INTERNATIONAL STANDARDS

AIRWORTHINESS OF AIRCRAFT

ANNEX 8

TO THE CONVENTION ON INTERNATIONAL CIVIL AVIATION

EIGHTH EDITION — JULY 1988

This edition incorporates all amendments adopted by the Council prior to 23 March 1995 and supersedes, on 22 March 1991, all previous editions of Annex 8.

For information regarding the applicability of the Standards *see* section 2 of Part II and 1.1 of Part III, and the Foreword.

INTERNATIONAL CIVIL AVIATION ORGANIZATION

AMENDMENTS

The issue of amendments is announced regularly in the *ICAO Journal* and in the monthly *Supplement to the Catalogue of ICAO Publications and Audio-visual Training Aids*, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date entered	Entered by
1-95	Incorporated in this edition		
96	10/11/94	—	ICAO
97	6/11/97; 12/3/2000	—	ICAO

CORRIGENDA			
No.	Date of issue	Date entered	Entered by

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FOREWORD

Historical Background

Standards and Recommended Practices for the Airworthiness of Aircraft were adopted by the Council on 1 March 1949 pursuant to the provisions of Article 37 of the Convention on International Civil Aviation (Chicago 1944) and designated as Annex 8 to the Convention.

The Annex contained, in Part II, general airworthiness procedures applicable to all aircraft and in Part III, minimum airworthiness characteristics for aeroplanes provided, or to be provided, with certificates of airworthiness classifying them in an established ICAO category. Part I contained definitions.

At its fourth session, the Airworthiness Division collaborating with the Operations Division made recommendations concerning the use of a performance code as an alternative to the one contained in the Annex, in which the climb values had the status of Recommended Practices. Further, the Airworthiness Division made recommendations concerning certain aspects of the certification in ICAO categories. As a result of those recommendations, the Council approved the incorporation of the alternative performance code as Attachment A, but stated its belief that since agreement had not yet been reached upon Standards covering performance, there existed no basis for certification in ICAO Category A. It urged the Contracting States to refrain from such certification pending the becoming effective of Standards on performance or until such time as the Council decides on the basic policy on airworthiness.

The Assembly at its seventh session (June 1953) endorsed the action already taken by the Council and the Air Navigation Commission to initiate a fundamental study of ICAO policy on international airworthiness and directed the Council to complete the study as rapidly as practicable.

In pursuing such study the Air Navigation Commission was helped by an international body of experts designated as the "Airworthiness Panel", which contributed to the preparation of the work of the Third Air Navigation Conference.

As a result of these studies a revised policy on international airworthiness was developed and it was approved by the Council in 1956. According to this policy the principle of certification in an ICAO Category was abandoned. Instead, Annex 8 included broad Standards which defined, for application by the competent national authorities, the complete minimum international basis for the recognition by States of certificates of airworthiness for the purpose of the flight of aircraft of other States into or over their territories, thereby achieving, among other purposes, protection of other aircraft, third persons and property. It was considered that this met the obligation of the Organization under Article 37 of the Convention to adopt International Standards of airworthiness.

It was recognized that the ICAO Standards of airworthiness would not replace national regulations and that national codes of airworthiness containing the full scope and extent of detail considered necessary by individual States would be necessary as the basis for the certification of individual aircraft. Each State would establish its own comprehensive and detailed code of airworthiness, or would select a comprehensive and detailed code established by another Contracting State. The level of airworthiness defined by this code would be indicated by the Standards, supplemented, if necessary, by Acceptable Means of Compliance.

In application of those principles, the Annex was declared as constituting the minimum standards for the purpose of Article 33. It was also recognized that the Annex might, at the time of adoption, not include technical Standards for all classes of aircraft or even for all classes of aeroplanes, if the Council felt that no technical Standards were required at that time to render Article 33 operative. Furthermore, adoption or amendment of the Annex declared to be complete for the purpose of Article 33 did not constitute the end of ICAO's work in the airworthiness field, as there was a need to continue international collaboration in airworthiness matters.

A revised text for Annex 8 consistent with the above principles was prepared on the basis of the recommendations made by the Third Air Navigation Conference (Montreal, September-October 1956). Part III of the Annex was limited to broad Standards stating the objectives rather than the methods of realizing those objectives. However, to indicate by examples the level of airworthiness intended by some of the broad Standards, specifications of a more detailed and quantitative nature were included under the title "Acceptable Means of Compliance". These specifications were intended to assist the Contracting States in the establishment and application of comprehensive and detailed national airworthiness codes.

To adopt a code giving an appreciably lower level of airworthiness than that given in an Acceptable Means of

Compliance was considered to be a violation of the Standard supplemented by that Acceptable Means of Compliance.

The revised text for Annex 8 was included in the Fourth Edition of the Annex, which superseded the First, Second and Third Editions.

Another recommendation of the Third Air Navigation Conference led to the establishment by the Council in 1957 of the Airworthiness Committee, consisting of airworthiness experts with broad experience and selected from those Contracting States and International Organizations willing to contribute.

Present policy on international airworthiness. There had been some concern about the slow progress that had been made over the years with respect to developing supplementary airworthiness specifications in the form of Acceptable means of Compliance. It was noted that the majority of the Acceptable Means of Compliance in Annex 8 had been developed in 1957 and were therefore applicable to only those aeroplane types operating at that time. No effort had been made to update the specifications in these Acceptable Means of Compliance nor had there been any recommendations from the Airworthiness Committee for upgrading of any of the Provisional Acceptable Means of Compliance, which had been developed as potential material for full-fledged Acceptable Means of Compliance. The Air Navigation Commission therefore requested the Airworthiness Committee to review the progress made by it since its inception with a view to determining whether or not desired results had been achieved and to recommend any changes to improve the development of detailed airworthiness specifications.

The Airworthiness Committee at its Ninth Meeting (Montreal, November/December 1970) made a detailed study of the problems and recommended that the concept of developing airworthiness specifications in the form of Acceptable Means of Compliance and Provisional Acceptable Means of Compliance should be abandoned and a provision should be made for an airworthiness technical manual to be prepared and published by ICAO to include guidance material intended to facilitate the development and uniformity of national airworthiness codes by Contracting States.

The Air Navigation Commission reviewed the recommendations of the Airworthiness Committee in the light of the history of the development of the airworthiness policy approved by the Council in 1956. It came to the conclusion that the basic objectives and principles on which the ICAO airworthiness policy had been based were sound and did not require any significant change. It was also concluded that the main reason for the slow progress in the development of airworthiness specifications in the form of Acceptable Means of Compliance and Provisional Acceptable Means of Compliance was the degree of mandatory status to the former implied by the following statement included in the Forewords of the Fourth and Fifth Editions of Annex 8:

> "To adopt a code giving an appreciably lower level of airworthiness than that given in an Acceptable Means of Compliance would be a violation of the Standard supplemented by that Acceptable Means of Compliance."

Several approaches were examined by the Air Navigation Commission to eliminate this difficulty. Finally it came to the conclusion that the idea of developing airworthiness specifications in the form of Acceptable Means of Compliance and Provisional Acceptable Means of Compliance should be abandoned and ICAO should declare that the States' obligations, for the purpose of Article 33 of the Convention, shall be met by their compliance with the broad Standards in Annex 8 supplemented, as necessary, by airworthiness technical guidance material, devoid of all mandatory implications or obligations. Also the requirement that each Contracting State should either establish its own comprehensive and detailed code of airworthiness or select a comprehensive and detailed code established by another Contracting State, should be retained.

The Council on 15 March 1972 approved the above approach to form the basis for the present policy of ICAO in the field of airworthiness. According to this policy:

a) the objective of international airworthiness Standards is to define, for application by the competent national authorities, the minimum level of airworthiness constituting the international basis for the recognition by States under Article 33 of the Convention, of certificates of airworthiness for the purpose of the flight of aircraft of other States into or over their territories thereby achieving, among other things, protection of other aircraft, third parties and property;

b) the Standards developed to meet the objective stated in a) above are considered by the Council as meeting, in the necessary scope and detail, the obligations of the Organization under Article 37 of the Convention to adopt International Standards of airworthiness;

c) international airworthiness Standards adopted by the Council are recognized as being the complete international code necessary to bring into force and effect the rights and obligations which arise under Article 33 of the Convention;

d) the technical airworthiness Standards in Annex 8 shall be presented as broad specifications stating the objectives rather than the means of realizing these objectives; ICAO recognizes that national codes of airworthiness containing the full scope and extent of detail considered

necessary by individual States are required as the basis for the certification by individual States of airworthiness of each aircraft;

e) to assist States in applying the Standards of Annex 8 and in developing their own comprehensive national codes in a uniform manner, detailed guidance material shall be developed and published expeditiously in the working languages of the Organization.

The Council also approved the issuance of the airworthiness guidance material under the title of "Airworthiness Technical Manual". It was understood that the guidance material will, before issuance, be examined by the Air Navigation Commission. It will however have no formal status and its main purpose would be to provide guidance to Contracting States in developing the detailed national airworthiness codes mentioned in 2.2 of Part II of the Annex.

A text for Annex 8 consistent with the policy on international airworthiness approved by the Council on 15 March 1972, was developed by the Air Navigation Commission.

Table A shows the origin of amendments together with a list of the principal subjects involved and the dates on which the Annex and the amendments were adopted by the Council, when they became effective and when they became applicable.

Applicability

The applicability of the Standards is indicated in section 2 of Part II and in 1.1 of Part III. The dates were established so as to take account of the provisions of Article 41 of the Convention. However, the Council has recommended that, as far as practicable, earlier dates be applied (see the Note under 1.1.2 of Part III).

Related Standards of Annex 6, Part I. Chapter 5 of Annex 6, Part I dealing with aeroplane performance operating limitations contains Standards that are complementary to the airworthiness Standards of Annex 8. Both state broad objectives. The Standards of Annex 6, Part I, Chapter 5, are supplemented by guidance material in the form of green page attachments which indicate by examples the level of performance intended by the Standards.

The Council has urged Contracting States not to impose on visiting aeroplanes operational requirements other than those established by the State of Registry, provided those requirements are not lower than the Standards of Chapter 5 of Annex 6, Part I, as amended by Amendment 2 and 2.2 of Part III of this edition of Annex 8.

Action by Contracting States

Notification of differences. The attention of Contracting States is drawn to the obligation imposed by Article 38 of the Convention by which Contracting States are required to notify the Organization of any differences between their national regulations and practices and the International Standards contained in this Annex and any amendments thereto. Contracting States are invited to keep the Organization currently informed of any differences which may subsequently occur, or of the withdrawal of any differences previously notified. A specific request for notification of differences will be sent to Contracting States immediately after the adoption of each Amendment to this Annex.

Use of the text of the Annex in national regulations. The Council, on 13 April 1948, adopted a resolution inviting the attention of Contracting States to the desirability of using in their own national regulations, as far as practicable, the precise language of those ICAO Standards that are of a regulatory character and also of indicating departures from the Standards, including any additional regulations that are important for the safety or regularity of air navigation. Wherever possible, the provisions of Part II of this Annex have been written in such a way as would facilitate incorporation, without major textual changes, into national legislation. The provisions of Part III of this Annex, on the other hand, are applicable to aeroplanes through the medium of national codes more comprehensive and detailed than the Standards, so that the Council's Resolution of 13 April 1948 does not apply to Part III.

Information concerning the national codes establishing compliance with the Annex. States are invited to notify the Organization either of the establishment or of the selection of the comprehensive and detailed national codes mentioned in 2.2 of Part II. States that establish such codes are invited to forward a copy of each with its successive amendments, and any appropriate interpretation document concerning them. States that select codes of other Contracting States to comply with 2.2 of Part II are invited to indicate the codes that they intend to use.

Use of the guidance material in the Airworthiness Technical Manual. Contracting States are invited to note that the material in the *Airworthiness Technical Manual* is intended to guide them in the development of their detailed and comprehensive national codes with a view to introducing uniformity in those national codes. The material has no mandatory status and Contracting States are quite free to differ from it either in detail or in methods. States are also not required to notify any differences that may exist between their detailed national regulations and practices and the relevant material in the *Airworthiness Technical Manual*.

General Information

An Annex is made up of the following component parts, not all of which, however, are necessarily found in every Annex; they have the status indicated.

1.— *Material comprising the Annex proper*

a) Standards and Recommended Practices adopted by the Council under the provisions of the Convention. They are defined as follows:

Standard: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38.

Recommended Practice: Any specification for physical characteristics, configuration, matériel, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention.

b) *Appendices* comprising material grouped separately for convenience but forming part of the Standards and Recommended Practices adopted by the Council.

c) *Provisions* governing the applicability of the Standards and Recommended Practices.

d) *Definitions* of terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted dictionary meanings. A definition does not have an independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

2.— *Material approved by the Council for publication in association with the Standards and Recommended Practices*

a) *Forewords* comprising historical and explanatory material based on the action of the Council and including an explanation of the obligations of States with regard to the application of the Standards and Recommended Practices ensuing from the Convention and the Resolution of Adoption.

b) *Introductions* comprising explanatory material introduced at the beginning of parts, chapters or sections of the Annex to assist in the understanding of the application of the text.

c) *Notes* included in the text, where appropriate, to give factual information or references bearing on the Standards or Recommended Practices in question, but not constituting part of the Standards or Recommended Practices.

d) *Attachments* comprising material supplementary to the Standards and Recommended Practices, or included as a guide to their application.

