Civil Aviation Authority of Singapore

Singapore Air Safety Publication
Part 5
Licensing of Flight Engineers

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FOREWORD

Pursuant to paragraph 20(14) of the Air Navigation Order, this Singapore Air Safety Publication (SASP) contains the requirements for the grant and renewal of flight crew licences under paragraph 20(1) of the Air Navigation Order (ANO). Any person applying for or holding a licence granted or renewed under the ANO shall comply with these requirements and all amendments which may made from time to time. Paragraph 2 of the ANO and SASP Part D contains the definitions of some terms used in this document, to facilitate the interpretation of the requirements in this SASP.

2 Failure to comply with any of these requirements may result in suspension or the revocation of the licence and may also lead to the penalties as provided under the Thirteenth Schedule of the ANO.

3 From Issue 2 of SASP Part 5, amendments to SASP Part 5 will be notified through Notice of Amendment (NOA) and shall take effect from the date stipulated in the NOAs.

4 Queries on flight engineer licensing requirements should be referred to:

Civil Aviation Authority of Singapore
Safety Policy & Licensing Division
Licensing Section
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AMENDMENTS

The space below is provided to keep a record of amendments to this publication.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS				**CORRIGENDA**			
No	Date Applicable	Date Entered	Entered By	No	Date Applicable	Date Entered	Entered By
1	**26 Jan 2015**	**26 Jan 2015**	**CAAS**				

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CHAPTER 1 GENERAL INFORMATION

1 INTRODUCTION

1.1 The Air Navigation Order 1990 (as amended) provides for the issue of Flight Engineer's licence which entitles persons to act as members of the flight crews of aircraft registered in the Republic of Singapore. The Civil Aviation Authority of Singapore (CAAS) may grant these licences, with ratings which extend or limit the privileges of the licences, to applicants who qualify in accordance with the requirements set out in this publication.

2 APPLICATION FOR A LICENCE

2.1 An applicant must be at least of eighteen years of age and will be required to pass a Licensing Medical Examination (LME) as required in SASP Part 9. He must also satisfy the requirements of general aeronautical experience, technical knowledge, flight engineering experience and English language proficiency, details of which are set out in this publication.

2.2 Prospective applicants are advised to undergo an initial Licensing Medical Examination in accordance to procedures described in Chapter 6 and ensure that their medical standard is satisfactory before commencing a course of training.

2.3 The application forms for the issue, extension or renewal of a Flight Engineer's licence are obtainable from the CAAS Safety Policy & Licensing Division, Singapore Changi Airport.

2.4 The application form, when completed, should be returned to the above address together with the prescribed fees, details of the general aeronautical engineering experience which the applicant wishes to claim as qualification for the licence (supported by corroborating evidence from past present employers that the candidate has the necessary experience required). Applicants must also produce evidence of their nationality.

2.5 Upon receipt of the completed application form and provided that the applicant meets the requirements with regard to age and general aeronautical engineering experience, arrangements will be made for him to take the technical examinations.

2.6 The applicant's personal flying log book which is required to be produced as evidence of flight engineering experience shall be completed in accordance with the Air Navigation Order 1990 (as amended) and in the pattern acceptable to CAAS. Every entry and signature therein shall be made in ink.

2.7 To qualify for the issue of a licence, an applicant will be required to pass the medical and technical examinations and complete the flying experience within the time periods specified in the relevant chapters of this SASP.

3 FEES

3.1 The fees payable on application are contained in the Air Navigation Order 1990 (as amended).

4 PRIVILEGES OF THE LICENCE

4.1 As listed in the Eighth Schedule of the Air Navigation Order 1990 (as amended), the holder of the licence shall be entitled to act as flight engineer in any type of aircraft specified in the aircraft rating included in the licence.

5 THE AIRCRAFT RATING

5.1 The aircraft rating is that section of a licence which lists the types of aircraft in which the licence holder is entitled to act as Flight Engineer.

5.2 CAAS may invalidate or delete a type rating from a licence at any time if there are grounds which show that it should be invalidated or deleted.

5.3 CAAS may issue a restricted type rating which allows the licence holder to perform flight engineering duties under supervision.

