HONG KONG

CIVIL AVIATION DEPARTMENT

CAD 50

THE FLIGHT ENGINEER'S LICENCE

(Third Edition January 2009)

FLIGHT STANDARDS & AIRWORTHINESS DIVISION January 2009

FOREWORD

The purpose of this publication is to give guidance to applicants on the procedure for the issue or variation of a Flight Engineer's Licence; to indicate the criteria adopted by the Civil Aviation Department (CAD) for assessing applications; and to provide a reference for the holders of licences so that they may ensure compliance with the CAD's requirements as they relate to the privileges of the licence. The requirements for conversion of a foreign flight engineer's licence to a Hong Kong licence are also specified.

The criteria which are given herein incorporate the Standards and Recommended Practices of Annex 1 to the Convention on International Civil Aviation.

CONTENTS

1 INTRODUCTION

1.1 Under Article 20 of the Air Navigation (Hong Kong) Order 1995 [AN(HK)O] the CAD may grant a Flight Engineer's Licence. Such a licence entitles the holder to act as flight engineer in any aircraft registered in Hong Kong for which the licence contains a valid aircraft rating. A licence will not be issued unless it contains at least one rating.

1.2 This publication sets out the requirements that have to be met for grant and renewal of the licence and associated aircraft ratings. The requirements for conversion of a foreign licence to a Hong Kong licence is also specified.

1.3 For conciseness, the pronoun "he" is used throughout. "She" should be substituted when appropriate.

2 MINIMUM AGE

A Flight Engineer's Licence will not be granted to any person under the age of 21 years.

3 MEDICAL REQUIREMENTS

3.1 The privileges of the Flight Engineer's Licence may not be exercised unless it contains a valid Class 2 Medical Certificate.

3.2 An applicant for the grant of a Flight Engineer's Licence is required to undergo a medical examination and satisfy the examiner that he meets the medical standards laid down. These are set out in broad terms in Annex 1 to the Convention on International Civil Aviation. In general, applicants must be free from any physical disabilities or defect of hearing, vision and colour perception.

3.3 The normal period of validity for a Medical Certificate is 12 months from the last day of the month in which it is issued. The licence holder may renew his medical certificate at any time by undergoing a renewal medical examination. A new medical certificate will take effect from the date of the renewal medical examination.

3.4 Prospective applicants for the Flight Engineer's Licence are strongly advised to undergo the examination for the initial Medical Certificate before they start their training. If they meet the standards required they will be issued with the certificate which should be forwarded, when all the other licensing requirements have been met, with their application for the licence. If the initial certificate has expired by then it must still be forwarded with the application together with a current medical certificate which may have been issued by an Approved Medical Assessor.

4 PREVIOUS EXPERIENCE REQUIREMENTS

4.1 Before being permitted to fly as a flight engineer under training in fulfilment of the requirements specified in paragraph 5, or being permitted to enter for the technical examinations or flight tests detailed in paragraphs 6 and 7, a prospective candidate for the licence must satisfy the CAD that he has acceptable experience as an aircraft engineer, or as a professional pilot, or as a military serviceman with relevant experience, as specified below. Forms for obtaining an assessment of acceptability of experience may be obtained from the Personnel Licensing Office (PELO), 10/F Commercial Building, Airport Freight Forwarding Centre, 2 Chun Wan Road, Chek Lap Kok, Hong Kong.

4.2 **Aircraft Engineer Experience**

Where aircraft engineer experience is offered, prospective applicants must be able to show that they:

4.2.1 have completed a recognised aeronautical engineering apprenticeship or an equivalent course of training or education acceptable to the CAD, and normally have had at least 12 months practical experience in the maintenance of large transport aircraft; or

4.2.2 hold an Aircraft Maintenance Engineer's Licence (which may be a 'Licence Without Type Rating') valid for any of the following:

(a) Category A: Aeroplanes 2

(b) Category C: Turbine Engines (Aeroplanes)

(c) Category R: Radio Comm/Nav and Radar

(d) Category X: Instruments

(e) Category X: Electrical

and normally have had at least 12 months practical experience in the maintenance of large transport aircraft; or

4.2.3 have obtained not less than 3 years general aeronautical engineering experience, including not less than 2 years practical experience in the maintenance of large transport aircraft.

4.3 Professional Pilot Experience

When Professional Pilot experience is offered, prospective applicants must be able to show that they:

4.31 hold a valid Airline Transport Pilot's Licence (Aeroplanes); or

4.3.2 hold a valid Commercial Pilot's Licence (Aeroplanes) which includes a rating permitting them to act as a Systems Panel Operator on an aeroplane certificated for operation by three pilots and have 200 hours experience as a pilot of such aeroplanes; or

4.3.3 hold a valid Commercial Pilot's Licence (Aeroplanes) and have at least 400 hours experience as pilot-in-command or co-pilot on the types of aeroplanes listed in Appendix A.

4.4 Military Serviceman Experience

Where military serviceman experience is offered, prospective applicants must be able to show that they have obtained at least 400 hours flying experience.