Selection of language

This Annex has been adopted in four languages — English, French, Russian and Spanish. Each Contracting State is requested to select one of those texts for the purpose of national implementation and for other effects provided for in the Convention, either through direct use or through translation into its own national language, and to notify the Organization accordingly.

Editorial practice

The following practice has been adhered to in order to indicate at a glance the status of each statement: *Standards* have been printed in light face roman; *Notes* have been printed in light face italics, the status being indicated by the prefix *Note*. There are no *Recommended Practices* in Annex 8.

In accordance with Annex 5, the International System of Units (SI) is used throughout this document.

Any reference to a portion of this document which is identified by a number includes all subdivisions of the portion.

Table A. Amendments to Annex 8

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted Effective Applicable*
1st Edition	First and Second Sessions of the Airworthiness Division (1946 and 1947)	—	1 March 1949 1 August 1949 1 September 1949
1 to 63 (2nd Edition)	Third and Fourth Sessions of the Airworthiness Division (1949 and 1951)	—	26 January 1950 1 January 1951 1 February 1951
64 to 83	Third and Fourth Sessions of the Airworthiness Division (1949 and 1951)	—	13 November 1951 15 April 1952 15 May 1952
84 (3rd Edition)	Fourth Session of the Airworthiness Division (1951)	Incorporation of an alternative performance code as an attachment.	2 December 1952 1 May 1953 1 June 1953
85 (4th Edition)	Third Air Navigation Conference (1956)	Revised text consistent with new policy on international airworthiness approved by the Council; Part III of Annex 8 limited to broad Standards stating objectives with more detailed examples of the level of airworthiness intended being included as "Acceptable Means of Compliance".	13 June 1957 1 October 1957 1 December 1957 or 13 June 1960 depending on date of application for certification for the aeroplane
86 (5th Edition)	Fourth Meeting of the Airworthiness Committee	Amendment of Standards for navigation lights and introduction of requirements for anti-collision lights.	13 December 1961 1 April 1962 13 December 1964
87	Proposal of the United States Committee on the Extension to the Standard Atmosphere	Redefinition of the standard atmosphere.	12 November 1963 1 April 1964 12 November 1966
88	Consequence of Amendment 2 to Annex 7	Revised definition of aircraft; revision of 2.2.3.2 b) of Part III to cater for 3-engined aeroplanes.	8 November 1967 8 March 1968 22 August 1968
89	Consequence of the adoption of Annex 16	Introduction of a reference to noise certification Standards in Annex 16 and Annex 6.	2 April 1971 2 August 1971 6 January 1972
90	Ninth Meeting of the Airworthiness Committee (1970)	Deletion of two Acceptable Means of Compliance for aeroplane performance from the 5th Edition.	10 December 1971 10 April 1972 7 December 1972
91 (6th Edition)	Council action following Ninth Airworthiness Committee	New text consistent with revised policy on airworthiness; deletion of Acceptable Means of Compliance; guidance material henceforth to appear in the *Airworthiness Technical Manual*.	16 March 1973 30 July 1973 23 May 1974
92	Tenth Meeting of the Airworthiness Committee	Introduction of provisions relating to the transmission of continuing airworthiness information; addition of a note concerning lease, charter and interchange of aircraft.	3 April 1974 3 August 1974 27 February 1975
93	Study by the Air Navigation Commission	Revision of the provisions relating to exterior lights to align with new provisions in Annexes 2 and 6.	22 March 1982 22 July 1982 22 March 1985

Amendment(s)	*Source(s)*	*Subject(s)*	*Adopted* *Effective* *Applicable*
94 (7th Edition)	Fourteenth Meeting of the Airworthiness Committee (1981)	Introduction of a new provision relating to information on faults, malfunctions, defects and other occurrences and to include SI units in conformity with Annex 5 provisions.	6 December 1982 6 April 1983 24 November 1983
95 (8th Edition)	Proposal of States; Studies by the Council and Air Navigation Commission; Third Meeting of the HELIOPS Panel	Extension of the standard atmosphere; strengthened provisions relating to crash survival and fire protection; introduction of airworthiness provisions for helicopters.	22 March 1988 31 July 1988 22 March 1991
96	Third meeting of the Continuing Airworthiness Panel (CAP/3)	Introduction of responsibilities of State of Design and definition thereof; revision of responsibilities of parties involved in transfer of information relating to continuing airworthiness; addition of new requirements concerning provision of maintenance information.	22 March 1994 25 July 1994 10 November 1994
97	Secretariat study, assisted by ISAD Study Group	Changes to design features; identification of a least-risk bomb location and addition of a new Chapter 11 containing security-related provisions.	12 March 1997 21 July 1997 6 November 1997; 12 March 2000

INTERNATIONAL STANDARDS

PART I. DEFINITIONS

When the following terms are used in the Standards for the Airworthiness of Aircraft, they have the following meanings:

Aeroplane. A power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight.

Aircraft. Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

Anticipated operating conditions. Those conditions which are known from experience or which can be reasonably envisaged to occur during the operational life of the aircraft taking into account the operations for which the aircraft is made eligible, the conditions so considered being relative to the meteorological state of the atmosphere, to the configuration of terrain, to the functioning of the aircraft, to the efficiency of personnel and to all the factors affecting safety in flight. Anticipated operating conditions do not include:

a) those extremes which can be effectively avoided by means of operating procedures; and

b) those extremes which occur so infrequently that to require the Standards to be met in such extremes would give a higher level of airworthiness than experience has shown to be necessary and practical.

Appropriate airworthiness requirement. The comprehensive and detailed airworthiness codes established by a Contracting State for the class of aircraft under consideration. (*See* 2.2 of Part II of this Annex.)

Approved. Accepted by a Contracting State as suitable for a particular purpose.

Configuration (as applied to the aeroplane). A particular combination of the positions of the moveable elements, such as wing flaps, landing gear, etc., which affect the aerodynamic characteristics of the aeroplane.

Critical power-unit(s). The power-unit(s) failure of which gives the most adverse effect on the aircraft characteristics relative to the case under consideration.

Design landing mass. The maximum mass of the aircraft at which, for structural design purposes, it is assumed that it will be planned to land.

Design take-off mass. The maximum mass at which the aircraft, for structural design purposes, is assumed to be planned to be at the start of the take-off run.

Design taxiing mass. The maximum mass of the aircraft at which structural provision is made for load liable to occur during use of the aircraft on the ground prior to the start of take-off.

Factor of safety. A design factor used to provide for the possibility of loads greater than those assumed, and for uncertainties in design and fabrication.

Final approach and take-off area (FATO). A defined area over which the final phase of the approach manoeuvre to hover or landing is completed and from which the take-off manoeuvre is commenced. Where the FATO is to be used by performance Class 1 helicopters, the defined area includes the rejected take-off area available.

Helicopter. A heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

Landing surface. That part of the surface of an aerodrome which the aerodrome authority has declared available for the normal ground or water run of aircraft landing in a particular direction.

Limit loads. The maximum loads assumed to occur in the anticipated operating conditions.

Load factor. The ratio of a specified load to the weight of the aircraft, the former being expressed in terms of aerodynamic forces, inertia forces, or ground reactions.

Performance Class 1 helicopter. A helicopter with performance such that, in case of engine failure, it is able to land on the rejected take-off area or safely continue the flight to an appropriate landing area.

Performance Class 2 helicopter. A helicopter with performance such that, in case of engine failure, it is able to safely continue the flight, except when the failure occurs

prior to a defined point after take-off or after a defined point before landing, in which cases a forced landing may be required.

Performance Class 3 helicopter. A helicopter with performance such that, in case of engine failure at any point in the flight profile, a forced landing must be performed.

Power-unit. A system of one or more engines and ancillary parts which are together necessary to provide thrust, independently of the continued operation of any other power-unit(s), but not including short period thrust-producing devices.

Pressure-altitude. An atmospheric pressure expressed in terms of altitude which corresponds to that pressure in the standard atmosphere.

Rendering (a Certificate of Airworthiness) valid. The action taken by a Contracting State, as an alternative to issuing its own Certificate of Airworthiness, in accepting a Certificate of Airworthiness issued by any other Contracting State as the equivalent of its own Certificate of Airworthiness.

Standard atmosphere. An atmosphere defined as follows:

a) the air is a perfect dry gas;

b) the physical constants are:

— Sea level mean molar mass:
$M_0 = 28.964420 \times 10^{-3}$ kg mol^{-1}
— Sea level atmospheric pressure:
$P_0 = 1013.250$ hPa
— Sea level temperature:
$t_0 = 15°C$
$T_0 = 288.15$ K
— Sea level atmospheric density:
$\rho_0 = 1.2250$ kg m^{-3}
— Temperature of the ice point:
$T_i = 273.15$ K
— Universal gas constant:
$R^* = 8.31432$ JK^{-1}mol^{-1}

c) the temperature gradients are:

Geopotential altitude (km)		*Temperature gradient (Kelvin per standard geopotential kilometre)*
From	*To*	
–5.0	11.0	–6.5
11.0	20.0	0.0
20.0	32.0	+1.0
32.0	47.0	+2.8
47.0	51.0	0.0
51.0	71.0	–2.8
71.0	80.0	–2.0

Note 1.— The standard geopotential metre has the value 9.80665 $m^2 s^{-2}$.

Note 2.— See Doc 7488 for the relationship between the variables and for tables giving the corresponding values of temperature, pressure, density and geopotential.

Note 3.— Doc 7488 also gives the specific weight, dynamic viscosity, kinematic viscosity and speed of sound at various altitudes.

State of Design. The State having jurisdiction over the organization responsible for the type design.

State of Manufacture. The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

State of Registry. The State on whose register the aircraft is entered.

Take-off surface. That part of the surface of an aerodrome which the aerodrome authority has declared available for the normal ground or water run of aircraft taking off in a particular direction.

Ultimate load. The limit load multiplied by the appropriate factor of safety.

PART II. ADMINISTRATION

Note.— Although the Convention on International Civil Aviation allocates to the State of Registry certain functions which that State is entitled to discharge, or obligated to discharge, as the case may be, the Assembly recognized, in Resolution A23-13, that the State of Registry may be unable to fulfil its responsibilities adequately in instances where aircraft are leased, chartered or interchanged — in particular without crew — by an operator of another State and that the Convention may not adequately specify the rights and obligations of the State of an operator in such instances until such time as Article 83 bis of the Convention enters into force. Accordingly, the Council urged that if, in the above-mentioned instances, the State of Registry finds itself unable to discharge adequately the functions allocated to it by the Convention, it delegate to the State of the operator, subject to acceptance by the latter State, those functions of the State of Registry that can more adequately be discharged by the State of the Operator. It is understood that pending entry into force of Article 83 bis of the Convention the foregoing action will only be a matter of practical convenience and will not affect either the provisions of the Chicago Convention prescribing the duties of the State of Registry or any third State.

1. CERTIFICATE OF AIRWORTHINESS

Note.— Certificate of Airworthiness as used in these Standards, is the Certificate of Airworthiness referred to in Article 31 of the Convention.

2. APPLICABILITY

2.1 The Standards of Part II are applicable as follows:

a) sections 4, 5 and 6 in respect of all aircraft, beginning 1 December 1957; and

b) sections 3, 7 and 8 and paragraph 2.2 in respect of all aircraft that are of types of which the prototype is submitted to appropriate national authorities for certification on or after 13 June 1960.

Note.— The applicability of the Standards in other parts of this Annex is stated in those parts.

2.2 A Contracting State shall not issue or render valid a Certificate of Airworthiness for which it intends to claim recognition pursuant to Article 33 of the Convention on International Civil Aviation, unless the aircraft complies with a comprehensive and detailed national airworthiness code established for that class of aircraft by the State of Registry or by any other Contracting State. This national code shall be such that compliance with it will ensure compliance with:

a) the Standards of Part II of this Annex; and

b) where applicable, with the Standards of Part III or Part IV of this Annex.

Where the design features of a particular aircraft render any of the Standards in Part III or Part IV inapplicable or inadequate, variations therefrom that are considered by the State of Registry to give at least an equivalent level of safety may be made.

Note.— An Airworthiness Technical Manual *(Doc 9051) containing guidance material has been published by ICAO. See the Foreword.*

3. PROOF OF COMPLIANCE WITH APPROPRIATE AIRWORTHINESS REQUIREMENTS

3.1 The Certificate of Airworthiness shall be issued by the Contracting State which approves the aircraft or by its authorized representatives on the basis of satisfactory evidence that the aircraft complies with the appropriate airworthiness requirements. Except when Certificates of Airworthiness are issued in accordance with 3.2, that State, or its authorized representatives, shall obtain such evidence in the manner prescribed in 3.1.1, 3.1.2 and 3.1.3.