6 SIGNING OF LICENCE

6.1 On being issued with a licence, the licence holder shall sign his name thereon in ink.

7 RENEWAL OF LICENCES AND RATINGS

7.1 For renewal of licences, the applicant shall produce evidence of recent satisfactory flight engineering experience and valid Medical Certificate as described in Chapter 6.

7.2 The maximum period of validity of a licence is twelve months. The period will run, on renewal, from the date of the medical examination, except that, if the applicant is medically examined during the thirty days, immediately preceding the date of expiry of the licence, the period of validity will be allowed to run from the date of expiry.

7.3 The maximum period of validity of a licence with only the restricted type rating shall also be twelve months. This licence will be renewed once for a further period of up to twelve months. If the licence is allowed to lapse, then provisions of paragraph 7.5 shall apply.

7.4 The recent experience requirements for renewal of a licence are set out in Chapter 2. At renewal, the types included in the aircraft rating will be reviewed. Types invalidated or removed from the licence can be restored upon the applicant passing the rest set out in Chapter 3 and any such examinations or tests as may be required by CAAS. The applicant is also required to submit evidence of recent satisfactory experience on the type.

7.5 When licences have lapsed, applications to renew them will be considered on the merits. Applicants may be required to pass all or any part of the examinations of tests set out in this publication, plus such recent flying experience as may be decided by the Director General of Civil Aviation.

8 EXAMINATIONS

8.1 Examinations are conducted by the Safety Policy & Licensing Division of CAAS. Candidates will be advised of the date, time and venue of the examination.

8.2 CAAS reserves the right to examine in any subject by any convenient method, and the examining board cannot enter into discussion or correspondence with candidates about their examination results.

8.3 Any concession or exemption from any part of the written examination required for the initial issue of a licence will be made at the discretion of the CAAS.

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CHAPTER 2 EXPERIENCE REQUIREMENTS FOR ISSUE, RENEWAL AND EXTENSION OF LICENCES

1 GENERAL EXPERIENCE

1.1 For the general issue of a Flight Engineer's licence, an applicant will be required to submit evidence of having had a least two years general aeronautical engineering experience, including not less than twelve months practical experience in the maintenance of aircraft. This experience must be completed before an application for examination can be accepted, and must be certified in accordance with Chapter 1 paragraph 2.4. Practical experience must be substantiated by a detailed work schedule acceptable to CAAS. As an alternative to the general aeronautical experience specified above, 200 hours flight time as pilot of an aircraft having four engines or more will be acceptable.

2 RESTRICTED TYPE RATING

2.1 Before an applicant can qualify for a licence with type rating, he will have to apply for a licence with restricted type rating. This licence will allow him to perform flight engineering duties under supervision on board an aircraft.

2.2 To qualify for restricted type rating, an applicant must have the required general aeronautical engineering experience, pass all examinations prescribed in Chapter 4 and have completed at least 10 hours of training on an approved flight simulator within the period of validity of the technical examinations.

3 FLYING EXPERIENCE

3.1 An applicant must submit evidence of having completed, within the six months immediately preceding the date of application for a licence, at least 100 hours satisfactory practical experience in flight engineering duties in the type of rating to which the application relates. Of these 100 hours, a maximum of 50 hours may be obtained in an approved flight simulator.

4 CERTIFICATE OF PRACTICAL ABILITY

4.1 An applicant is required to produce a Certificate of Practical Ability for each type of aircraft which he wishes to have included in the aircraft rating of the licence. Details of the requirements for obtaining this certificate are set out in Chapter 3.

5 RENEWAL REQUIREMENTS

5.1 An applicant for renewal of a Flight Engineer's licence must produce evidence that he has completed satisfactorily at least six hours flight engineering duties during the twelve months immediately preceding the date of applicant for renewal.

5.2 To retain a type in the aircraft rating of a licence at least one flight as flight engineer must be done in the type within the twelve months immediately preceding the date of application for renewal.

5.3 To renew a licence with a restricted type rating, an applicant, must perform at lest one flight under the supervision of a training flight engineer during the twelve months immediately preceding the date of application for renewal.

5.4 Applicants for the renewal of a licence, type rating or restricted type rating who are unable to satisfy the above recent experience requirements may be required to satisfy all or any part of the requirements specified in this publication for the issue or extension of a licence as may be appropriate in the circumstances.