4.5 Holder of a Foreign Flight Engineer's Licence

Terms for the validation or conversion of foreign FE licences will be given on application to PELO at the address in paragraph 4.1.

5 FLYING TRAINING REQUIREMENTS

Issue

5.1 Having had his previous experience assessed as acceptable, a prospective applicant for a Flight Engineer's Licence must undergo not less than 100 hours of supervised flight engineer flying training in the first type of aircraft to be included in the licence. This may be reduced to 50 hours where he holds a pilot's licence which already includes an aircraft rating for that type. Up to half the required flying training hours may be obtained in an approved flight simulator of the aircraft type for which application has been made.

5.2 The whole of the required flying training for initial grant of a licence must have been completed within the 12 months immediately preceding the date of application for the licence.

Extension

5.3 Before a further type rating can be added to a licence the holder must obtain not less than 50 hours flight engineer experience under supervision on the type. Up to half of this may be obtained on the approved aircraft flight simulator of the aircraft type for which application has been made. The whole of this experience must be obtained within the 6 months immediately preceding the date of application for the additional rating.

6 TECHNICAL EXAMINATION REQUIREMENTS

6.1 The flight engineer's licensing technical examinations are conducted in two parts.

6.1.1 *Aircraft (General) X Flight Engineer*

This examination is taken only for initial grant of the licence and is made up of four sections:-

(i) Technical Examination Aircraft General
- Principles of Flight (Aeroplane)*
- Engines*
- Electrics & Automatic Flight*
- Airframe Systems (Aeroplanes)*

In this section, sub-sections marked *must be attempted at one sitting and are subject to the partial pass rule whereby a candidate who passes 50% of the required papers and achieves a mark of 50% in any failed subject, will be granted a partial pass, and be allowed two further attempts to pass the outstanding paper with the following conditions:

(a) A time bar of one month will be imposed between each sitting; and

(b) all outstanding papers must be taken at each attempt.

(ii) Documentation and Aviation Law

(iii) Loading

(iv) Human Performance

The pass mark for each section and each subsection is 75%. The examination papers will be scored by the marks awarded for correct answer. No adjustment will be made for incorrect answers or unanswered questions. Only failed sections need to be taken again.

The syllabus for each section is given at Appendix B and a list of publications which applicants may find helpful in preparing for examinations is at Appendix C.

6.1.2 *Aircraft (Type)*

This examination consists of a single paper specific to the type of aircraft for which a rating is being sought. For initial grant of the licence, it is taken on the first type of aircraft to be included in the licence. Subsequently it is taken on each type for which an additional rating is sought. The pass mark in each case is 75% overall. The examination papers will be scored by the marks awarded for correct answer. No adjustment will be made for incorrect answers or unanswered questions. The syllabus is given at Appendix D.

6.2 The dates and times at which examinations are held are published from time to time in Aeronautical Information Circulars.

6.3 The technical examinations may be taken at any time within the 12 months immediately preceding the date of application for the licence; for initial issue of the licence the General may be taken at the same time as the Type if the candidate so desires.

7 FLIGHT TEST REQUIREMENTS

7.1 Before an aircraft type can be included in the Aircraft Rating page of the licence, either for initial issue of the licence or as an additional aircraft type, the applicant for the licence or additional rating must pass a flight test on the type. The syllabus for the test is at Appendix E.

7.2 Type rating flight tests are conducted by Flight Engineer Type Rating Examiners authorised by the CAD for the purpose.

7.3 That part of a type rating flight test dealing with ground handling and external checks must be carried out on the appropriate aircraft. The remainder may be conducted in flight or on a flight simulator approved by the CAD for the purpose. Separate items may be conducted on separate occasions and by different examiners but all the items must be passed within the 6 months immediately preceding the date of application.

7.4 Application forms for the type rating flight test may be obtained from authorised examiners or from the Personnel Licensing Office at the address given in paragraph 4.1.

8 ISSUE AND RENEWAL OF THE FLIGHT ENGINEER'S LICENCE

8.1 Application forms for grant and renewal of a Flight Engineer's Licence and details of fees payable may be obtained from the Personnel Licensing Office.

8.2 As soon as a candidate for the licence has met all the qualifying requirements he should send the completed application form, together with the documentary evidence called for in the form, and the licensing fees to the Personnel Licensing Office. One copy of a recent photograph, full face only, size 25mm x 30mm, should also be enclosed.

8.3 The period of validity of the HK Flight Engineer's Licence is 10 years from the date of issue.

8.4 Flight Engineer's Licences are renewed on request, provided that the licence to be renewed is current, contains a valid medical certificate and either a C of T or C of E that is either current or has expired not more than 5 years before the date of application. Payment of the appropriate fees must also be made.

8.5 Aircraft Ratings in the old licence will be transferred to the new licence provided the associated C of T or C of E for that particular type is either current or expired not more than 5 years before the date of application.