3.1.1 There shall be an approved design consisting of such drawings, specifications, reports and documentary evidence as are necessary to show that the aircraft complies with the appropriate airworthiness requirements. Records shall be maintained to establish the identification of the aircraft with its approved design.

3.1.2 During the course of construction, the aircraft shall be inspected in accordance with a system of inspection approved by the State, to determine that it conforms in all essential respects with the approved design, and that its construction and assembly are satisfactory.

3.1.3 The aircraft shall be subjected to such flight tests as are deemed necessary by the State to show compliance with the appropriate airworthiness requirements.

3.2 When an aircraft possessing a valid Certificate of Airworthiness issued by a Contracting State is entered on the register of another Contracting State, the new State of Registry, when issuing another Certificate of Airworthiness or rendering the original certificate valid, may consider prior issuance of the Certificate of Airworthiness by a Contracting State as satisfactory evidence, in whole or in part, that the aircraft is airworthy and need not follow the procedure prescribed in 3.1.1, 3.1.2 and 3.1.3.

Note.— This applies both when the aircraft is registered for the first time and when the aircraft changes its nationality.

3.3 Contracting States, in addition to determining compliance with the appropriate airworthiness requirements for an aircraft, shall take whatever other steps they deem necessary to ensure that the Certificate of Airworthiness is withheld if the aircraft is known or suspected to have dangerous features not specifically guarded against by those requirements.

4. CONTINUING AIRWORTHINESS OF AIRCRAFT

4.1 Determination of continuing airworthiness

a) The continuing airworthiness of an aircraft shall be determined by the State of Registry in relation to the appropriate airworthiness requirements in force for that aircraft.

b) The State of Registry shall develop or adopt requirements to ensure the continued airworthiness of the aircraft during its service life.

Note 1.— These requirements will also cover maintenance requirements of Annex 6.

Note 2.— Guidance on continuing airworthiness requirements is contained in the Continuing Airworthiness Manual.

4.2 Information related to continuing airworthiness of aircraft

4.2.1 When a Contracting State first enters on its register an aircraft of a particular type for which it is not the State of Design and issues or validates a Certificate of Airworthiness in accordance with 2.2 of this Part, it shall advise the State of Design that it has entered such an aircraft on its register.

4.2.2 The State of Design of an aircraft shall transmit any generally applicable information which it has found necessary for the continuing airworthiness of the aircraft and for the safe operation of the aircraft (hereinafter called mandatory continuing airworthiness information) as follows:

a) to every Contracting State which has in accordance with 4.2.1 advised the State of Design that it has entered the aircraft on its register; and

b) to any other Contracting State upon request.

Note 1.— In 4.2, the term "mandatory continuing airworthiness information" is intended to include mandatory requirements for modification, replacement of parts or inspection of aircraft and amendment of operating limitations and procedures. Among such information is that issued by Contracting States in the form of airworthiness directives.

Note 2.— ICAO Circular 95 — The Continuing Airworthiness of Aircraft in Service *— provides the necessary information to assist Contracting States in establishing contact with competent authorities of other Contracting States, for the purpose of maintaining continuing airworthiness of aircraft in service.*

4.2.3 The State of Registry shall, upon receipt of mandatory continuing airworthiness information from the State of Design, adopt the mandatory information directly or assess the information received and take appropriate action.

4.2.4 Any Contracting State which has entered on its register an aircraft in respect of which that Contracting State is not the State of Design and for which it has issued or validated a Certificate of Airworthiness in accordance with 2.2 of this Part, shall ensure the transmission to the State of Design of all mandatory continuing airworthiness information originated in respect of that aircraft in the former Contracting State.

4.2.5 The State of Registry shall ensure that in respect of aircraft of over 5 700 kg maximum certificated take-off mass, there exists a system whereby information on faults, malfunctions, defects and other occurrences which cause or might cause adverse effects on the continuing airworthiness of the aircraft is transmitted to the organization responsible for the type design of that aircraft.

Note.— Guidance on interpretation of "the organization responsible for the type design" is contained in the Airworthiness Technical Manual (Doc 9051).

4.2.6 The State of Design shall ensure that, in respect of aircraft over 5 700 kg maximum certificated take-off mass, there exists a system for:

a) receiving information submitted in accordance with 4.2.5;

b) deciding if and when airworthiness action is needed;

c) developing the necessary airworthiness actions; and

d) promulgating the information on those actions including that required in 4.2.2.

4.2.7 The State of Design shall ensure that, in respect of aeroplanes over 5 700 kg maximum certificated take-off mass, there exists a continuing structural integrity programme to ensure the airworthiness of the aeroplane. The programme shall include specific information concerning corrosion prevention and control.

4.2.8 Each Contracting State shall establish, in respect of aircraft over 5 700 kg maximum certificated take-off mass, the type of service information that is to be reported to its airworthiness authority by operators, organizations responsible for type design and maintenance organizations. Procedures for reporting this information shall also be established.

4.2.9 Where the State of Manufacture of an aircraft is other than the State of Design there shall be an agreement acceptable to both States to ensure that the manufacturing organization co-operates with the organization responsible for the type design in assessing information received on experience with operating the aircraft.

5. VALIDITY OF CERTIFICATE OF AIRWORTHINESS

5.1 A Certificate of Airworthiness shall be renewed or shall remain valid, subject to the laws of the State of Registry, provided that the State of Registry shall require that the continuing airworthiness of the aircraft shall be determined by a periodical inspection at appropriate intervals having regard to lapse of time and type of service or, alternatively by means of a system of inspection, approved by the State, which will produce at least an equivalent result.

5.2 Method of rendering a Certificate of Airworthiness valid

When a State of Registry renders valid a Certificate of Airworthiness issued by another Contracting State, as an alternative to issuance of its own Certificate of Airworthiness, it shall establish validity by suitable authorization to be carried with the former Certificate of Airworthiness accepting it as the equivalent of the latter. The validity of the authorization shall not extend beyond the period of validity of the Certificate of Airworthiness, but whenever the period of validity of the Certificate of Airworthiness is renewed, the authorization may be renewed or another authorization issued by the State of Registry for a period corresponding to the period of validity of the Certificate of Airworthiness.

6. TEMPORARY LOSS OF AIRWORTHINESS

6.1 General

Any failure to maintain an aircraft in an airworthy condition as defined by the appropriate airworthiness requirements shall render the aircraft ineligible for operation until the aircraft is restored to an airworthy condition.

6.2 Damage to aircraft

When an aircraft has sustained damage, the State of Registry shall judge whether the damage is of a nature such that the aircraft is no longer airworthy as defined by the appropriate airworthiness requirements.

6.2.1 If the damage is sustained or ascertained when the aircraft is on the territory of another Contracting State, the authorities of the other Contracting State shall be entitled to prevent the aircraft from resuming its flight on the condition that they shall advise the State of Registry immediately, communicating to it all details necessary to formulate the judgement referred to in the introductory Standard of 6.2.

6.2.2 When the State of Registry considers that the damage sustained is of a nature such that the aircraft is no longer airworthy, it shall prohibit the aircraft from resuming flight until it is restored to an airworthy condition; the State of Registry may, however, in exceptional circumstances, prescribe particular limiting conditions to permit the aircraft to fly without fare-paying passengers to an aerodrome at which it can be restored to an airworthy condition, and the Contracting State that has originally, in accordance with 6.2.1, prevented the aircraft from resuming flights, shall permit such flight.

6.2.3 When the State of Registry considers that the damage sustained is of a nature such that the aircraft is still airworthy, the aircraft shall be allowed to resume its flight.

7. STANDARD FORM OF CERTIFICATE OF AIRWORTHINESS

The Certificate of Airworthiness shall contain the information indicated in the following form, and shall be generally similar to it (see Figure 1).

8. AIRCRAFT LIMITATIONS AND INFORMATION

Each aircraft shall be provided with a flight manual, placards, or other documents stating the approved limitations within which the aircraft is considered airworthy as defined by the appropriate airworthiness requirements, and additional instructions and information necessary for the safe operation of the aircraft.

*	*State of Registry* *Issuing Authority*	*

CERTIFICATE OF AIRWORTHINESS

1. Nationality and registration marks	2. Manufacturer and manufacturers' designation of aircraft	3. Aircraft serial number
. . . . .	. . . . .	. . . . .
. . . . .	. . . . .	. . . . .

4. Categories . . . . . .

5. This Certificate of Airworthiness is issued pursuant to the Convention on International Civil Aviation dated 7 December 1944 and †..... in respect of the above-mentioned aircraft which is considered to be airworthy when maintained and operated in accordance with the foregoing and the pertinent operating limitations.

Date of issue ..... Signature .....

† Insert reference to appropriate Airworthiness Code.

6. **

* For use of the State of Registry.

** This space shall be used either for periodic endorsement (giving date of expiry), or for a statement that the aircraft is being maintained under a system of continuous inspection.

Figure 1

PART III. AEROPLANES

CHAPTER 1. GENERAL

1.1 Applicability

1.1.1 The Standards of Part III, except for those specified in 8.4, are applicable in respect of all aeroplanes designated in 1.1.3, that are of types of which the prototype is submitted to the appropriate national authorities for certification on or after 13 June 1960.

1.1.2 The Standards specified in 8.4 of Part III are applicable in respect of all aeroplanes designated in 1.1.3 that are of types of which the prototype is submitted to the appropriate national authorities for certification on or after 22 March 1985.

Note.— The Council recognizes that the amended Standards relating to fire protection, crash survival and provisions for emergency are very important to safety and urges the implementation of the substance of these amended Standards, if feasible and practicable, before their applicability date of 22 March 1991.

1.1.3 The Standards of Part III shall apply to aeroplanes of over 5 700 kg maximum certificated take-off mass intended for the carriage of passengers or cargo or mail in international air navigation.

Note.— The following Standards do not include quantitative specifications comparable to those found in national airworthiness codes. In accordance with 2.2 of Part II, they are to be supplemented by national requirements prepared by Contracting States.

1.1.4 The level of airworthiness defined by the appropriate parts of the comprehensive and detailed national code referred to in 2.2 of Part II for the aeroplanes designated in 1.1.3 shall be at least substantially equivalent to the over-all level intended by the broad Standards of Part III.

1.1.5 Unless otherwise stated, the Standards apply to the complete aeroplane including power-units, systems and equipment.

1.2 Number of power-units

The aeroplane shall have not less than two power-units.

1.3 Limitations

1.3.1 Limiting conditions shall be established for the aeroplane, its power-units and its equipment (see 9.2). Compliance with the Standards of Part III shall be established assuming that the aeroplane is operated within the limitations specified. The limitations shall be sufficiently removed from any condition(s) prejudicial to the safety of the aeroplane to render the likelihood of accidents arising therefrom extremely remote.

1.3.2 Limiting ranges of mass, centre of gravity location, load distribution, speeds, and altitude or pressure-altitude shall be established within which compliance with all the pertinent Standards in Part III is shown, except that combinations of conditions which are fundamentally impossible to achieve need not be considered.

Note 1.— The maximum operating mass and centre of gravity limits may vary, for example, with each altitude and with each practicably separate operating condition, e.g. take-off, en route, landing.

Note 2.— The following items, for instance, may be considered as basic aeroplane limitations:

— maximum certificated take-off mass

— maximum certificated taxiing mass

— maximum certificated landing mass

— maximum certificated zero fuel mass

— most forward and rearward centre of gravity positions in various configurations (take-off, en route, landing).

Note 3.— Maximum operating mass may be limited by the application of Noise Certification Standards (see Annex 16 and Annex 6, Parts I and II).

1.4 Unsafe features and characteristics

The aeroplane shall not possess any feature or characteristic which renders it unsafe under the anticipated operating conditions.

1.5 Proof of compliance

1.5.1 Compliance with the appropriate airworthiness requirements shall be based on evidence either from tests, from calculations, or from calculations based on tests, provided that in each case the accuracy achieved will ensure a level of airworthiness equal to that which would be achieved were direct tests conducted.

1.5.2 The tests of 1.5.1 shall be such as to provide reasonable assurance that the aeroplane, its components, and equipment are reliable and function correctly under the anticipated operating conditions.

CHAPTER 2. FLIGHT

2.1 General

2.1.1 Compliance with the Standards prescribed in Chapter 2 shall be established by flight or other tests conducted upon an aeroplane or aeroplanes of the type for which a Certificate of Airworthiness is sought, or by calculations based on such tests, provided that the results obtained by calculations are equal in accuracy to, or conservatively represent, the results of direct testing.

2.1.2 Compliance with each Standard shall be established for all applicable combinations of aeroplane mass and centre of gravity position, within the range of loading conditions for which certification is sought.