6 EXTENSION OF LICENCES

6.1 An applicant who wishes to extend a licence to include an additional type rating must first qualify for a restricted type rating by passing Part 2 of the examination on an appropriate aircraft and completing at least 10 hours training on an approved flight simulator.

6.2 The applicant must perform flight engineering duties under supervision for at least 50 hours before a type rating endorsement can be made. Of this 50 hours, a maximum of 25 hours may be obtained in an approved flight simulator.

6.3 All such requirements must be met within the six months immediately preceding the date of application for extension of the licence.

6.4 In certain instances where the type of aircraft to be endorsed is a variant of the type already on the licence, a reduction in the number of flying hours required may be permitted. Each case will be treated on its own merits.

CHAPTER 3 TYPE RATING TEST

1 CERTIFICATE OF PRACTICAL ABILTY

1.1 To qualify for the inclusion of a type in the aircraft rating, an applicant is required to submit a certificate showing that he has carried out flight engineering duties satisfactorily during a test in the type. Details of the test are set out in paragraph 2.

1.2 The Certificate of Practical Ability must be signed by the pilot-in-command or CAAS Authorised Flight Engineer Examiner (see paragraph 1.3). He is required to certify that he has witnessed the applicant's ability to carry out flight engineering duties satisfactorily in the course of the test. Sections of the test may be done on separate flights but all sections must be completed within the period of six months immediately preceding the date of application for an issue or extension of licence. When sections of the test are done on separate flights, each person who signs the certificate must certify that he witnessed the particular sections on board the aircraft in which they were carried out.

1.3 The pilot-in-command or CAAS Authorised Flight Examiner who signs the certificate must be the holder or a Singapore licence and have the appropriate type rating included in the aircraft rating of this licence.

2 TYPE RATING TEST

2.1 The test will consist of knowledge of ground handling and a flight during which the applicant will be required to show that he is competent in all normal and emergency procedures applicable to the aircraft including:

(a) Ground Handling

- ✈ Familiarity with towing procedures
- ✈ Familiarity with picketing procedures (where applicable)
- ✈ Refueling
- ✈ Starting
- ✈ Running up
- ✈ Shutting down

(b) Take-off and in-flight

- ✈ Use of check list; cruise control procedure including the use of appropriate tables and graphs; checking fuel consumption

- ✈ Operation and control of propellers if fitted, pressurisation; de-icing and electrical equipment and control surfaces associated with the main and tail planes

(c) Emergencies

- ✈ Familiarity with the action required in the event of fire and engine failure
- ✈ Familiarity with the emergency operation of flaps, landing gear, flying controls and associated devices
- ✈ Familiarity with the action required for fuel jettisoning
- ✈ Recognition of malfunction of components and the appropriate corrective action, if practicable
- ✈ Flight with one or more engines inoperative (when appropriate)

CHAPTER 4 TECHNICAL EXAMINATION CONDITIONS

1 SUBJECTS OF THE EXAMINATION

1.1 The subjects of the written examination are:

(a) Part 1 - Aircraft (General)

- ✈ Aviation Law
- ✈ Airframe
- ✈ Power Plants
- ✈ Electrics
- ✈ Avionics
- ✈ Weight and Balance
- ✈ Human Performance and Limitations
- ✈ Radiotelephony Theory

(b) Part 2 - Aircraft (Type)

Specific aircraft nominated by the applicant, and may be conducted in one or more parts

1.2 - *deleted*-

2 PERIOD ALLOWED FOR THE COMPLETION OF EXAMINATION

2.1 Part 1 examination - must be completed for the initial issue of a licence and before proceeding to Part 2

2.2 Part 2 examination - must be completed for the initial issue of a licence and subsequent extension of the licence to include an additional type rating. This examination will be based only on the aircraft nominated by the applicant.

3 EXAMINATION STANDARDS

3.1 To qualify for a pass in any of the examination, candidates must attain the appropriate standard set by CAAS.

3.2 Candidates who fail any part or subject are only required to repeat the examination in the part or subject in which they fail.

3.3 A pass in Part 1 of the examination will remain valid for a period of twelve months and in Part 2 for six months. Application must be made to CAAS for an extension of this validity period if there are grounds for doing so.

4 DIRECTIONS TO CANDIDATES

4.1 Candidates are not permitted to bring any reference books or papers into the examination room. All work must be shown on the answer sheets provided.