8.6 If the validity of the most recent Aircraft Rating C of T and the C of E contained in the licence have both expired by a period of more than 5 years, but less than 10 years, the applicant will be required to pass examinations in Documentation and Aviation Law, the Aircraft (Type) and the Aircraft Rating flight test in respect of the type of aircraft to be transferred to the new licence, before the licence will be renewed. This requirement may be modified if the applicant has continued flying on an equivalent licence issued by a Contracting State to the Chicago Convention of Civil Aviation (i.e. ICAO licence).

8.7 If the validity of the most recent Aircraft Rating C of T and the C of E contained in the licence have both expired by a period of more than 10 years, the applicant will be required to pass all ground examinations for Flight Engineer's Licence and the Aircraft Rating flight test. This requirement may be modified if the applicant has continued flying on an equivalent ICAO licence.

8.8 After making application for renewal and before the new licence can be issued, the current licence must be presented to the PELO in order to transfer Ratings to the new licence.

8.9 Application to renew a licence may be made up to 60 days before the date of expiry of the current licence. To avoid any unlicensed period, holders should make application for renewal well within the period of validity of the current licence. The legal requirement for licence holders to carry a valid licence with them on any flight for the purpose of public transport that involves flight outside Hong Kong airspace should be kept in mind when making arrangements for licence renewal.

8.10 The period of validity of the new licence will commence from the date of expiry of the old licence.

8.11 Any licence renewed after the expiry of the validity date stated on the licence will be treated as a re-issue. A pass in the subject "Human Performance" will be required for the re-issue of a Flight Engineer's Licence. However, Flight Engineer's Licence holders who renew their licences in the normal way (i.e. without a break or up to 60 days before expiry) or have previously obtained a pass in the subject will not be required to sit the examination.

9 MAINTENANCE OF AIRCRAFT RATING PRIVILEGES

9.1 Public Transport Flights

If the privileges of an aircraft rating entered in a licence are to be exercised on a flight being conducted for the purposes of public transport, the holder must:

9.1.1 within the six months immediately preceding the flight have:

(a) undergone a test in the type of aircraft in which the privileges are to be exercised conducted by an Authorised Flight Engineer Type Rating Examiner (the test will consist of items selected from the syllabus at Appendix E and may be conducted in flight or in an approved flight simulator); and

(b) have had included in the licence a Certificate of Test relating to the test and signed by the authorised examiner, or by an authorised officer, on initial grant of the rating; or

9.1.2 within the 13 months immediately preceding the flight have:

(a) undergone two tests as specified in paragraph 9.1.1(a) at an interval of not less than four months between them; and

(b) had Certificates of Test entered in the licence accordingly, signed by persons authorised to sign such certificates.

9.2 Any flight other than for public transport

If the privileges of an aircraft rating are to be exercised on any flight other than for the purposes of public transport, the holder of the licence in which it is contained must:

9.2.1 within the 13 months immediately preceding the flight have undergone a test as specified in paragraph 9.1.1(a) and have had entered in his licence a Certificate of Test as specified in paragraph 9.1.1(b), or

9.2.2 within the 13 months immediately preceding the flight have had entered in the licence a Certificate of Experience, in respect of the type of aircraft in which the flight is to be conducted, signed and dated by an Authorised Flight Engineer Type Rating Examiner or by an authorised officer. In order to have a Certificate of Experience entered in a licence the holder must produce evidence, by means of his personal flying logbook, to the authorised person who is to sign the certificate that he

has completed at least 5 hours flying as a flight engineer in the preceding 13 months, including at least one flight on each type of aircraft to which the certificate is to relate.

10 CONVERSION OF FOREIGN FLIGHT ENGINEER'S LICENCE TO A HONG KONG LICENCE

10.1 Applicability

10.1.1 A licence will not be accepted for conversion where the presented licence is one which was issued for reasons of equivalence by the issuing authority.

10.1.2 A licence will not be accepted for conversion to an equivalent Hong Kong flight engineer's licence unless the applicant meets the experience requirements, and passes the ground examinations and flight tests prescribed by the Hong Kong Civil Aviation Department (CAD) for the particular class of licence being applied for.

10.1.3 Subject to all of the above, the holder of a valid ICAO Contracting State professional flight crew licence applying for an equivalent Hong Kong licence may be eligible for exemption from certain written licensing examinations in accordance with the provisions of paragraph 10.

10.1.4 Notwithstanding the preceding paragraphs, in cases where the Director-General of Civil Aviation (DGCA) has reasonable doubt as to the equivalence of the licence presented for conversion, he may require the licence holder to meet certain experience requirements, examinations and tests, in addition to those set out in paragraph 10, before granting an equivalent Hong Kong licence.

10.1.5 An application for licence conversion will not be processed until the applicant can show evidence of a genuine requirement to hold a Hong Kong professional flight crew licence and exercise the privileges of the licence on a Hong Kong registered aircraft.