2.1.3 Where necessary, appropriate aeroplane configurations shall be established for the determination of performance in the various stages of flight and for the investigation of the aeroplane's flying qualities.

2.2 Performance

2.2.1 General

2.2.1.1 Sufficient data on the performance of the aeroplane shall be determined and scheduled in the aeroplane flight manual to provide operators with the necessary information for the purpose of determining the total mass of the aeroplane on the basis of the values, peculiar to the proposed flight, of the relevant operational parameters, in order that the flight may be made with reasonable assurance that a safe minimum performance for that flight will be achieved.

2.2.1.2 The performance scheduled for the aeroplane shall not require exceptional skill or alertness on the part of the pilot.

2.2.1.3 The scheduled performance of the aeroplane shall be consistent with compliance with 1.3.1 and with the operation in logical combinations of those of the aeroplane's systems and equipment the operation of which may affect performance.

2.2.2 Minimum performance

At the maximum mass scheduled (see 2.2.3) for take-off and for landing as functions of the aerodrome elevation or pressure-altitude either in the standard atmosphere or in specified still air atmospheric conditions, and, for seaplanes, in specified conditions of smooth water, the aeroplane shall be capable of accomplishing the minimum performances specified in 2.2.2.1 and 2.2.2.2 respectively, not considering obstacles, or runway or water run length.

Note.— This Standard permits the maximum take-off mass and maximum landing mass to be scheduled in the aeroplane flight manual against, for example:

— aerodrome elevation, or

— pressure-altitude at aerodrome level, or

— pressure-altitude and atmospheric temperature at aerodrome level,

so as to be readily usable when applying the national code on aeroplane performance operating limitations.

2.2.2.1 *Take-off*

a) The aeroplane shall be capable of taking off assuming the critical power-unit to fail (see 2.2.3), the remaining power-units being operated within their take-off power limitations.

b) After the end of the period during which the take-off power may be used, the aeroplane shall be capable of continuing to climb, with the critical power-unit inoperative and the remaining power-units operated within their maximum continuous power limitations, up to a height that it can maintain and at which it can carry out a circuit of the aerodrome.

c) The minimum performance at all stages of take-off and climb shall be sufficient to ensure that under conditions of operation departing slightly from the idealized conditions for which data are scheduled (2.2.3), the departure from the scheduled values is not disproportionate.

2.2.2.2 *Landing*

a) Starting from the approach configuration and with the critical power-unit inoperative, the aeroplane shall be capable, in the event of a missed approach, of continuing the flight to a point from which a fresh approach can be made.

b) Starting from the landing configuration, the aeroplane shall be capable, in the event of a balked landing, of making a climb out, with all power-units operating.

2.2.3 Scheduling of performance

Performance data shall be determined and scheduled in the aeroplane flight manual so that their application by means of the operating rules to which the aeroplane is to be operated in accordance with 5.2 of Annex 6, Part I, will provide a safe relation between the performance of the aeroplane and the aerodromes and routes on which it is capable of being operated. Performance data shall be determined and scheduled for the following stages for the ranges of mass, altitude or pressure-altitude, wind velocity, gradient of the take-off and landing surface for landplanes, water surface conditions, density of water and strength of current for seaplanes, and for any other operational variables for which the aeroplane is to be certificated.

2.2.3.1 *Take-off.* The take-off performance data shall include the accelerate-stop distance and the take-off path.

2.2.3.1.1 *Accelerate-stop distance.* The accelerate-stop distance shall be the distance required to accelerate and stop, or, for a seaplane to accelerate and come to a satisfactorily low speed, assuming the critical power-unit to fail suddenly at a point not nearer to the start of the take-off than that assumed when determining the take-off path (see 2.2.3.1.2).

2.2.3.1.2 *Take-off path.* The take-off path shall comprise the ground or water run, initial climb and climb out, assuming the critical power-unit to fail suddenly during the take-off (see 2.2.3.1.1). The take-off path shall be scheduled up to a height that the aeroplane can maintain and at which it can carry out a circuit of the aerodrome. The climb out shall be made at a speed not less than the take-off safety speed as determined in accordance with 2.3.1.3.

2.2.3.2 *En route.* The en-route climb performance shall be the climb (or descent) performance with the aeroplane in the en-route configuration with:

a) the critical power-unit inoperative; and

b) the critical two power-units inoperative in the case of aeroplanes having three or more power-units.

The operating engines shall not exceed maximum continuous power.

2.2.3.3 *Landing.* The landing distance shall be the horizontal distance traversed by the aeroplane from a point on the approach flight path at a selected height above the landing surface to the point on the landing surface at which the aeroplane comes to a complete stop or, for a seaplane, comes to a satisfactorily low speed. The selected height above the landing surface and the approach speed shall be appropriately related to operating practices. This distance may be supplemented by such distance margin as may be necessary; if so, the selected height above the landing surface, the approach speed and the distance margin shall be appropriately interrelated and shall make provision for both normal operating practices and reasonable variations therefrom.

Note.— If the landing distance includes the distance margin specified in this Standard, it is not necessary to allow for the expected variations in the approach and landing techniques in applying 5.2.7.3 of Annex 6, Part I.

2.3 Flying qualities

The aeroplane shall comply with the Standards of 2.3 at all altitudes up to the maximum anticipated altitude relevant to the particular requirement in all temperature conditions relevant to the altitude in question and for which the aeroplane is approved.

2.3.1 Controllability

The aeroplane shall be controllable and manoeuvrable under all anticipated operating conditions and it shall be possible to make smooth transitions from one flight condition to another (e.g. turns, sideslips, changes of engine power, changes of aeroplane configurations) without requiring exceptional skill, alertness, or strength on the part of the pilot even in the event of failure of any power-unit. A technique for safely controlling the aeroplane shall be established for all stages of flight and aeroplane configurations for which performance is scheduled.

Note.— This Standard is intended, among other things, to relate to operation in conditions of no appreciable atmospheric turbulence and also to ensure that there is not undue deterioration of the flying qualities in turbulent air.

2.3.1.1 *Controllability on the ground (or water).* The aeroplane shall be controllable on the ground (or on the water) during taxiing, take-off, and landing under the anticipated operating conditions.

2.3.1.2 *Controllability during take-off.* The aeroplane shall be controllable in the event of sudden failure of the critical power-unit at any point in the take-off, when the aeroplane is handled in the manner associated with the scheduling of take-off paths and accelerate-stop distances.

2.3.1.3 *Take-off safety speed.* The take-off safety speeds assumed when the performance of the aeroplanes (after leaving the ground or water) during the take-off is determined shall provide an adequate margin above the stall and above the minimum speed at which the aeroplane remains controllable after sudden failure of the critical power-unit.

2.3.2 Trim

The aeroplane shall have such trim, and other characteristics as to ensure that the demands made on the pilot's attention and ability to maintain a desired flight condition are not excessive when account is taken of the stage of flight at which these demands occur and their duration. This shall apply both in normal operation and in the conditions associated with the failure of one or more power-units for which performance characteristics are established.

2.3.3 Stability

The aeroplane shall have such stability in relation to its other flight characteristics, performance, structural strength, and most probable operating conditions (e.g. aeroplane configurations and speed ranges) as to ensure that demands made on the pilot's powers of concentration are not excessive when the stage of the flight at which these demands occur and their duration are taken into account. The stability of the aeroplane shall not, however, be such that excessive demands are made on the pilot's strength or that the safety of the aeroplane is prejudiced by lack of manoeuvrability in emergency conditions.

2.3.4 Stalling

2.3.4.1 *Stall warning.* When the aeroplane is made to approach a stall both in straight and turning flight with all power-units operating and with one power-unit inoperative, clear and distinctive stall warning shall be apparent to the pilot with the aeroplane in all permissible configurations and powers, except those which are not considered to be essential for safe flying. The stall warning and other characteristics of the aeroplane shall be such as to enable the pilot to arrest the development of the stall after the warning begins and, without altering the engine power, to maintain full control of the aeroplane.

2.3.4.2 *Behaviour following a stall.* In any configuration and power in which it is considered that the ability to recover from a stall is essential the behaviour of the aeroplane following a stall shall not be so extreme as to make difficult a prompt recovery without exceeding the airspeed or strength limitations of the aeroplane. It shall be acceptable to throttle back the operating power-units during recovery from the stall.

2.3.4.3 *Stalling speeds.* The stalling speeds or minimum steady flight speeds in configurations appropriate for each stage of flight (e.g. take-off, en route, landing) shall be established. One of the values of the power used in establishing the stalling speeds shall be not more than that necessary to give zero thrust at a speed just above the stall.

2.3.5 Flutter and vibration

It shall be demonstrated by suitable tests that all parts of the aeroplane are free from flutter and excessive vibration in all aeroplane configurations under all speed conditions within the operating limitations of the aeroplane (see 1.3.2). There shall be no buffeting severe enough to interfere with control of the aeroplane, to cause structural damage or to cause excessive fatigue to the flight crew.

Note.— Buffeting as a stall warning is considered desirable and discouragement of this type of buffeting is not intended.

CHAPTER 3. STRUCTURES

3.1 General

The Standards of Chapter 3 apply to the aeroplane structure consisting of all portions of the aeroplane, the failure of which would seriously endanger the aeroplane.

3.1.1 Mass and mass distribution

Unless otherwise stated, all structural Standards shall be complied with when the mass is varied over the applicable range and is distributed in the most adverse manner, within the operating limitations on the basis of which certification is sought.

3.1.2 Limit loads

Except as might be otherwise qualified, the external loads and the corresponding inertia loads, or resisting loads obtained for the various loading conditions prescribed in 3.3, 3.4 and 3.5 shall be considered as limit loads.

3.1.3 Strength and deformation

In the various loading conditions prescribed in 3.3, 3.4 and 3.5 no part of the aeroplane structure shall sustain detrimental deformation at any load up to and including the limit load, and the aeroplane structure shall be capable of supporting the ultimate load.

3.2 Airspeeds

3.2.1 Design airspeeds

Design airspeeds shall be established for which the aeroplane structure is designed to withstand the corresponding manoeuvring and gust loads in accordance with 3.3. In establishing the design airspeeds, consideration shall be given to the following speeds:

a) V_A, the design manoeuvring speed;

b) V_B, the speed at which the maximum vertical gust velocity assumed in accordance with 3.3.2 can be withstood;

c) V_C, a speed not expected to be exceeded in normal cruising flight taking into account possible effects of upsets when flying in turbulent conditions;

d) V_D, maximum dive speed, sufficiently greater than the speed in c), to make it unlikely that such a design speed would be exceeded as a result of inadvertent speed increases in the anticipated operating conditions, taking into account the flying qualities and other characteristics of the aeroplane;

e) V_{E_1} to V_{E_n}, maximum speeds at which flaps and landing gears may be extended or other configuration changes be made.

The speeds V_A, V_B, V_C, and V_E in a), b), c) and e) shall be sufficiently greater than the stalling speed of the aeroplane to safeguard against loss of control in turbulent air.

3.2.2 Limiting airspeeds

Limiting airspeeds, based on the corresponding design airspeeds with safety margins, where appropriate, in accordance with 1.3.1 shall be included in the aeroplane flight manual as part of the operating limitations (see 9.2.2).

3.3 Flight loads

The flight loading conditions of 3.3.1, 3.3.2 and 3.5 shall be considered for the range of mass and mass distributions prescribed in 3.1.1 and at airspeeds established in accordance with 3.2.1. Asymmetrical as well as symmetrical loading shall be taken into account. The air, inertia, and other loads resulting from the specified loading conditions shall be distributed so as to approximate actual conditions closely or to represent them conservatively.

3.3.1 Manoeuvring loads

Manoeuvring loads shall be computed on the basis of manoeuvring load factors appropriate to the manoeuvres permitted by the operating limitations. They shall not be less than values which experience indicates will be adequate for the anticipated operating conditions.

3.3.2 Gust loads

Gust loads shall be computed for vertical and horizontal gust velocities and gradients which statistics or other evidence indicate will be adequate for the anticipated operating conditions.

3.4 Ground and water loads

The structure shall be able to withstand all the loads due to the reactions of the ground and water surface which are likely to arise during taxiing, take-off and landing.

3.4.1 Landing conditions

The landing conditions at the design take-off mass and at the design landing mass shall include such symmetrical and asymmetrical attitudes of the aeroplane at ground or water contact, such velocities of descent and such other factors, affecting the loads imposed upon the structure as might be present in the anticipated operating conditions.

3.5 Miscellaneous loads

In addition to or in conjunction with the manoeuvring and gust loads and with the ground and water loads, consideration shall be given to all other loads (flight control loads, cabin pressures, effects of engine operation, loads due to changes of configuration, etc.) which are likely to occur in the anticipated operating conditions.

3.6 Flutter, divergence and vibration

The aeroplane structure shall be designed to be free from flutter, structural divergence (i.e. unstable structural distortion due to aerodynamic loading), and loss of control due to structural deformation, at speeds within and sufficiently beyond the operating limitations to comply with 1.3.1. Adequate strength shall be provided to withstand the vibration and buffeting that might occur in the anticipated operating conditions.