4.2 Unsatisfactory conduct, including the slightest infringement of examination regulations may result in the candidates being disqualified in all subjects he has taken and debarred from further participation in the examination for a period of twelve months. A candidate quality of a second offence may be permanently debarred from the examination.

CHAPTER 5 SYLLABUS OF EXAMINATION

1 PART 1 - AIRCRAFT (GENERAL)

1.1 Aviation Law

The privileges and duties of a flight engineer including duty and rest periods. A detailed knowledge of the action required when reporting defects. The information contained in the relevant manuals and publications. An understanding of the documents and/or certificates in respect of air operators, airworthiness, registration, maintenance, inspection, repairs, replacement modifications and fitness for flight. A general understanding of maintenance schedules, maintenance schedules, maintenance procedures and operational requirements for aircraft. The requirements applicable to the carrying out to duplicate inspections of control systems. A detailed knowledge of the log books to be kept, the equipment and documents to be carried on internal and international flights and of carriage of munitions of war and dangerous goods. General knowledge of engineering and maintenance administration and approval of persons and organisations.

1.2 Airframes

1.2.1 Theory of Flight – Definition of terms, such as, angle of incidence; lift/drag ratio; stability control; pitching; rolling; yawing; stalling; centre of pressure and gravity; dutch-roll; sweepback. A general knowledge airflow over the aircraft, the forces acting on an aircraft in flight, the relationship between speed and angle of attack.

1.2.2 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 an engine performance; the International Standard Atmosphere. Understanding of terms, such as, QFE, QNE & QNH.

1.2.3 Flight controls – Definition of terms such as differential ailerons; flaps; horn balance; mass balance; slats; slots. A general knowledge of flight control systems including; speed brakes; spoilers; moveable tail surfaces; servo and balance devices; lift-augmentation; flaps; trimming devices; mach trim; yaw damping; artificial fee; stall warning (stick shaker or nudger) and identification (stick push).

1.2.4 Hydraulic Systems - Definition of term, such as, cavitation; bleeding; aeration. A general understanding of the basic theory of hydraulics. A general knowledge of the principles of operation of hydraulic systems and components such as reservoirs; accumulators; pumps; actuators. A general knowledge of the types hydraulic fluids used.

1.2.5 Airconditioning and Pressurisation - Definition of terms, such as, differential pressure -ambient pressure; mass flow. A general knowledge of the principles and operation of pressurisation and airconditioning systems and system components.

1.2.6 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.

1.2.7 Fuel Systems - A general knowledge of aircraft fuel systems and components, such as, booster pumps; system venting; fuel heating; jettisoning. A general knowledge of fuels 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, such as, imperial gallon to US gallon and litre; imperial standard pound to kilogramme; centigrade degree to Fahrenheit degree,

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

1.2.9 Emergency Equipment - A general knowledge of the use and operation of emergency equipment and system, such as, lightning; portable fire extinguishers; crew and passenger oxygen; lift jackets; life rafts and escape equipment.

1.2.10 Defects - Definition of terms, such as deferred defects; pilots 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 landing, structural damage and ingestion of foreign objects. The defects which may occur as the result of exceeding aircraft/engine/system limitations.

1.3 **Power Plants**

As applicable to engine type.

1.3.1 Piston Engine - Definition of terms, such as, compression ratio; horsepower; supercharging; valve lead; valve overlap. A general understanding of the principles and operation of supercharged piston engines, including their fuel systems. A general knowledge of the effect of altitude, ambient conditions and power off-takes on the performance of engines. A general knowledge of fire detection and fire extinguishing systems.

1.3.2 Propellers - Definition of terms, such as, fixed pitch; variable pitch; constant speed; feathering; blade angle; propeller slip; blade face; centrifugal twisting moment; reverse pitch. A general understanding of the principles and operation of propellers and propeller control systems.

1.3.3 Turbine Engines - Definition of terms, such as, pressure ratio; thrust, surging, convergence, divergence; impulse; reaction. A general understanding of the principles and operation of gas turbine engines including fuel systems. A general knowledge of the effect of altitude, ambient conditions, bleeds and power off-takes on the performance of engines. A general knowledge of fire detection and fire extinguishing systems.