10.2 General

10.2.1 Before a licence is issued, the DGCA requires to be satisfied that the applicant is a fit person to hold the licence, and is qualified by reason of his knowledge, experience, competence, skill, physical and mental fitness to act in the capacity to which the licence relates. For these purposes the applicant shall provide such information and evidence as is required of him by the DGCA and shall also undergo such examinations and tests as the DGCA may require.

10.2.2 The terms under which an applicant may convert his valid licence to a Hong Kong licence will be assessed individually and he will be notified in writing. Each term of issue will be valid for the period stated thereon.

10.2.3 A Hong Kong Flight Engineer's licence will not be issued unless it contains an Aircraft Rating for an aircraft type registered in Hong Kong. No exemption from the Aircraft Rating flight test will be granted.

10.3 Ground Examinations

10.3.1 Examinations for flight engineer's licences are specified in paragraph 6 above. An applicant will be informed in writing of the particular examination papers needed to pass in order to qualify for the licence being sought. Application for exemption from written examinations will not be considered if based upon an exemption previously granted by another licensing authority.

10.3.2 The Aircraft General group papers are:

Principles of Flight (Aeroplanes)*
Engines*
Electrics and Automatic Flight*
Airframe Systems (Aeroplanes)*

10.3.3 Required examination subjects marked *must be attempted at one sitting and are subject to the partial pass rule whereby a candidate who passes 50% of the required papers and achieves a mark of 50% in any failed subject, will be granted a partial pass, and be allowed two further attempts to pass the outstanding paper with the following conditions:

(a) A time bar of one month will be imposed between each sitting; and

(b) all outstanding papers must be taken at each attempt.

10.3.4 A candidate who fails to obtain a full pass within three attempts will have his licence conversion terms reassessed, with a time bar of three months imposed before resit.

10.3.5 All required examinations must be passed within a period of six months commencing from the end of the calendar month in which the first examination for licence conversion was taken, failing which, the licence issue terms will be reassessed and the applicant may lose exemptions previously granted.

10.3.6 Examinations are of the multi-choice format. The examination papers will be scored by the marks awarded for correct answer. No adjustment will be made for incorrect answers or unanswered questions. The achieved mark is rounded to the nearest whole number and the pass mark is 75%. Examination results are normally published within five working days of the examination.

10.4 Exemptions from ground examinations

10.4.1 Exemptions from examinations may be granted either on the basis of flight experience or on previous examination results.

10.4.2 No exemption from Aircraft Type Technical examination will be granted.

10.4.3 Exemption from the Loading examination may be granted to an applicant who has passed the relevant examination in the State of Issue of their licence or has at least 500 hours in aircraft that are certificated for multi crew operation according to the manufacturer's flight manual.

10.4.4 Exemption from the Human Performance may be granted to an applicant who has passed the examination in the State of Issue of their licence to a syllabus acceptable to the HK CAD.

10.4.5 Exemption from the examination Principles of Flight (Aeroplanes) will normally be granted to the holder of a foreign professional flight engineer's licence.

10.4.6 Exemption from the examination Engines may be granted to an applicant with military experience of, or whose licence is endorsed for, a turbine engined aircraft and on which the applicant has at least 100 hours experience.

10.4.7 Exemption from the examination subjects Electrics and Automatic Flight and Airframe Systems may be granted to an applicant with military experience of, or whose licence is endorsed for, one or more transport aircraft types that are pressurised and have an MTWA that exceeds 5700 kg, and on which the applicant has a total of 100 hours certified experience.

10.5 Licence Validation

10.5.1 A Certificate of Validation may normally be issued under one of the circumstances:

(a) where there is a requirement to complete training and testing in a Hong Kong registered aircraft towards the grant of a Hong Kong Flight Engineer's Licence (Line training on public transport flights are not permitted for this purpose);

(b) the holder of a valid foreign Flight Engineer's Licence carrying out an overseas delivery flight or short term specialized operations on a Hong Kong registered aircraft.

10.5.2 An applicant shall apply to the PELO for a Certificate of Validation. For this to be issued the applicant must produce:

(a) a completed form DCA 634;

(b) a cheque for the appropriate fee made payable to "The Government of the Hong Kong Special Administrative Region";

(c) a valid foreign licence to act as a Flight Engineer;

(d) for the purpose of paragraph 10.5.1(b), a valid and current Aircraft rating on the type he is going to operate; and

(e) a medical certificate to cover the required period of validation (normally 60 days) issued by the same licensing authority that issued the Flight Engineer's Licence.

10.5.3 When the certificate of validation is issued on the basis of a foreign Flight Engineer's Licence issued by an ICAO contracting state, such Flight Engineer's Licence is considered to be valid during the specified period as if the licence has been granted under the AN(HK)O. The holder is also considered to have satisfied the equivalent Hong Kong medical standards appropriate to the Flight Engineer's Licence.

10.5.4 A Certificate of Validation would include conditions detailing the purpose and privileges of the validation and the Certificate of Validation must be carried together with the applicable foreign licence when exercising its privileges.