3.7 Fatigue strength

The strength and fabrication of the aeroplane shall be such as to ensure that the probability of disastrous fatigue failure of the aeroplane's structure under repeated loads and vibratory loads in the anticipated operating conditions is extremely remote.

CHAPTER 4. DESIGN AND CONSTRUCTION

4.1 General

Details of design and construction shall be such as to give reasonable assurance that all aeroplane parts will function effectively and reliably in the anticipated operating conditions. They shall be based upon practices which experience has proven to be satisfactory or which are substantiated by special tests or by other appropriate investigations or both.

4.1.1 Substantiating tests

The functioning of all moving parts essential to the safe operation of the aeroplane shall be demonstrated by suitable tests in order to ensure that they will function correctly under all operating conditions for such parts.

4.1.2 Materials

All materials used in parts of the aeroplane essential for its safe operation shall conform to approved specifications. The approved specifications shall be such that materials accepted as complying with the specifications will have the essential properties assumed in the design.

4.1.3 Fabrication methods

The methods of fabrication and assembly shall be such as to produce a consistently sound structure which shall be reliable with respect to maintenance of strength in service.

4.1.4 Protection

The structure shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes, which could pass unnoticed, taking into account the maintenance the aeroplane will receive.

4.1.5 Inspection provisions

Adequate provision shall be made to permit any necessary examination, replacement, or reconditioning of parts of the aeroplane which require such attention, either periodically or after unusually severe operations.

4.1.6 Design features

Special consideration shall be given to design features which affect the ability of the flight crew to maintain controlled flight. This shall include at least the following:

a) *Controls and control systems.* The design of the controls and control systems shall be such as to minimize the possibility of jamming, inadvertent operations, and unintentional engagement of control surface locking devices.

b) *System survivability.* As of 12 March 2000, aeroplane systems shall be designed, arranged and physically separated to maximize the potential for continued safe flight and landing after any event resulting in damage to the aeroplane structure or systems.

c) *Crew environment.* The design of the flight crew compartment shall be such as to minimize the possibility of incorrect or restricted operation of the controls by the crew, due to fatigue, confusion or interference. Consideration shall be given at least to the following: layout and identification of controls and instruments, rapid identification of emergency situations, sense of controls, ventilation, heating and noise.

d) *Pilot vision.* The arrangement of the pilot compartment shall be such as to afford a sufficiently extensive, clear and undistorted field of vision for the safe operation of the aeroplane, and to prevent glare and reflections which would interfere with the pilot's vision. The design features of the pilot windshield shall permit under precipitation conditions sufficient vision for the normal conduct of flight and for the execution of approaches and landing.

e) *Provision for emergencies.* Means shall be provided which shall either automatically prevent or shall enable the flight crew to deal with emergencies resulting from foreseeable failures of equipment and systems the failure of which would endanger the aeroplane. Reasonable provisions shall be made for continuation of essential services following power-unit or system(s) failure(s) to the extent that such failure(s) are catered for in performance and operating limitations Standards in this Annex and in Annex 6, Parts I and II.

f) *Fire precautions.* The design of the aeroplane and the materials used in its manufacture including cabin interior furnishing materials replaced during major refurbishing shall be such as to minimize the possibility of in-flight and

ground fires and also to minimize the production of smoke and toxic gases in the event of a fire. Means shall be provided to contain or to detect and extinguish such fires as might occur in such a way that no additional danger to the aeroplane is caused.

g) *Fire suppression.* As of 12 March 2000, cargo compartment fire suppression systems, including their extinguishing agents, shall be designed so as to take into account a sudden and extensive fire such as could be caused by an explosive or incendiary device.

h) *Incapacitation of occupants.* Design precautions shall be taken to protect against possible instances of cabin depressurization and against the presence of smoke or other toxic gases, including, as of 12 March 2000, those caused by explosive or incendiary devices, which could incapacitate the occupants of the aeroplane.

i) *Protection of the flight crew compartment from smoke and fumes*. As of 12 March 2000, means shall be provided to minimize entry into the flight crew compartment of smoke, fumes and noxious vapours generated by an explosion or fire on the aeroplane.

4.1.7 Emergency landing provisions

4.1.7.1 Provisions shall be made in the design of the aeroplane to protect the occupants, in the event of an emergency landing, from fire and from the direct effects of deceleration forces as well as from injuries arising from the effect of deceleration forces on the aeroplane's interior equipment.

4.1.7.2 Facilities shall be provided for the rapid evacuation of the aeroplane in conditions likely to occur following an emergency landing. Such facilities shall be related to the passenger and crew capacity of the aeroplane.

4.1.7.3 The interior layout of the cabin and the position and number of emergency exits, including the means of locating and illuminating the escape paths and exits, shall be such as to facilitate rapid evacuation of the aeroplane in conditions likely to occur following an emergency landing.

4.1.7.4 On aeroplanes certificated for ditching conditions, provisions shall be made in the design to give maximum practicable assurance that safe evacuation from the aeroplane of passengers and crew can be executed in case of ditching.

4.1.8 Ground handling

Adequate provisions shall be made in the design to minimize the risk that ground handling operations (e.g. towing, jacking) may cause damage, which could pass unnoticed, to the parts of the aeroplane essential for its safe operation. The protection which any limitations and instructions for such operations might provide may be taken into account.

CHAPTER 5. ENGINES

5.1 Scope

The Standards of Chapter 5 shall apply to engines of all types which are used on the aeroplane as primary propulsion units.

5.2 Design, construction and functioning

The engine complete with accessories shall be designed and constructed so as to function reliably within its operating limitations under the anticipated operating conditions when properly installed in the aeroplane in accordance with Chapter 7 and, if applicable, fitted with a suitable propeller.

5.3 Declared ratings, conditions and limitations

The power ratings and the conditions of the atmosphere upon which they are based and all operating conditions and limitations, which are intended to govern the operation of the engine, shall be declared.

5.4 Tests

An engine of the type shall complete satisfactorily such tests as are necessary to verify the validity of the declared ratings conditions and limitations and to ensure that it will operate satisfactorily and reliably. The tests shall include at least the following:

a) *Power calibration.* Tests shall be conducted to establish the power or thrust characteristics of the engine when new and also after the tests in b) and c). There shall be no excessive decrease in power at the conclusion of all the tests specified.

b) *Operation.* Tests shall be conducted to ensure that starting, idling, acceleration, vibration, overspeeding and other characteristics are satisfactory and to demonstrate adequate margins of freedom from detonation, surge, or other detrimental conditions as may be appropriate to the particular type engine.

c) *Endurance.* Tests of sufficient duration shall be conducted at such powers, thrust, speeds and other operating conditions as are necessary to demonstrate reliability and durability of the engine. They shall also include operation under conditions in excess of the declared limits to the extent that such limitations might be exceeded in actual service.

CHAPTER 6. PROPELLERS

6.1 Scope

The Standards of Chapter 6 shall apply to propellers of all types.

6.2 Design, construction and functioning

The propeller assembly complete with accessories shall be designed and constructed so as to function reliably within its operating limitations under the anticipated operating conditions when properly fitted to the engine and installed in the aeroplane in accordance with Chapter 7.

6.3 Declared ratings, conditions and limitations

The power ratings and all operating conditions and limitations, which are intended to govern the operation of the propeller, shall be declared.

6.4 Tests

A propeller of the type shall complete satisfactorily such tests as are necessary to ensure that it will operate satisfactorily and reliably within the declared ratings, conditions and limitations. The texts shall include at least the following:

a) *Operation.* Tests shall be conducted to ensure that strength vibration and overspeeding characteristics are satisfactory and to demonstrate proper and reliable functioning of pitch changing and control mechanisms.

b) *Endurance.* Tests of sufficient duration shall be conducted at such powers, speeds and other operating conditions as are necessary to demonstrate reliability and durability of the propeller.

CHAPTER 7. POWERPLANT INSTALLATION

7.1 General

7.1.1 Applicable Standards

The powerplant installation shall comply with the Standards of Chapter 4 and with the Standards of this Chapter.

7.1.2 Compliance with engine and propeller limitations

The powerplant installation shall be so designed that the engines and propellers (if applicable) are capable of being used in the anticipated operating conditions. In conditions established in the aeroplane flight manual the aeroplane shall be capable of being operated without exceeding the limitations established for the engines and propellers in accordance with Chapters 5, 6 and 7.

7.1.3 Control of engine rotation

In those installations where continued rotation of an engine which had failed would increase the hazard of fire or of a serious structural failure, means shall be provided for the crew to stop the rotation of the engine in flight, or to reduce it to a safe level.

7.1.4 Engine restarting

Means shall be provided for restarting an engine at altitudes up to a declared maximum altitude.

7.2 Arrangement and functioning

7.2.1 Independence of power-units

The powerplant shall be arranged and installed so that each power-unit together with its associated systems is capable of being controlled and operated independently from the others and so that there is at least one arrangement of the powerplant and systems in which any failure, unless the probability of its occurrence is extremely remote, cannot result in a loss of more power than that resulting from complete failure of the critical power-unit.

7.2.2 Propeller vibration

The propeller vibration stresses shall be determined and shall not exceed values which have been found safe for operation within the operating limitations established for the aeroplane.

7.2.3 Cooling

The cooling system shall be capable of maintaining powerplant temperatures within the established limits (see 7.1.2) at ambient air temperatures up to the maximum air temperature appropriate to intended operation of the aeroplane. The maximum and, if necessary, minimum air temperature for which the powerplant has been established to be suitable shall be scheduled in the aeroplane flight manual.

7.2.4 Associated systems

The fuel, oil, air induction, and other systems associated with the powerplant, shall be capable of supplying each engine in accordance with its established requirements, under all conditions affecting the functioning of the systems (e.g. engine power, aeroplane attitudes and accelerations, atmospheric conditions, fluid temperatures) within the anticipated operating conditions.

7.2.5 Fire protection

For regions of the powerplant where the potential fire hazards are particularly serious because of the proximity of ignition sources to combustible materials, the following shall apply in addition to the general Standard of 4.1.6 e).

a) *Isolation.* Such regions shall be isolated by fire resisting material from other regions of the aeroplane where the presence of fire would jeopardize continued flight, taking into account the probable points of origin and paths of propagation of fire.

b) *Flammable fluids.* Flammable fluid system components located in such regions shall be capable of containing

the fluid when exposed to fire conditions. Means shall be provided for the crew to shut off the flow of flammable fluids into such regions if a fire occurs.

c) *Fire protection.* There shall be provided a sufficient number of fire detectors so located as to ensure rapid detection of any fire which might occur in such regions.

d) *Fire extinguishment.* Such regions shall be provided with a fire extinguisher system capable of extinguishing any fire likely to occur therein, unless the degree of isolation, quantity of combustibles, fire resistance of the structure, and other factors, is such that any fire likely to occur in the region would not jeopardize the safety of the aeroplane.

CHAPTER 8. INSTRUMENTS AND EQUIPMENT

8.1 Required instruments and equipment

The aeroplane shall be provided with approved instruments and equipment necessary for the safe operation of the aeroplane in the anticipated operating conditions. These shall include the instruments and equipment necessary to enable the crew to operate the aeroplane within its operating limitations.

Note.— Instruments and equipment additional to the minimum necessary for the issuance of a Certificate of Airworthiness are prescribed in Annex 6, Parts I and II, for particular circumstances or on particular kinds of routes.

8.2 Installation

Instrument and equipment installations shall comply with the Standards of Chapter 4.

8.3 Safety and survival equipment

Prescribed safety and survival equipment which the crew or passengers are expected to use or operate at the time of an emergency shall be reliable, readily accessible and easily identified, and its method of operation shall be plainly marked.

*8.4 Navigation lights and anti-collision lights

8.4.1 The lights required by Annex 2 to be displayed by aeroplanes in flight or operating on the movement area of an aerodrome shall have intensities, colours, fields of coverage and other characteristics such that they furnish the pilot of another aircraft or personnel on the ground with as much time as possible for interpretation and for subsequent manoeuvre necessary to avoid a collision. In the design of such lights due account shall be taken of the conditions under which they may reasonably be expected to perform these functions.

Note 1.— It is likely that lights will be viewed against a variety of backgrounds, such as typical city lighting, clear starry sky, moonlit water and daytime conditions of low background luminance. Furthermore, collision risk situations are most likely to arise in terminal control areas in which aircraft are manoeuvring in the intermediate and lower flight levels at closing speeds that are unlikely to exceed 900 km/h (500 kt).

Note 2.— See Part III of the Airworthiness Technical Manual *(Doc 9051) for detailed technical specifications for exterior lights for aeroplanes.*

8.4.2 Lights shall be installed in aeroplanes so as to minimize the possibility that they will:

a) adversely affect the satisfactory performance of the flight crews' duties; or

b) subject an outside observer to harmful dazzle.