1.4 **Electrics**

1.4.1 Definition of terms, such as voltage, current, resistance, frequency. A general understanding of the meaning of terms used in AC and DC electrical circuitry. A general knowledge of the principles and functioning of alternating and direct current power generation and control systems. Real and reactive loads; paralleled and non-paralleled and non-paralleled generator systems; the effects of change in frequency on inductive loads; the methods of achieving constant frequency; electrical motors; types of circuit protection devices, their limitations and methods of restoring electrical supply; battery systems.

Fundamentals of basic electrical engineering practice.

1.5 **Avionics**

1.5.1 Instruments - A general knowledge of instruments, such as, pressure operated flight instruments; temperature and pressure indicators; position indicators and transmitters; engine speed indicators; pitot-static systems; quantity measuring systems; fuel flow measurement. Principles of two and three frame gyroscopes - rigidity, precision, random and apparent drift.

1.5.2 Compasses - Definition of terms, such, as deviation; coefficient; variation; correction cards and their use; causes and effects of deviation. General knowledge of the principles of operation of direct reading magnetic compasses.

1.5.3 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 used for feeding information to the automatic flight control system.

1.5.4 Radio Systems - Understanding and familiarisation of systems such as ILS; GS; VOR; ADF; HF; UHF; To-from indication, VOR radial; localiser beam; magnetic bearing.

1.5.5 Navigation Systems - A general knowledge of systems such as the IRS, GPS, INS.

1.6 **Weight and Balance**

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

1.7 **Human Performance and Limitations**

1.7.1 Basic Aviation Physiology and Health Maintenance:

- ✈ Basic physiology and the effects of flight.
- ✈ Anatomy and physiology of eye, ear, vestibular, circulatory, and respiratory systems.
- ✈ Composition of the atmosphere, gas laws and the nature of the human requirement of oxygen.
- ✈ Effects of reduced ambient pressure and of sudden decompression; times of useful consciousness.
- ✈ Recognising and coping with hypoxia and hyperventilation.
- ✈ Entrapped gases and barotrauma
- ✈ Diving and flying.
- ✈ Effects of acceleration (+/– G) on circulatory system, vision and consciousness.
- ✈ Mechanism, effects and management of motion sickness.
- ✈ Flying and health.
- ✈ Noise and age-induced hearing loss.
- ✈ Visual defects and their correction.
- ✈ Arterial disease and coronary risk factors, ECG, blood pressure, stroke.
- ✈ Diet, exercise, obesity.

- ✈ Fits, faints and the EEG.
- ✈ Psychiatric diseases, drug dependence and alcoholism.
- ✈ Tropical diseases and their prophylaxis, hepatitis and sexually transmitted diseases
- ✈ Common ailments and fitness to fly: gastro-enteritis, colds, use of common drugs and their side effects.
- ✈ Toxic hazards
- ✈ Causes and management of in-flight incapacitation.

1.7.2 Basic Aviation Psychology:

- ✈ Basic plan of human information processing including concepts of sensation, attention, memory, central decision-making and creation of mental models.
- ✈ Limitations of central decision channel and mental workload.
- ✈ Function of attention in selecting information sources, attention-getting stimuli.
- ✈ Types of memory: peripheral or sensory, long term (semantic and episodic), short term or working, motor (skills).
- ✈ Memory limitations and failures.
- ✈ Perception, the integration of sensory information to form a mental model.
- ✈ Effects of experience and expectation on perception.
- ✈ Erroneous mental models: visual, vestibular and other illusions.
- ✈ Recognising and managing spatial disorientation.
- ✈ Use of visual cues in landing.
- ✈ Eye movements, visual search techniques.
- ✈ Skill-, rule- and knowledge-based behaviours.
- ✈ Nature of skill acquisition, exercise of skill, conscious and automatic behaviour, errors of skill.
- ✈ Rule-based behaviour, procedures, simulator training, failures in rule-based behaviour.
- ✈ Knowledge-based behaviour: problem solving and decision making, inference formation, failures in knowledge-based behaviour.
- ✈ Maintaining accurate mental models, situational awareness, conformation bias.