10.6 Application for licence conversion

10.6.1 The holder of a foreign flight engineer's licence applying for a Hong Kong licence must submit Form DCA 218 (with a recent full face photograph attached) together with:

(a) a cheque for the appropriate fee made payable to "The Government of the Hong Kong Special Administrative Region";

(b) proof of nationality;

(c) copy of the flight engineer's licence offered for conversion, to include evidence of :

(i) a multi-engined aircraft rating; and

(ii) a medical certificate;

(d) copy of the Flight Radiotelephony Operator's Licence offered for conversion;

(e) copy of all the examinations results passed for the issue of the licence;

(f) copy of the last six months entries of the applicant's personal flying log book; and

(g) completed form CAD 605.

10.6.2 These should be submitted to:

Personnel Licensing Office
Flight Standards and Airworthiness Division
Civil Aviation Department
10/F., Commercial Building
Airport Freight Forwarding Centre
2 Chun Wan Road
Chek Lap Kok
Hong Kong

10.6.3 An expired Flight Engineer Licence may be accepted for converting into a Hong Kong licence subject to the following conditions:

(a) the expired Flight Engineer's Licence was issued by an ICAO Contracting State (conditions set out in paragraph 10.1.4 should be observed);

(b) the expired Flight Engineer's Licence was obtained through examination and not by conversion. The examination results must be made available to the PELO for checking;

(c) the applicant who holds the expired Flight Engineer's Licence must remain in current flying practices and must possess a valid Flight Engineer's Licence issued by another ICAO Contracting State. The Flight Radiotelephony Operator's Licence, Multi-engined Aircraft Rating and Medical Certificate attached to that licence must be valid and current; and

(d) the applicant must fulfill all the rest of the normal conversion terms stated in this document and other relevant licensing requirements set out by the HK CAD.

10.6.4 It is the applicant's responsibility to furnish the required evidence of experience and qualifications in support of his applicant, and applications that do not conform with the above requirements will not be processed. Additionally the CAD is not prepared to address other licensing authorities in order to obtain information on an applicant's behalf.

10.6.5 Before a licence is issued, original documents will be required for verification.

APPENDIX A LIST OF AIRCRAFT WHICH ARE ACCEPTABLE TO THE CIVIL AVIATION DEPARTMENT FOR THE PURPOSE OF SATISFYING THE REQUIREMENTS OF PARAGRAPH 4.3.3

B747-200

B747-300

APPENDIX B SYLLABUS FOR THE AIRCRAFT (GENERAL) EXAMINATION:

1 TECHNICAL EXAMINATION - AIRCRAFT GENERAL

1.1 Theory of Flight

An understanding of the derivation of lift. The effects of varying airflow conditions and the distribution of forces on an aircraft in flight. The means by which stability is derived and the principles upon which it is based. The effects of varying speed on the aircraft. The means by which lift may be augmented and the associated effects in flight. Interrelationship between the units used to measure aircraft speed. The meaning and significance of associated terms.

1.2 Properties of Air

Definition of terms such as, density; pressure; humidity. The relationship between density, pressure and temperature. A general knowledge of the effects of variation of density, pressure, temperature and humidity on aircraft and engine performance; the International Standard Atmosphere.

1.3 Ground Handling and Servicing

A general knowledge of the methods employed and precautions to be taken during the ground handling and servicing of aircraft such as refuelling; defuelling; towing; taxying; removal of ice, snow and frost prior to take-off.

1.4 Pressurisation and Air Conditioning

The general principle of cabin pressurisation and air conditioning.

An understanding of air supply systems and the methods used to regulate the pressure, temperature and humidity of the supply. The requirements of and means by which cabin ventilation is achieved. Control of air conditioning and pressurisation systems. Safety features embodied (including oxygen systems) and the effects of varying ambient conditions on the systems and components.

1.5 A.C. and D.C. Electrics

An understanding of the general principles underlying the production of d.c. or a.c. from electro-magnetic or chemical sources. The quantities and units associated with electrics.

An understanding of generators and their control. Electrical supply systems and associated components. The paralleling of supplies. The components and parameters employed to monitor generator, battery or bus-bar supplies. Failure warning devices. Circuit protection devices. The production of constant frequency a.c. from d.c. Lead acid and nickel cadmium batteries. Motors and actuators. Bonding. Single and double pole distribution. The transformation of a.c./d.c. power from a.c. supplies. The effects of varying supply parameters on inductive or capacitive loads.

1.6 Flying controls

The general principles of primary and secondary flying controls and their related systems.

An understanding of the effects on an aircraft of the operation of a flying control. The means by which inputs are relayed to control surfaces. Powered flying control systems. Trim, servo and stability augmentation systems. Lift augmentation systems. The effects associated with deployment of spoiler and lift dumping devices. Stall warning and recovery systems.

1.7 Fuel Systems

A general knowledge of aircraft fuel systems and components such as, booster pumps; system venting; fuel heating; jettisoning; the problems associated with fuel storage on board the aircraft and the features incorporated to accommodate these problems. A general knowledge of fuel used. The methods employed in ascertaining fuel specific gravity and fuel contamination. An ability to convert between the various international measurements of volume, weight and temperature.