Note.— In order to avoid the effects mentioned in 8.4.2, it will be necessary in some cases to provide means whereby the pilot can switch off or reduce the intensity of the flashing lights.

* Please refer to 1.1.2 of this Part.

CHAPTER 9. OPERATING LIMITATIONS AND INFORMATION

9.1 General

The operating limitations within which compliance with the Standards of this Annex is determined, together with any other information necessary to the safe operation of the aeroplane, shall be made available by means of an aeroplane flight manual, markings and placards, and such other means as may effectively accomplish the purpose. The limitations and information shall include at least those prescribed in 9.2, 9.3 and 9.4.

9.2 Operating limitations

Limitations which there is a risk of exceeding in flight and which are defined quantitatively shall be expressed in suitable units and corrected if necessary for errors in measurements so that the flight crew can, by reference to the instruments available to them, readily determine when the limitations are reached.

9.2.1 Loading limitations

The loading limitations shall include all limiting mass, centres of gravity position, mass distributions, and floor loadings (see 1.3.2).

9.2.2 Airspeed limitations

The airspeed limitations shall include all speeds (see 3.2) which are limiting from the standpoint of structural integrity or flying qualities of the aeroplane, or from other considerations. These speeds shall be identified with respect to the appropriate aeroplane configurations and other pertinent factors.

9.2.3 Powerplant limitations

The powerplant limitations shall include all those established for the various powerplant components as installed in the aeroplane (see 7.1.2 and 7.2.3).

9.2.4 Limitations on equipment and systems

The limitations on equipment and systems shall include all those established for the various equipment and systems as installed in the aeroplane.

9.2.5 Miscellaneous limitations

Any necessary limitations with respect to conditions found to be prejudicial to the safety of the aeroplane (see 1.3.1).

9.2.6 Flight crew limitations

The flight crew limitations shall include the minimum number of flight crew personnel necessary to operate the aeroplane, having regard among other things to the accessibility to the appropriate crew members of all necessary controls and instruments and to the execution of the established emergency procedures.

Note.— See Annex 6 — Operation of Aircraft, *Parts I and II, for the circumstances in which the flight crew shall include members in addition to the minimum flight crew defined in this Annex.*

9.2.7 Flying time limitation after system or power-unit failure

The systems limitations shall include the maximum flying time for which system reliability has been established in relation to the approval of operations by aeroplanes with two turbine power-units beyond the threshold time established in accordance with 4.7 of Annex 6, Part I.

Note.— The maximum time established in accordance with 4.7 of Annex 6, Part I for a particular route may be less than that determined in accordance with 9.2.7 because of the operational considerations involved.

9.3 Operating information and procedures

9.3.1 Types of eligible operations

There shall be listed the particular types of operations, as may be defined in Annex 6, Parts I and II, to the Convention or be generally recognized, for which the aeroplane has been shown to be eligible by virtue of compliance with the appropriate airworthiness requirements.

9.3.2 Loading information

The loading information shall include the empty mass of the aeroplane, together with a definition of the condition of the aeroplane at the time of weighing, the corresponding centre of gravity position, and the reference point(s) and datum line(s) to which the centre of gravity limits are related.

Note.— Usually the empty mass excludes the mass of the crew and payload, and the usable fuel supply and the drainable oil; it includes the mass of all fixed ballast, unusable fuel supply, undrainable oil, total quantity of engine coolant and total quantity of hydraulic fluid.

9.3.3 Operating procedures

A description shall be given of normal and emergency operating procedures which are peculiar to the particular aeroplane and necessary for its safe operation. These shall include procedures to be followed in the event of failure of one or more power-units.

9.3.4 Handling information

Sufficient information shall be given on any significant or unusual features of the aeroplane characteristics. Those stalling speeds or minimum steady flight speeds required to be established by 2.3.4.3 shall be scheduled.

9.3.5 Least-risk bomb location

A least-risk location on the aeroplane shall be identified where a bomb or other explosive device may be placed to minimize the effects on the aeroplane in the case of detonation.

9.4 Performance information

The performance of the aeroplane shall be scheduled in accordance with 2.2. There shall be included information regarding the various aeroplane configurations and powers involved and the relevant speeds, together with information which would assist the flight crew in attaining the performance as scheduled.

9.5 Aeroplane flight manual

An aeroplane flight manual shall be made available. It shall identify clearly the specific aeroplane or series of aeroplanes with which it is related. The aeroplane flight manual shall include at least the limitations, information and procedures specified in this chapter.

9.6 Markings and placards

9.6.1 Markings and placards on instruments, equipment, controls, etc., shall include such limitations or information as necessary for the direct attention of the flight crew during flight.

9.6.2 Markings and placards, or instructions, shall be provided to give any information which is essential to the ground crew in order to preclude the possibility of mistakes in ground servicing (e.g. towing, refuelling) which could pass unnoticed and which could jeopardize the safety of the aeroplane in subsequent flights.

CHAPTER 10. CONTINUING AIRWORTHINESS — MAINTENANCE INFORMATION

10.1 General

Information for use in developing procedures for maintaining the aeroplane in an airworthy condition shall be made available. The information shall include that described in 10.2, 10.3 and 10.4.

10.2 Maintenance information

Maintenance information shall include a description of the aeroplane and recommended methods for the accomplishment of maintenance tasks. Such information shall include guidance on defect diagnosis.

10.3 Maintenance programme information

Maintenance programme information shall include the maintenance tasks and the recommended intervals at which these tasks are to be performed.

10.4 Maintenance information resulting from the type design approval

Maintenance tasks and frequencies that have been specified as mandatory by the State of Design in approval of the type design shall be identified as such.

CHAPTER 11. SECURITY

11.1 Least-risk bomb location

As of 12 March 2000, consideration shall be given during the design of the aeroplane to the provision of a least-risk bomb location.

11.2 Protection of the flight crew compartment

As of 12 March 2000, in all aeroplanes which are equipped with a flight crew compartment door, this door and the flight crew compartment bulkhead shall be designed to minimize penetration by small arms fire and grenade shrapnel.

11.3 Interior design

As of 12 March 2000, consideration shall be given to design features which will deter the easy concealment of weapons, explosives or other dangerous objects on board aircraft and which will facilitate search procedures for such objects.

PART IV. HELICOPTERS

CHAPTER 1. GENERAL

1.1 Applicability

1.1.1 The Standards of Part IV are applicable in respect of all helicopters designated in 1.1.2, that are of types of which the prototype is submitted to the appropriate national authorities for certification on or after 22 March 1991.

Note.— The Council recognizes that the Standards relating to fire protection, crash survival and provisions for emergency are very important to safety and urges the implementation of the substance of these Standards as soon as it is feasible and practicable before the applicable date.

1.1.2 The Standards of Part IV shall apply to helicopters intended for the carriage of passengers or cargo or mail in international air navigation.

Note.— The following Standards do not include quantitative specifications comparable to those found in national airworthiness codes. In accordance with 2.2 of Part II, they are to be supplemented by national requirements prepared by Contracting States.

1.1.3 The level of airworthiness defined by the appropriate parts of the comprehensive and detailed national code referred to in 2.2 of Part II for the helicopters designated in 1.1.2 shall be at least substantially equivalent to the over-all level intended by the broad Standards of Part IV.

1.1.4 Unless otherwise stated, the Standards apply to the complete helicopter including power-units, systems and equipment.

1.2 Limitations

1.2.1 Limiting conditions shall be established for the helicopter, its power-unit(s) and its equipment (see 9.2). Compliance with the Standards of Part IV shall be established assuming that the helicopter is operated within the limitations specified. The limitations shall be sufficiently removed from any condition(s) prejudicial to the safety of the helicopter to render the likelihood of accidents arising therefrom extremely remote.

1.2.2 Limiting ranges of mass, centre of gravity location, load distribution, speeds and ambient conditions shall be established within which compliance with all the pertinent Standards in Part IV is shown, except that combinations of conditions which are fundamentally impossible to achieve need not be considered.

Note 1.— The maximum operating mass and centre of gravity limits may vary, for example, with each altitude and with each practicably separate operating condition, e.g. take-off, en route, landing.

Note 2.— The following items, for instance, may be considered as basic helicopter limitations:

— *maximum certificated take-off (including lift-off) mass*

— *maximum certificated ground-taxiing mass*

— *maximum certificated landing mass*

— *most forward, rearward, and lateral centre of gravity positions in various configurations*

— *maximum certificated cargo sling mass.*

Note 3.— Maximum operating mass may be limited by the application of Noise Certification Standards (see Annex 16 and Annex 6, Part III).

1.3 Unsafe features and characteristics

The helicopter shall not possess any feature or characteristic which renders it unsafe under the anticipated operating conditions.

1.4 Proof of compliance

1.4.1 Compliance with the appropriate airworthiness requirements shall be based on evidence either from tests, calculations, calculations based on tests, or other methods provided that in each case the accuracy achieved will ensure a

level of airworthiness equal to that which would be achieved were direct tests conducted.

1.4.2 The tests of 1.4.1 shall be such as to provide reasonable assurance that the helicopter, its components and equipment are reliable and function correctly under the anticipated operating conditions.

CHAPTER 2. FLIGHT

2.1 General

2.1.1 Compliance with the Standards prescribed in Chapter 2 shall be established by flight or other tests conducted upon a helicopter or helicopters of the type for which a Certificate of Airworthiness is sought, or by calculations (or other methods) based on such tests, provided that the results obtained by calculations (or other methods) are equal in accuracy to, or conservatively represent, the results of direct testing.

2.1.2 Compliance with each Standard shall be established for all applicable combinations of helicopter mass and centre of gravity position, within the range of loading conditions for which certification is sought.

2.1.3 Where necessary, appropriate helicopter configurations shall be established for the determination of performance in the various stages of flight and for the investigation of the helicopter's flying qualities.

2.2 Performance

2.2.1 General

2.2.1.1 Sufficient data on the performance of the helicopter shall be determined and scheduled in the helicopter flight manual to provide operators with the necessary information for the purpose of determining the total mass of the helicopter on the basis of the values, peculiar to the proposed flight, of the relevant operational parameters, in order that the flight may be made with reasonable assurance that a safe minimum performance for that flight will be achieved.

2.2.1.2 The performance scheduled for the helicopter shall not require exceptional skill or alertness on the part of the pilot.

2.2.1.3 The scheduled performance of the helicopter shall be consistent with compliance with 1.2.1 and with the operation in logical combinations of those of the helicopter's systems and equipment the operation of which may affect performance.

2.2.2 Minimum performance

At the maximum mass scheduled (see 2.2.3) for take-off and for landing as functions of the take-off or landing site elevation or pressure-altitude either in the standard atmosphere or in specified still air atmospheric conditions, and, for water operations, in specified conditions of smooth water, the helicopter shall be capable of accomplishing the minimum performances specified in 2.2.2.1 and 2.2.2.2 respectively, not considering obstacles, or final approach and take-off area length.

Note.— This Standard permits the maximum take-off mass and maximum landing mass to be scheduled in the helicopter flight manual against, for example at the take-off or landing site:

— elevation, or

— pressure-altitude, or

— pressure-altitude and atmospheric temperature,

so as to be readily usable when applying the national code on helicopter performance operating limitations.

2.2.2.1 *Take-off*

a) In the event of critical power-unit failure, at or after the take-off decision point (for performance Class 1) or the defined point after take-off (for performance Class 2), performance Classes 1 and 2 helicopters shall be capable of continuing safe flight, the remaining power-unit(s) being operated within the approved limitations.

b) The minimum performance at all stages of take-off and climb shall be sufficient to ensure that under conditions of operation departing slightly from the idealized conditions for which data are scheduled (2.2.3), the departure from the scheduled values is not disproportionate.

2.2.2.2 *Landing*

a) Starting from the approach configuration, in the event of critical power-unit failure at or before the landing decision point (performance Class 1) or the defined point before landing (performance Class 2), the helicopter shall be capable of continuing safe flight, the remaining power-unit(s) being operated within the approved limitations.

b) Starting from the landing configuration, the helicopter shall be capable, in the event of a balked landing, of making a climb out, with all power-units operating.

2.2.3 Scheduling of performance

Performance data shall be determined and scheduled in the helicopter flight manual so that their application by means of the operating rules to which the helicopter is to be operated in accordance with 5.1.2 of Annex 6, Part III, will provide a safe relation between the performance of the helicopter and the aerodromes, heliports and routes on which it is capable of being operated. Performance data shall be determined and scheduled for the following stages for the ranges of mass, altitude or pressure-altitude, wind velocity, and other ambient conditions and any other operational variables for which the helicopter is to be certificated, and additionally for amphibians, water surface conditions and strength of current.

2.2.3.1 *Take-off.* The take-off performance data shall include the take-off distance required and the take-off path. For performance Class 1 helicopters, it shall also include the rejected take-off distance required.