1.7.3 Stress, Fatigue and their Management:

- ✈ Models and effects of stress.
- ✈ Definitions, concepts and models of stress.
- ✈ Arousal: concepts of over- and under-arousal.
- ✈ Environmental stresses and their effects: heat, noise, vibration, low humidity.
- ✈ Domestic stress, home relationships, bereavement, financial and time commitments.
- ✈ Work stress, relationships with colleagues and management.
- ✈ Effects of stress on attention, motivation and performance.
- ✈ Life stress and health, other clinical effects of stress.
- ✈ Defence mechanisms, identifying stress and stress management.
- ✈ Sleep and fatigue.
- ✈ Biological clocks and circadian rhythms, sleep/wakefulness and temperature rhythms, ‘zeitgebers’.
- ✈ Sleep stages, sleep at abnormal times of day, required quantity of sleep.
- ✈ Work-induced fatigue.
- ✈ Shift work.

- ✈ Time zone crossing, circadian disrhythmia, re-synchronisation.
- ✈ Rostering problems, sleep management and naps.
- ✈ Sleep hygiene.
- ✈ Management of sleep with drugs.

1.7.4 Social Psychology and Ergonomics of the Flight Deck

- ✈ Individual differences, social psychology and flight deck management.
- ✈ Individual differences, definitions of intelligence and personality.
- ✈ Assessing personality.
- ✈ Main dimensions of personality: extroversion and anxiety. Other important traits: warmth and sociability, impulsivity, tough-mindedness, dominance, stability and boldness.
- ✈ Goal-directed and person-directed types of behaviour.
- ✈ Autocratic and democratic leadership styles.
- ✈ Individual personality-related problems of flying, especially risk-taking.
- ✈ Personality interaction on the flight deck and the interaction of personality with status or seniority, role (e.g. handling/non-handling) and perceived ability of crew members.
- ✈ Concepts of conformity, compliance and risky shift. Implications of these concepts for the flight deck with regard to effects of crew size.
- ✈ Communication: verbal and non-verbal communication, one and two way communication, different communication styles.
- ✈ Methods of maximising crew effectiveness and improving flight deck, or cockpit resource, management.
- ✈ Interacting with cabin crew, air traffic services, maintenance personnel and passengers.
- ✈ The Design of Flight Decks, Documentation and Procedures.
- ✈ Basic principles of control, display and workspace design.
- ✈ Eye datum, anthropometry and workspace constraints, external vision requirements, reach, comfort and posture.
- ✈ Display size, legibility, scale design, colour and illumination. Common errors in display interpretation.
- ✈ Control size, loading, location and compatibility of controls with displays.
- ✈ Presentation of warning information and misinterpretation of warnings.
- ✈ Design and appropriate use of checklists and manuals.
- ✈ Effects of automation and the ‘glass cockpit’. Integration of information from many data sources on one display and automatic selection of displayed information. Mode and status representation.
- ✈ Machine intelligence and relationship between aircraft decisions and pilot decisions.
- ✈ Avoidance of complacency and boredom, maintaining situational awareness, maintaining basic flying skills.

1.8 **Radiotelephony Theory**

1.8.1 The use of normal R/T communications and procedures, eg the phonetic alphabet; standard R/T phraseology; reporting departure; requesting D/F assistance and meteorological information; transmitting position reports; distress and urgency procedures.

2 PART 2 - AIRCRAFT (TYPE)

2.1 Limitations

Weight and loading limitations, definition of the datum point, centre of gravity limits (if centre of gravity) limits vary and are shown by a graph, questions on the matter are only a general nature; speed limitations; engine operating limitations; temperature, altitude and cabin pressure limitations.

2.2 Engine Operation

The management of the engine of the propeller, and of their installations, and the effect of changes in ambient conditions on their performance. Starting procedure and method of determining that power output is satisfactory. Operation under normal, abnormal and emergency conditions for both forward and reverse thrust and precautions to be observed (this covers running up, taxying, take-off, cruising, shutting down and/or relighting/restarting in the air, landing shutting down). Symptoms indicating icing and management of equipment provided to contend with icing when icing is experienced or expected. Action in the event of fire in flight and on the ground.

2.3 Operation of propulsive devices which are not associated with the main engine(s)

The principles of operation and the effect of changes in the ambient conditions on performance. Management under normal, abnormal and emergency conditions.

2.4 Auxiliary power units (when approved for use in flight)

Management under normal, abnormal and emergency conditions. Action in the event of fire in flight and on the ground.