1.8 Hydraulic Systems

The general principles of transmission of force by fluid under pressure.

An understanding of the means by which pressure is produced and how pressure is controlled in a system. Constant pressure and constant delivery systems. Accumulators and the reasons for their installation. Valves associated with pressure distribution. Normal and abnormal system operation. Safety features which may be incorporated in systems. The problems associated with storage and supply of hydraulic fluid on an aircraft. The requirements of hydraulic fluids and seals and the different types encountered.

1.9 Ice and rain protection

Definition of terms such as, glaze icing; hoar frost; ice accretion; dew point. A general understanding of the effects of ice and rain on aircraft and engine performance. A general knowledge of the functions and operation of ice and rain protection systems and the various components employed by them.

1.10 Instruments

A general knowledge of instruments such as, pressure operated flight instruments; temperature and pressure indicators; position indicators and transmitters; rev/min indicators; quantity measuring system; fuel flow measurement.

1.11 Automatic flight control

A general knowledge of the methods used in flight to control aircraft automatically, including a general knowledge of the type of complementary system(s) used for feeding information to the automatic flight control system(s).

1.12 Propulsion

As applicable to the type of aircraft to be entered in the Aircraft Rating on initial issue of the licence:

(a) *Piston engines and supercharging*

The general principles of this type of engine as a propulsive unit, including propellers.

An understanding of the principles of fuel injection and carburetion and the means by which such systems are controlled automatically or manually to accommodate varying conditions. Induction anti-icing. The principles of ignition and the means by which ignition requirements may be met. Engine starting and shut down, and the systems which may be employed to achieve such operations. The requirements of engine cooling and lubrication systems and the means by which these requirements may be met. Engine fire detection and protection.

The parameters which may be measured to assess engine performance in flight and the effect of varying ambient conditions on these parameters.

The general principles of supercharging/turbo-charging piston engines.

An understanding of the various means available for supercharging/turbo-charging. The mechanisms which may be employed to regulate superchargers/turbo-chargers and how they achieve their effect. The effects on engine parameters of varying supercharging and ambient conditions. The meaning and significance of full throttle height, manifold pressure, boost, exhaust gas temperature, and the effects of varying ambient conditions and control inputs on them.

(b) *Gas turbine engines*

The general principles of gas turbine engines.

An understanding of the various stages of a gas turbine cycle. The problems associated with centrifugal and axial compressors and the means by which they are overcome. Engine fuel control and delivery to the combustion systems. The effects of varying ambient conditions and the methods which may be employed to accommodate them. Engine starting, relighting and shutdown and the systems which may be employed to achieve such operations. The requirements of engine lubrication systems and the means by which they may be met. Any requirements for thrust augmentation and the means by which it may be met, and the effect on the engine of its operation. Thrust reverse systems. Engine fire detection and protection. The parameters which may be measured to assess engine performance in flight and the effect of varying ambient conditions and air bleeds on these parameters. Engine anti-icing systems.

(c) *Variable pitch propellers*

A general understanding of the principles and operation of propellers and propeller control systems, and associated terms. The effect on engine parameters of propeller pitch changes.

NOTES:

(i) If additional ratings are later sought for aircraft having different propulsion systems to those upon which a rating or ratings are already held, questions on those parts of the above not previously examined may be included with the type paper.

(ii) A candidate opting for (a) must take (c) variable pitch propellers.

1.13 Emergency Equipment

A general knowledge of the use and operation of emergency equipment on systems such as:- lighting; portable fire extinguishers; crew and passenger oxygen; life jackets; life rafts and escape equipment.

1.14 Defects

Definition of terms such as:- MEL; deferred defects; pilot reported defects; in-flight monitoring. A general knowledge of typical defects which may be apparent in the air or on the ground as a result of: flight through severe turbulence; lightning strikes; heavy landings, structural damage and ingestion of foreign objects. The defects which may occur as the result of exceeding aircraft/engine/system limitations.

2 DOCUMENTATION AND AVIATION LAW

A detailed knowledge of the action required when defects are reported. A detailed knowledge of the information contained in the relevant manuals. An understanding of the documents and/or certificates in respect of registration, maintenance, repairs and replacements. A general understanding of maintenance schedules and maintenance procedures. The requirements applicable to the carrying out of duplicate inspections of control systems. A detailed knowledge of the log books to be kept and of the equipment and documents to be carried on internal and international flights. A general knowledge of the following:

(i) Air Navigation (Hong Kong) Order 1995

Certificate of airworthiness	Art 7(1) 8(1), (2), (3), (4), (6), (7)
Certificate of maintenance	Art 9(1), (2), (3), (4), (5), (6), (7), (8)
Defect rectification	Art 11(1), (2), (3), (4), (5), (6), (7), (8), (9)
Equipment of aircraft	Art 13(2), (4), (5), (6), (8) Art 14(1), (2), (4), (5)
Composition of crew	Art 18(1), (2), (6)
Licensing of crew	Art 19(1), (2), (5), (7), (9) Art 20(1), (2), (3), (4)(a), (6), 7(a), 7(b), (8), (10)
Personal flying log book	Art 22
Operations Manual	Art 25(5)
Loading	Art 28(1), (4), (5)
Public transport – operations conditions	Art 29(1), (2), (3), (4)
Commanders pre flight action	Art 32(e), (g), (h)
Operation of radio	Art 35(1), (2), (4), (8)
FDR/CVR	Art 37(1)
Dropping of persons	Art 41
Munitions of war	Art 43
Dangerous goods	Art 44
Carriage of persons	Art 45
Exits & break in markings	Art 46

Imperilling safety of aircraft	Art 47
Imperilling safety of any person or property	Art 48
Drunkenness in aircraft	Art 49
Smoking in aircraft	Art 50
Authority of commander of aircraft	Art 51
Stowaways	Art 52
Fatigue of crew	Art 53 Art 54(1) Art 55 Art 56
Documents & records	Art 57 Art 59(1)(b), 3(a), 3(b), (4) Art 61(c)
Breach of conditions	Art 62(1), (2), (3)
Offences regarding documents	Art 63
Rules of the air	Art 64
Provision of air traffic services	Art 64A
Mandatory reporting	Art 86
Obstruction of persons	Art 89
Extra-territorial effect	Art 92
Application of Order to Chinese controlled aircraft not registered in Hong Kong	Art 93
Application of Order to the Crown and visiting forces, etc.	Art 94

Exemption from Order	Art 95
Interpretation	Art 98(1), (3), (4), (5), (6)
Classification and marking of aircraft	Schedule 1, Part A; Part B
Categories of aircraft	Schedule 3
Aircraft equipment	Schedule 5, Scales A, G, H, N, O, P, S, X
Licences & ratings	Schedule 9, Part A, 5, Flight Engineer's Licence (FEL) Part B (insofar as applicable to FEL) Part C, cases G & H; 2, 3(b), 4(a), 5(a), 5(b), 5(d), 5(e), 6, 7
Documents to be carried	Schedule 12
Rules of the air	Schedule 14 Section I Section III, 8, 9, 10, 11 Section IV, 17 Section VII, 32, 33 Section VIII, 42, 43, 44, 45, 46

(ii) Hong Kong Aviation Requirements HKAR-1 Airworthiness Procedures.

(iii) Civil Aviation (Investigation of Accidents) Regulations.

(iv) Air Navigation (General) Regulations
Schedule 15 Reg. 1, 2, 4

(iv) The Hong Kong Aeronautical Information Publication

(v) Hong Kong Aeronautical Information Circulars.

3 WEIGHT AND BALANCE

A detailed understanding of the loading of aircraft such as, centre-of-gravity (C of G) determination for take-off and landing; changes in the C of G position as a result of fuel consumption; adjustment of loads and/or passenger seating in order to ensure that the centre-of-gravity remains with the prescribed limits.

4 HUMAN PERFORMANCE

A detailed understanding of basic aviation physiology and health maintenance, aviation psychology, stress and stress management, and social psychology and ergonomics of the flight deck.

APPENDIX C LIST OF PUBLICATIONS WHICH CANDIDATES FOR AIRCRAFT (GENERAL) TECHNICAL EXAMINATIONS MAY FIND HELPFUL

Book: Hong Kong Aviation Requirements
HKAR-1 Airworthiness Procedures

Author: HK CAD

Publisher: Civil Aviation Department, Flight Standard and Airworthiness Division, 10/F Commercial Building, Airport Freight Forwarding Centre, 2 Chun Wan Road, Chek Lap Kok, Lautau, Hong Kong.

Book: **Civil Aircraft Inspection Procedures**

Author: CAA

Publisher: CAA, obtainable from CAA Printing and Publication Services, Greville House, 37 Gratton Road, Cheltenham, Glos., GL50 2BN.

Book: **Mechanics of Flight**

Author: A C Kermode

Publisher: Pitman

Book: **Fundamentals of Aircraft Environment Control**

Author: Alvin Ebeling

Publisher: Pitman

Book: **Into Thin Air**

Author: E W Still

Publisher: Normalair, Yeovil

Book: **The Jet Engine**

Publisher: Rolls Royce

Book: **Thrust for Flight**

Author: W Thomson

Publisher: Pitman

Book: **Handling the Big Jets**

Author: D P Davies

Publisher: CAA, obtainable from CAA Printing and Publication Services, Greville House, 37 Gratton Road, Cheltnham, Glos., GL50 2BN.