2.2.3.1.1 *Take-off decision point.* (For performance Class 1 helicopters only) The take-off decision point shall be the point in the take-off phase used in determining take-off performance and from which either a rejected take-off may be made or a take-off safely continued, with the critical power-unit inoperative.

2.2.3.1.2 *Take-off distance required.* (For performance Class 1 helicopters only) The take-off distance required shall be the horizontal distance required from the start of the take-off to the point at which V_{TOSS}, a selected height above the take-off surface, and a positive climb gradient are achieved, following failure of the critical power-unit at the take-off decision point, the remaining power-unit(s) operating within approved operating limits.

2.2.3.1.3 *Rejected take-off distance required.* (For performance Class 1 helicopters only) The rejected take-off distance required shall be the horizontal distance required from the start of the take-off to the point where the helicopter comes to a complete stop following a power-unit failure and rejection of the take-off at the take-off decision point.

2.2.3.1.4 *Take-off distance required.* (For performance Class 2 and 3 helicopters only) The take-off distance required shall be the horizontal distance required from the start of take-off to the point where the best rate of climb speed (Vy) or the best angle of climb speed (Vx) or a selected intermediate speed (provided this speed does not involve flight within the avoid areas of the height-velocity diagrams) and a selected height above the take-off surface are achieved, all engines operating at approved take-off power.

2.2.3.2 *En route.* The en-route performance shall be the climb, cruise, or descent performance with:

a) the critical power-unit inoperative;

b) the critical two power-units inoperative in the case of helicopters having three or more power-units; and

c) the operating engine(s) not exceeding the power for which they are certificated.

2.2.3.3 *Landing.* The landing performance data shall include the landing distance required and, for performance Class 1 helicopters, the landing decision point.

2.2.3.3.1 *Landing decision point.* (For performance Class 1 helicopters only) The landing decision point shall be the latest point in the approach phase from which either a landing may be made or a rejected landing (go-around) safely initiated, with the critical power-unit inoperative.

2.2.3.3.2 *Landing distance required.* Landing distance required shall be the horizontal distance required to land and come to a complete stop from a point on the approach flight path at a selected height above the landing surface.

2.3 Flying qualities

The helicopter shall comply with the Standards of 2.3 at all altitudes up to the maximum anticipated altitude relevant to the particular requirement in all temperature conditions relevant to the altitude in question and for which the helicopter is approved.

2.3.1 Controllability

The helicopter shall be controllable and manoeuvrable under all anticipated operating conditions and it shall be possible to make smooth transitions from one flight condition to another (e.g. turns, sideslips, changes of engine power, changes of helicopter configurations) without requiring exceptional skill, alertness, or strength on the part of the pilot even in the event of failure of any power-unit. A technique for safely controlling the helicopter shall be established for all stages of flight and helicopter configurations for which performance is scheduled.

Note.— This Standard is intended, among other things, to relate to operation in conditions of no appreciable atmospheric turbulence and also to ensure that there is no undue deterioration of the flying qualities in turbulent air.

2.3.1.1 *Controllability on the ground (or water).* The helicopter shall be controllable on the ground (or on the water) during taxiing, take-off and landing under the anticipated operating conditions.

2.3.1.2 *Controllability during take-off.* The helicopter shall be controllable in the event of sudden failure of the critical power-unit at any point in the take-off, when the helicopter is handled in the manner associated with the scheduling of the take-off data.

2.3.2 Characteristics of flight controls

The helicopter shall have such trim, and handling capabilities as to ensure that the demands made on the pilot's attention and ability to maintain a desired flight condition are not excessive when account is taken of the stage of flight at which these demands occur and their duration. In the event of a malfunction of the systems associated with the flight controls, there must not be any significant deterioration of the handling characteristics.

2.3.3 Stability

The helicopter shall have such stability in relation to its other flight characteristics, performance, structural strength, and most probable operating conditions (e.g. helicopter configurations and speed ranges) as to ensure that demands made on the pilot's powers of concentration are not excessive when the stage of the flight at which these demands occur and their duration are taken into account. The stability of the helicopter shall not, however, be such that excessive demands are made on the pilot's strength or that the safety of the helicopter is prejudiced by lack of manoeuvrability in emergency conditions.

2.3.4 Autorotation

2.3.4.1 *Rotor speed control.* The autorotation characteristics of the helicopter shall be such as to enable the pilot to control the rotor speed to within prescribed limits, and to maintain full control of the helicopter.

2.3.4.2 *Behaviour following a power loss.* The behaviour of the helicopter following a power loss shall not be so extreme as to make difficult a prompt recovery of rotor speed without exceeding the airspeed or strength limitations of the helicopter.

2.3.4.3 *Autorotation airspeeds.* The autorotation airspeeds recommended for maximum range and minimum rate of descent shall be established.

2.3.5 Flutter and vibration

It shall be demonstrated by suitable tests that all parts of the helicopter are free from flutter and excessive vibration in all helicopter configurations under all speed conditions within the operating limitations of the helicopter (see 1.2.2). There shall be no vibration severe enough to interfere with control of the helicopter, to cause structural damage or to cause excessive fatigue to the flight crew.

CHAPTER 3. STRUCTURES

3.1 General

The Standards of Chapter 3 apply to the helicopter structure consisting of all portions of the helicopter, the failure of which would seriously endanger the helicopter.

3.1.1 Mass and mass distribution

Unless otherwise stated, all structural Standards shall be complied with when the mass is varied over the applicable range and is distributed in the most adverse manner, within the operating limitations on the basis of which certification is sought.

3.1.2 Limit loads

Except as might be otherwise qualified, the external loads and the corresponding inertia loads, or resisting loads obtained for the various loading conditions prescribed in 3.4, 3.5 and 3.6 shall be considered as limit loads.

3.1.3 Strength and deformation

In the various loading conditions prescribed in 3.4, 3.5 and 3.6 no part of the helicopter structure shall sustain detrimental deformation at any load up to and including the limit load, and the helicopter structure shall be capable of supporting the ultimate load.

3.2 Airspeeds

3.2.1 Design airspeeds

Design airspeeds shall be established for which the helicopter structure is designed to withstand the corresponding manoeuvring and gust loads in accordance with 3.4.

3.2.2 Limiting airspeeds

Limiting airspeeds, based on the corresponding design airspeeds with safety margins, where appropriate, in accordance with 1.2.1 shall be included in the helicopter flight manual as part of the operating limitations (see 9.2.2). When airspeed limitations are a function of mass, mass distribution, altitude, rotor speed, power or other factors, airspeed limitations based on the critical combination of these factors shall be established.

3.3 Main rotor(s) rotational speed limits

A range of main rotor(s) speeds shall be established that:

a) with power on, provides adequate margin to accommodate the variations in rotor speed occurring in any appropriate manoeuvre, and is consistent with the kind of governor or synchronizer used; and

b) with power off, allows each appropriate autorotative manoeuvre to be performed throughout the ranges of airspeed and mass for which certification is requested.

3.4 Flight loads

The flight loading conditions of 3.4.1, 3.4.2 and 3.6 shall be considered for the range of mass and mass distributions prescribed in 3.1.1 and at airspeeds established in accordance with 3.2.1. Asymmetrical as well as symmetrical loading shall be taken into account. The air, inertia, and other loads resulting from the specified loading conditions shall be distributed so as to approximate actual conditions closely or to represent them conservatively.

3.4.1 Manoeuvring loads

Manoeuvring loads shall be computed on the basis of manoeuvring load factors appropriate to the manoeuvres permitted by the operating limitations. They shall not be less than values which experience indicates will be adequate for the anticipated operating conditions.

3.4.2 Gust loads

Gust loads shall be computed for vertical and horizontal gust velocities which statistics or other evidence indicate will be adequate for the anticipated operating conditions.

3.5 Ground and water loads

The structure shall be able to withstand all the loads due to the reactions of the ground or water surface, as applicable, which are likely to arise during start-up, ground and water taxiing, lift-off, touchdown and rotor braking.

3.5.1 Landing conditions

The landing conditions at the design take-off mass and at the design landing mass shall include such symmetrical and asymmetrical attitudes of the helicopter at ground or water contact, such velocities of descent and such other factors affecting the loads imposed upon the structure as might be present in the anticipated operating conditions.

3.6 Miscellaneous loads

In addition to or in conjunction with the manoeuvring and gust loads and with the ground and water loads, consideration shall be given to all other loads (flight control loads, cabin pressures, effects of engine operation, loads due to changes of configuration, loads due to external mass, etc.) which are likely to occur in the anticipated operating conditions.

3.7 Flutter, divergence and vibration

Each part of the helicopter structure shall be free from excessive vibration or oscillation (ground resonance, flutter, etc.) under each appropriate speed and power condition.

3.8 Fatigue strength

The strength and fabrication of the helicopter shall be such as to ensure that the probability of disastrous fatigue failure of the helicopter's structure under repeated loads and vibratory loads in the anticipated operating conditions is extremely remote.

Note.— This Standard can be complied with by the establishment of "safe lives" or "fail safe" characteristics of the structure, having regard to the reasonable expected load magnitudes and frequencies under the anticipated operating conditions and inspection procedures. For some parts of the structure it might be necessary to establish "fail safe" characteristics as well as "safe lives".

CHAPTER 4. DESIGN AND CONSTRUCTION

4.1 General

Details of design and construction shall be such as to give reasonable assurance that all helicopter parts will function effectively and reliably in the anticipated operating conditions. They shall be based upon practices which experience has proven to be satisfactory or which are substantiated by special tests or by other appropriate investigations or both.

4.1.1 Substantiating tests

The functioning of all moving parts essential to the safe operation of the helicopter shall be demonstrated by suitable tests in order to ensure that they will function correctly under all operating conditions for such parts.

4.1.2 Materials

All materials used in parts of the helicopter essential for its safe operation shall conform to approved specifications. The approved specifications shall be such that materials accepted as complying with the specifications will have the essential properties assumed in the design.

4.1.3 Fabrication methods

The methods of fabrication and assembly shall be such as to produce a consistently sound structure which shall be reliable with respect to maintenance of strength in service.

4.1.4 Protection

The structure shall be protected against deterioration or loss of strength in service due to weathering, corrosion, abrasion, or other causes, which could pass unnoticed, taking into account the maintenance the helicopter will receive.

4.1.5 Inspection provisions

Adequate provision shall be made to permit any necessary examination, replacement, or reconditioning of parts of the helicopter which require such attention, either periodically or after unusually severe operations.

4.1.6 Design features

Special consideration shall be given to design features which affect the ability of the flight crew to maintain controlled flight. This shall include at least the following:

a) *Controls and control systems.* The design of the controls and control systems shall be such as to minimize the possibility of jamming, inadvertent operations, and unintentional engagement of control surface locking devices.

   i) Each control and control system shall operate with the ease, smoothness and positiveness appropriate to its function; and

   ii) each element of each flight control system shall be designed to minimize the probability of any incorrect assembly that could result in the malfunction of the system.

b) *Crew environment.* The design of the flight crew compartment shall be such as to minimize the possibility of incorrect or restricted operation of the controls by the crew, due to fatigue, confusion or interference. Consideration shall be given at least to the following: lay-out and identification of controls and instruments, rapid identification of emergency situations, sense of controls, ventilation, heating and noise.

c) *Pilot vision.* The arrangement of the pilot compartment shall be such as to afford a sufficiently extensive, clear and undistorted field of vision for the safe operation of the helicopter, and to prevent glare and reflections which would interfere with the pilot's vision. The design features of the pilot windshield shall permit under precipitation conditions sufficient vision for the normal conduct of flight and for the execution of approaches and landing.

d) *Provision for emergencies.* Means shall be provided which shall either automatically prevent or shall enable the flight crew to deal with emergencies resulting from foreseeable failures of equipment and systems the failure of which would endanger the helicopter. Reasonable provisions shall be made for continuation of essential services following power-unit or system(s) failure(s) to the extent that such failure(s) are catered for in performance and operating limitations Standards in this Annex and in Annex 6, Part III.

e) *Fire precautions.* The design of the helicopter and the materials used in its manufacture including cabin

interior furnishing materials replaced during major refurbishing shall be such as to minimize the possibility of in-flight and ground fires and also to minimize the production of smoke and toxic gases in the event of a fire. Means shall be provided to contain or to detect and extinguish, wherever possible, all accessible fires as might occur in such a way that no additional danger to the helicopter is caused.

f) *Incapacitation of occupants.* Design precautions shall be taken to protect against possible instances of cabin depressurization and against the presence of smoke or other toxic gases which could incapacitate the occupants of the helicopter.

4.1.7 Emergency landing provisions

Provisions shall be made in the design of the helicopter to protect the occupants from fire and effects of deceleration in the event of an emergency landing. Facilities shall be provided for rapid evacuation of the helicopter in conditions likely to occur following an emergency landing and such facilities shall be related to the passenger and crew capacity of the helicopter. On helicopters certificated for ditching conditions, provisions shall also be made in the design to give maximum practicable assurance that safe evacuation from the helicopter of passengers and crew can be executed in case of ditching.

