaining the valise containing the lifejacket (hereinafter referred to as the "valise") which was stowed underneath their seat. Subsequent investigation showed that because the stowage pouch, in which the valise was retained, was not positioned close to the front edge of the seat pan, difficulty arose for some passengers in locating and releasing the valise.
2. Attention of operators and manufacturers is drawn to the need for careful interpretation of the requirements of accessibility of safety equipment as they relate to the occupants of aircraft, and particularly passengers , having ready and easy access to the valise during all phases of the flight. These requirements apply not only to the initial certification of the aeroplane type but also to modifications to seats, seating arrangements, and equipment stowage arrangements.
3. Interpretation of the requirement for ease of accessibility will in most installation necessitate the valises, when stowed under seats, being located near to the front edge of the seat pan, arranged so as to allow the occupant of the seat readily to remove the valise from the stowage pouch, which may be two handed operation, in the shortest possible time. The method for removing the valise from the stowage pouch should, therefore not necessitate any extensive body movement by a seated passenger with safety belt fastened. Furthermore, the possibility of the valise being ejected or falling from its stowage pouch onto the cabin floor either during normal operation or in an emergency should be minimal.

Appendix 21- THE USE AND INTERPRETATION OF UNFAMILAR UNITS

1. A degree of uncertainty evidently arose when an area was expressed using the symbol "mm^2" to expressed the concept of a square millimeter. This usage is similar to that, in Imperial Units, of "in^2" to represent square inches (or "sq in").
2 Figure 1, illustrates the unit of area of one square inch, or 1 in^2" (cross-hatched). An area of two square inches is shown, occupying twice the area. A two inch square, i.e. a square of sides of 2 inches, clearly occupies four times the area of 4 $in^{2.}$ Figure 2 similarly illustrates the unit of area of one square millimeter, or 1 mm^2, and as an example, an area of 50 square millimeters (i.e. 50 mm^2, in that case a rectangle 5 mm by 10 mm). Once again this is quite different from the area of a 50mm square, which is 50 times greater.

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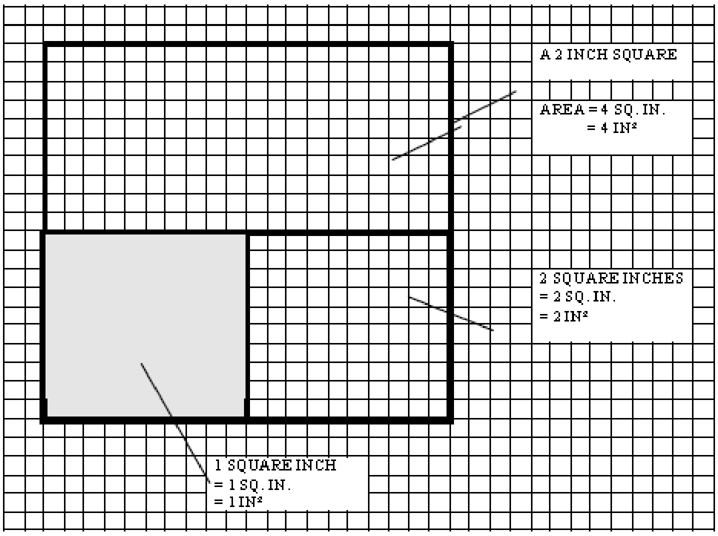