Book: **Aircraft Instruments**

Author: E H J Pallett

Publisher: Pitman

Book: **Maintenance and Repair of Aerospace Vehicles**

Author: J L McKinley and R D Bent

Publisher: McGraw-Hill Book Co (for Norhtrop Inst of Tech)

Book: **Electricity and Electronics of Aerospace Vehicles**

Author: J L McKinley and R D Bent

Publisher: McGraw-Hill Book Co (for Northrop Inst of Tech)

Book: **Aircraft Electrical Systems**

Author: E H J Pallett

Publisher: Pitman

Book: **Human Performance and Limitations**

Author: Roger G Green/Helen Muir/Melanie James/ David Gradwell/Roger L Green

Publisher: Avebury Aviation

ADDENDIX D SYLLABUS FOR THE TECHNICAL EXAMINATION PART 2: AIRCRAFT TYPE

1 LIMITATIONS

A detailed knowledge of airframe and engine operating limitations, weight and balance limitations including datum point location. A general understanding of the practical application of available data.

2 GROUND HANDLING AND SERVICING

A detailed knowledge of the ground starting procedures; aircraft refuelling; towing; servicing of aircraft systems and engines. A general knowledge of the methods and precautions during the ground handling and servicing of the aircraft including the calculation of correct oleo extension; tyre and brake wear; removal of ice, snow and frost; and the operation of servicing connections and fuel tank drain points.

3 PRESSURISATION AND AIR CONDITIONING

A detailed knowledge of the normal, abnormal and emergency operating procedures. A general knowledge of the systems including the methods employed to heat, ventilate and pressurise the aircraft in automatic and manual modes; electrical supplies; the location of components and safety devices.

4 ELECTRICAL SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operating procedures. A detailed knowledge of normal and emergency lighting systems and emergency electrical power systems. A general knowledge of main and ground power electrical supplies including fuses and circuit breakers.

5 FLIGHT CONTROL SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operating procedures. A general knowledge of the flight control systems including, where applicable, speed brakes; spoilers; moveable tail surfaces; servo and balance devices; lift augmentation; flaps; trimming devices; mach trim; yaw damping; control locks; artificial feel; stall warning (stick shaker or nudger) and identification (stick pusher).

6 FUEL SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operation procedures. A general knowledge of the systems including fuels to be used; location and capacities of fuel compartments; calculation of fuel consumption enroute; fuel jettisoning; electrical supplies; location of components.

7 HYDRAULIC SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operating procedures. A general knowledge of the systems including fluids to be used.

8 ICE AND RAIN PROTECTION

A detailed knowledge of the normal, abnormal and emergency operating procedures. A general knowledge of the systems including, indications of icing; replenishment and duration of supplies; engine bleeds; electrical supplies; location of components.

9 INSTRUMENTS AND AUTOMATIC FLIGHT CONTROL SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operation procedures. A general knowledge of the systems including, normal and alternative pitot static systems; air data systems; flight recorder; automatic pilot; compasses; flight director, central warning system and warning devices; switching systems; electrical supplies; location of components.

10 LANDING GEAR AND BRAKING SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operation procedures. A general knowledge of the systems including anti-skid; brake limitations; electrical supplies; location of components.

11 RADIO, COMMUNICATIONS AND RADAR

A general knowledge of the normal, abnormal and emergency use of the radio, communication, navigation and radar systems. A general knowledge of the systems including circuit protection; warning devices; electrical supplies; location of components.

12 POWER PLANT

A detailed knowledge of the normal, abnormal and emergency operating procedures. Where applicable a general knowledge of the engine, auxiliary power unit and power plant systems including, ground and in-flight starting; methods of determining power output; propellers; thrust reversers; engine fuel; water or water methanol; warnings; electrical supplies; location of components. A general knowledge of the engine oil system including, grades of oil to be used; tank capacities; checking of oil contents; calculation of oil consumption; location of components.

13 FIRE PROTECTION SYSTEMS

A detailed knowledge of the normal, abnormal and emergency operating procedures. A general knowledge of the systems including fire detection, warning and extinguishing; electrical supplies; location of components.

14 EMERGENCY EQUIPMENT

A general knowledge of the location, usage and operation of emergency equipment such as, portable fire extinguishers; crew and passenger oxygen; life jackets; life rafts; escape equipment; doors; windows; hatchets; air stairs. A general knowledge of the operating procedures for any special equipment fitted for specified flight roles.

NOTE: See Note following Appendix B paragraph 1.12 regarding possible additional Power Plant examination requirements.

APPENDIX E SYLLABUS FOR THE AIRCRAFT TYPE RATING TEST

1 Ground handling procedures.

2 Transit servicing.

3 Internal and external pre-flight checks.

4 Documents relating to the aircraft's airworthiness.

5 Use of check lists.

6 Ground checking of the operation of all systems under his control.

7 In-flight normal operation of all systems under his control.

8 In-flight abnormal or alternative operation of all systems under his control.

9 Systems-second significant failure (where applicable to type).

10 All emergency drills appropriate to the flight engineer's crew station including:

(a) action in the event of fuselage fire, and smoke drills;

(b) engine failure or fire;

(c) engine re-lighting;

(d) alternative flaps and landing gear lowering drills;

(e) fuel jettisoning;

(f) emergency descent;

(g) crew coordination and procedures in case of pilot incapacitation.