4.1.8 Ground handling

Adequate provisions shall be made in the design to minimize the risk that ground handling operations (e.g. towing, jacking) may cause damage, which could pass unnoticed, to the parts of the helicopter essential for its safe operation. The protection which any limitations and instructions for such operations might provide may be taken into account.

CHAPTER 5. ENGINES

5.1 Scope

The Standards of Chapter 5 shall apply to engines of all types which are used on the helicopter as primary propulsion units.

5.2 Design, construction and functioning

The engine complete with accessories shall be designed and constructed so as to function reliably within its operating limitations under the anticipated operating conditions when properly installed in the helicopter in accordance with Chapter 6 and with the suitable rotor and power transmission installed.

5.3 Declared ratings, conditions and limitations

The power ratings and the conditions of the atmosphere upon which they are based and all operating conditions and limitations, which are intended to govern the operation of the engine, shall be declared.

5.4 Tests

An engine of the type shall complete satisfactorily such tests as are necessary to verify the validity of the declared ratings, conditions and limitations and to ensure that it will operate satisfactorily and reliably. The tests shall include at least the following:

a) *Power calibration.* Tests shall be conducted to establish the power characteristics of the engine when new and also after the tests in b) and c). There shall be no excessive decrease in power at the conclusion of all the tests specified.

b) *Operation.* Tests shall be conducted to ensure that starting, idling, acceleration, vibration, overspeeding and other characteristics are satisfactory and to demonstrate adequate margins of freedom from detonation, surge, or other detrimental conditions as may be appropriate to the particular type engine.

c) *Endurance.* Tests of sufficient duration shall be conducted at such powers, engine and rotor speeds and other operating conditions as are necessary to demonstrate reliability and durability of the engine. They shall also include operation under conditions in excess of the declared limits to the extent that such limitations might be exceeded in actual service.

CHAPTER 6. ROTOR AND POWER TRANSMISSION SYSTEMS AND POWERPLANT INSTALLATION

6.1 General

The powerplant installation, including rotor and power transmission system, shall comply with the Standards of Chapter 4 and with the Standards of this chapter.

6.2 Design, construction and functioning

The rotor and power transmission systems assembly complete with accessories shall be designed and constructed so as to function reliably within its operating limitations under the anticipated operating conditions when properly fitted to the engine and installed in the helicopter in accordance with this chapter.

6.3 Declared ratings, conditions and limitations

The power ratings and all operating conditions and limitations, which are intended to govern the operation of the rotor and power transmission systems, shall be declared.

6.3.1 Maximum and minimum rotor rotational speed limitations

Maximum and minimum speeds for the rotors in both power-on and power-off conditions shall be established. Any operating conditions (e.g. airspeed) which affect such maxima or minima shall be declared.

6.3.2 Rotor underspeed and overspeed warnings

When the helicopter is made to approach a rotor rotational speed limit, with or without power-units inoperative, clear and distinctive warnings shall be apparent to the pilot. The warnings and initial characteristics of the condition shall be such as to enable the pilot to arrest the development of the condition after the warning begins, and to recover the rotor rotational speed to within prescribed normal limits and to maintain full control of the helicopter.

6.4 Tests

Rotor and power transmission systems shall complete satisfactorily such tests as are necessary to ensure that they will operate satisfactorily and reliably within the declared ratings, conditions and limitations. The tests shall include at least the following:

a) *Operation.* Tests shall be conducted to ensure that strength vibration and overspeeding characteristics are satisfactory and to demonstrate proper and reliable functioning of pitch changing and control mechanisms and free wheel mechanisms.

b) *Endurance.* Tests of sufficient duration shall be conducted at such powers, engine and rotor speeds and other operating conditions as are necessary to demonstrate reliability and durability of the rotor and power transmission systems.

6.5 Compliance with engine and rotor and power transmission systems limitations

The powerplant installation shall be so designed that the engines and rotor and power transmission systems are capable of being used in the anticipated operating conditions. In conditions established in the helicopter flight manual the helicopter shall be capable of being operated without exceeding the limitations established for the engines and rotor and power transmission systems in accordance with Chapters 5 and 6.

6.6 Control of engine rotation

In those installations where continued rotation of an engine which had failed would increase the hazard of fire or of a serious structural failure, means shall be provided for the crew to stop the rotation of the engine in flight, or to reduce it to a safe level.

6.7 Engine restarting

Means shall be provided for restarting an engine at altitudes up to a declared maximum altitude.

6.8 Arrangement and functioning

6.8.1 Independence of power-units

For performance Class 1 and 2 helicopters, the powerplant shall be arranged and installed so that each power-unit together with its associated systems is capable of being controlled and operated independently from the others and so that there is at least one arrangement of the powerplant and systems in which any failure, unless the probability of its occurrence is extremely remote, cannot result in a loss of more power than that resulting from complete failure of the critical power-unit.

6.8.2 Rotor and power transmission systems vibration

The vibration stresses for the rotor and power transmission systems shall be determined and shall not exceed values which have been found safe for operation within the operating limitations established for the helicopter.

6.8.3 Cooling

The cooling system shall be capable of maintaining powerplant and power transmission systems temperatures within the established limits (see 6.5) at all ambient temperatures approved for operation of the helicopter. The maximum and minimum air temperatures for which the powerplant and power transmission systems have been established to be suitable shall be scheduled in the helicopter flight manual.

6.8.4 Associated systems

The fuel, oil, air induction, and other systems associated with each power-unit, each power transmission unit and each rotor, shall be capable of supplying the appropriate unit in accordance with its established requirements, under all conditions affecting the functioning of the systems (e.g. engine power setting, helicopter attitudes and accelerations, atmospheric conditions, fluid temperatures) within the anticipated operating conditions.

6.8.5 Fire protection

For designated fire zones where the potential fire hazards are particularly serious because of the proximity of ignition sources to combustible materials, the following shall apply in addition to the general Standard of 4.1.6 e).

a) *Isolation.* Such zones shall be isolated by fire resisting material from other zones of the helicopter where the presence of fire would jeopardize continued flight, taking into account the probable points of origin and paths of propagation of fire.

b) *Flammable fluids.* Flammable fluid system components located in such zones shall be capable of containing the fluid when exposed to fire conditions. Means shall be provided for the crew to shut off the flow of hazardous quantities of flammable fluids into such zones if a fire occurs.

c) *Fire protection.* There shall be provided a sufficient number of fire detectors so located as to ensure rapid detection of any fire which might occur in such zones.

d) *Fire extinguishment.* Such zones shall be provided with a fire extinguisher system capable of extinguishing any fire likely to occur therein, unless the degree of isolation, quantity of combustibles, fire resistance of the structure, and other factors, are such that any fire likely to occur in the zone would not jeopardize the safety of the helicopter.

CHAPTER 7. INSTRUMENTS AND EQUIPMENT

7.1 Required instruments and equipment

The helicopter shall be provided with approved instruments and equipment necessary for the safe operation of the helicopter in the anticipated operating conditions. These shall include the instruments and equipment necessary to enable the crew to operate the helicopter within its operating limitations.

Note.— Instruments and equipment additional to the minimum necessary for the issuance of a Certificate of Airworthiness are prescribed in Annex 6, Part III, for particular circumstances or on particular kinds of routes.

7.2 Installation

Instrument and equipment installations shall comply with the Standards of Chapter 4.

7.3 Safety and survival equipment

Prescribed safety and survival equipment which the crew or passengers are expected to use or operate at the time of an emergency shall be reliable, readily accessible and easily identified, and its method of operation shall be plainly marked.

7.4 Navigation lights and anti-collision lights

7.4.1 The lights required by Annex 2 to be displayed by helicopters in flight or operating on the movement area of an aerodrome or a heliport shall have intensities, colours, fields of coverage and other characteristics such that they furnish the pilot of another aircraft or personnel on the ground with as much time as possible for interpretation and for subsequent manoeuvre necessary to avoid a collision. In the design of such lights due account shall be taken of the conditions under which they may reasonably be expected to perform these functions.

Note 1.— It is likely that lights will be viewed against a variety of backgrounds, such as typical city lighting, clear starry sky, moonlit water and daytime conditions of low background luminance. Furthermore, collision risk situations are most likely to arise in terminal control areas in which aircraft are manoeuvring in the intermediate and lower flight levels at closing speeds that are unlikely to exceed 900 km/h (500 kt).

Note 2.— See Part IV of the Airworthiness Technical Manual *(Doc 9051) for detailed technical specifications for exterior lights for helicopters.*

7.4.2 Lights shall be installed in helicopters so as to minimize the possibility that they will:

a) adversely affect the satisfactory performance of the flight crews' duties; or

b) subject an outside observer to harmful dazzle.

Note.— In order to avoid the effects mentioned in 7.4.2, it will be necessary in some cases to provide means whereby the pilot can switch off or reduce the intensity of the flashing lights.

CHAPTER 8. ELECTRICAL SYSTEMS

The electrical system shall be so designed and installed as to ensure that it will perform its intended function under any foreseeable operating conditions.

CHAPTER 9. OPERATING LIMITATIONS AND INFORMATION

9.1 General

The operating limitations within which compliance with the Standards of this Annex is determined, together with any other information necessary to the safe operation of the helicopter, shall be made available by means of a helicopter flight manual, markings and placards, and such other means as may effectively accomplish the purpose. The limitations and information shall include at least those prescribed in 9.2, 9.3 and 9.4.

9.2 Operating limitations

Limitations which there is a risk of exceeding in flight and which are defined quantitatively shall be expressed in suitable units and corrected if necessary for errors in measurements so that the flight crew can, by reference to the instruments available to them, readily determine when the limitations are reached.

9.2.1 Loading limitations

The loading limitations shall include all limiting mass, centres of gravity positions, mass distributions, and floor loadings (see 1.2.2).

9.2.2 Airspeed limitations

The airspeed limitations shall include all speeds (see 3.2) which are limiting from the standpoint of structural integrity or flying qualities of the helicopter, or from other considerations. These speeds shall be identified with respect to the appropriate helicopter configurations and other pertinent factors.

9.2.3 Powerplant and power transmission limitations

The powerplant limitations shall include all those established for the various powerplant and transmission components as installed in the helicopter.

9.2.4 Rotor limitations

Limitations on rotor speeds shall include maximum and minimum rotor speeds for power-off (autorotation) and power-on conditions.

9.2.5 Limitations on equipment and systems

The limitations on equipment and systems shall include all those established for the various equipment and systems as installed in the helicopter.

9.2.6 Miscellaneous limitations

Any necessary limitations with respect to conditions found to be prejudicial to the safety of the helicopter (see 1.2.1).

9.2.7 Flight crew limitations

The flight crew limitations shall include the minimum number of flight crew personnel necessary to operate the helicopter, having regard among other things to the accessibility to the appropriate crew members of all necessary controls and instruments and to the execution of the established emergency procedures.

Note.— See Annex 6 — Operation of Aircraft, *Part III, for the circumstances in which the flight crew shall include members in addition to the minimum flight crew defined in this Annex.*

9.3 Operating information and procedures

9.3.1 Types of eligible operations

There shall be listed the particular types of operations, as may be defined in Annex 6, Part III, to the Convention or be generally recognized, for which the helicopter has been shown to be eligible by virtue of compliance with the appropriate airworthiness requirements.

9.3.2 Loading information

The loading information shall include the empty mass of the helicopter, together with a definition of the condition of the helicopter at the time of weighing, the corresponding centre of gravity position, and the reference point(s) and datum line(s) to which the centre of gravity limits are related.

Note.— Usually the empty mass excludes the mass of the crew and payload, and the usable fuel supply and the

drainable oil; it includes the mass of all fixed ballast, unusable fuel supply, undrainable oil, total quantity of engine coolant and total quantity of hydraulic fluid.

9.3.3 Operating procedures

A description shall be given of normal and emergency operating procedures which are peculiar to the particular helicopter and necessary for its safe operation. These shall include procedures to be followed in the event of failure of one or more power-units.

9.3.4 Handling information

Sufficient information shall be given on any significant or unusual features of the helicopter characteristics.

9.4 Performance information

The performance of the helicopter shall be scheduled in accordance with 2.2. There shall be included information regarding the various helicopter configurations and powers involved and the relevant speeds, together with information which would assist the flight crew in attaining the performance as scheduled.

9.5 Helicopter flight manual

A helicopter flight manual shall be made available. It shall identify clearly the specific helicopter or series of helicopters with which it is related. The helicopter flight manual shall include at least the limitations, information and procedures specified in this chapter.

9.6 Markings and placards

9.6.1 Markings and placards on instruments, equipment, controls, etc., shall include such limitations or information as necessary for the direct attention of the flight crew during flight.

9.6.2 Markings and placards, or instructions, shall be provided to give any information which is essential to the ground crew in order to preclude the possibility of mistakes in ground servicing (e.g. towing, refuelling, etc.) which could pass unnoticed and which could jeopardize the safety of the helicopter in subsequent flights.

— END —