Figure 1

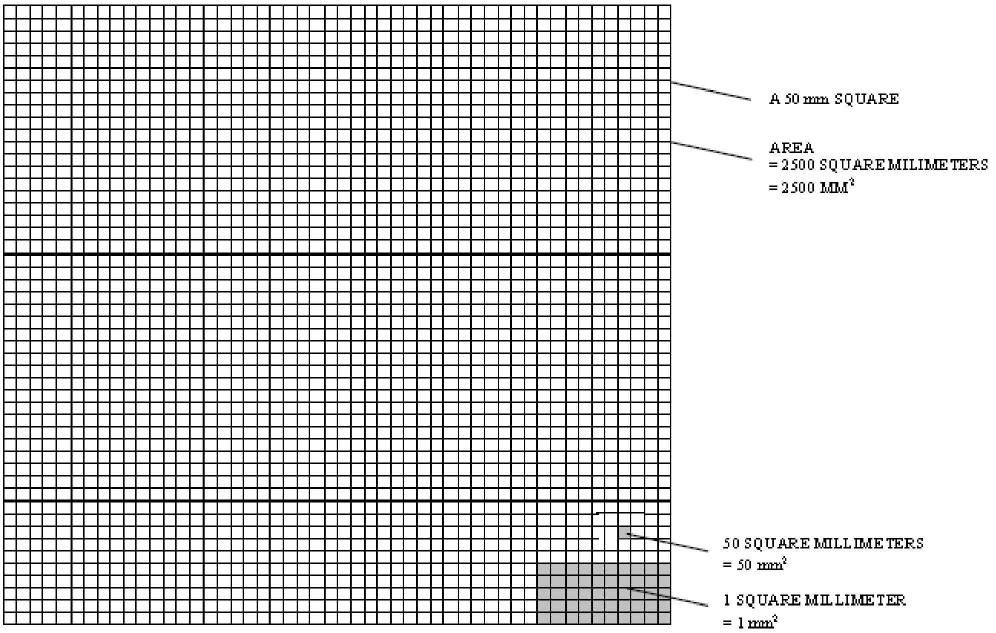

Figure 2

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Appendix 22- ELECTRICAL CABLE FAILURE

In a well-documented occurrence, damage to the insulation of electrical cables, caused by defective circuit identification printing, was contributory factor to a significant aircraft electrical system fault in flight. The incorrect application of hot stamp printing resulted in excessive penetration of insulation and a group of individual cable damage sites coincided physically in a loom. Fluid from a leaking toilet waste system contaminated the cables on the damaged area and severe electrical arcing occurred which was of sufficient intensity to rupture the damaged cables and also others in close proximity.

In addition to avoiding damage to cables during installation, modification or repair activity, there is a need for vigilance in the following areas:

(a) Fluid contamination of electrical equipment is obviously to be avoided but it is particularly necessary to appreciate that certain contaminants, notably that from toilet waste systems (which is saline) and fluids which contain sugar, such as sweetened drinks, can induce electrical tracking of components, degraded electrical cables being an example.

(b) Cable looms are particularly vulnerable to liquid contamination because they can provide a drainage path. Care should be taken to route cables away from known areas of possible leakage but, should contamination occur, cable looms must be thoroughly cleaned and dried and nay unsealed electrical items removed to workshops for examination.

(c) In areas where it is not possible to provide segregation between electrical cables and pipes which carry fluid, it is good design practice to keep pipe joints to an unavoidable minimum. The fitment of drip shields or drained enclosures to joints in liquid waste systems is recommended.

(d) The DCA will pay additional attention to the quality control of hot stamp printing applied by cable users and will expect to see appropriate testing of cables after printing. The preferred method of ensuring that the insulation of printed cable has not been degraded is to employ a High Voltage Test using one of the systems defined in British Standard G 230 Test 16. Continuous testing is not required provided an adequate sample is tested whenever any machine setting is altered, including changes of alphanumeric characters.

(e) It is important to note that hot stamp printing may only be applied onto cable types and sizes which have been certified as capable of accepting such marking. Cable manufacturers will be able to advise on suitable test and inspection methods.

Personnel engaged in servicing of aircraft are reminded that the discovery of a potentially hazardous failure condition during maintenance of fault finding may well justify the raising of a Mandatory Defect Report. In the context of this Appendix, any unexplained degradation of cable insulation would warrant such a report. Physical evidence should be retained for investigation.

Appendix 23- HYDRAULIC FLUID CONTAMINATION

1. A shut off valve, integral with a flying control actuator, jammed due to internal corrosion and could not function correctly causing an accident to a large helicopter. The corrosion had been induced by chlorine contamination of the hydraulic fluid.
2. Whilst manufacturer's publications and accepted maintenance practices have always stressed the need for scrupulous cleanliness when dealing with hydraulic components, there has been little emphasis on the potential hazards which may result from the vulnerability of both phosphate ester and mineral based hydraulic fluids to contamination by cleaning solvents or water.
3. Cleaning fluids in general contain or are based on chlorinated solvents. These solvents or their residue can combine with excessive amounts of water which are often found in hydraulic systems to form hydrochloric acid. This acid will attack internal metallic surfaces in a system, particularly ferrous materials, and produce rust-like corrosion. Such corrosion is virtually impossible to stop and component overhaul and thorough system decontamination is usually necessary to restore the system to serviceable condition.
4. Residual contamination by chlorinated solvents during hydraulic system maintenance or component overhaul must be prevented. When chlorinated solvents are used, care should be taken to ensure that all surfaces, including connectors associated with hydraulic test rigs or ground power supply sources are free from residual solvent before assembly or connection to the aircraft system.
5. All overhaul agencies and maintenance personnel must be alert to this significant but obscure hazard and are advised to review their maintenance procedures to ensure that chlorinated solvents cannot get into hydraulic systems or components.
6. In some fluids an excess of water may, even in the absence of chlorine contamination, result in a built-up of acidity, or the formation of gelatinous deposits which can clog filter elements and small passageways. Therefore, hydraulic fluid in aircraft systems test rigs should be periodically checked for total acidity and water content to ensure these parameters remain within the appropriate aircraft manufacturer's recommended limits.