2.5 Auxiliary power units (when approved for ground use only)

Management under normal and abnormal conditions. Action in the event of fire.

2.6 Fuel systems (including engine refrigerants such as water or water-methanol)

Grade(s) of fuel to be used. Refrigerant to be used. Location and management of re-fuelling and de-fuelling and water/sediment drainage points. Tank capacities (usable/unusable fuel) and means of ascertaining contents on the ground and in flight; means of ascertaining fuel consumption en route. Management under normal, abnormal and emergency conditions. Effects of altitude changes in flight.

2.7 Oil systems (engine)

Grade(s) of oil to be used. Location of replenishing an drainage points. Capacity (tank, sump or usable and means of ascertaining contents on the ground and in flight.) Management under normal, abnormal and emergency conditions.

2.8 Controls (including flaps, slats, spoilers, air brakes and equivalent devices)

Direction of movement of controls, functioning of trimming, servo and balance tabs or alternative devices. Management under normal, abnormal and emergency conditions.

Operation of feel simulation systems and associated checking procedures. Operation of stall protection/prevention/systems and associated check procedures.

2.9 **Automatic stabilisation systems (systems to augment stability in flight such as mach trim, yaw damper, etc)**

Management under normal, abnormal and emergency conditions. Indications of abnormal functioning.

2.10 **Automatic pilot systems (systems for automatic control of the path of the aeroplane)**

Management under normal, abnormal and emergency conditions. Indications of abnormal functioning. Switching arrangements with associated systems.

2.11 **Instrument and compass system (including flight systems)**

Note: Only type knowledge is covered and only to the extent detailed below. It is emphasised that this examination is not concerned with either general or type knowledge of how instrument and compasses work, nor with their operational use.

Normal and alternative pitot, static and vacuum supplies. Normal, alternative and emergency electrical power supplies; associated circuit protection, switching and warning devices. Operation of the instrument and compass controls (knobs, switches, etc) which affect the presentation given by the instruments and compasses; warning devices associated with instrument and compass presentation. Switching arrangements with associated systems.

2.12 **Pneumatic-pressure and/or vacuum systems**

The purpose of the principal components. Management under normal, abnormal and emergency conditions.

2.13 **Hydraulic Systems**

Location of replenishing points. Means of ascertaining contents on the ground and in flight. Management under normal, abnormal and emergency conditions.

2.14 **Landing gear (land and/or water), wheel brakes, and braking devices not associated with the engines**

Management under normal, abnormal and emergency conditions.

2.15 **Electrical Systems**

Meaning of terms. Knowledge of the condition of aircraft batteries and the method of ascertaining the voltage and charge. An elementary knowledge of the principles of operation of the generating system(s). Ground power supplies. Location and functioning of circuit breakers and fuses. Lighting systems, internal and external. Management of the electrical systems under normal, abnormal and emergency conditions.

2.16 **Radio and Radar Systems**

Note : Only type knowledge is covered and only to the extent detailed below. It is emphasised that this examination is not concerned with either general or type knowledge of how radio and radar systems work, nor with the use of such systems.

Normal, alternative and emergency power supplies, associated circuit protection, switching and warning devices.

2.17 **Air conditioning and pressurisation systems**

The purpose of the principal components. Management under normal, abnormal and emergency conditions. Indications of abnormal functioning.

2.18 **Ice and rain protection system**

Indications of icing. Management when icing is experienced or expected under normal, abnormal and emergency conditions. Management to maintain clear vision. Replenishment and duration of supplies.

2.19 **Emergency equipment and procedures**

Location and management of emergency exits and equipment, including oxygen. Action in the event of fire (other than engine or auxiliary power unit fire which is included in the appropriate section). Methods of dispersal of smoke in compartments.

2.20 **Fuselage apertures (doors, hatches, etc)**

Security procedures and indications for fuselage apertures and associated devices such as air-stairs.

2.21 **Equipment for specified flight roles (spray gear, freight, etc)**

Management under normal, abnormal and emergency conditions.

2.22 **Flight recorders**

Management under normal, abnormal and emergency conditions. Indications of abnormal functioning.

CHAPTER 6 MEDICAL PROCEDURES (ADMINISTRATION)

1 LICENSING MEDICAL EXAMINATION (LME)

1.1 An applicant for the initial issue or renewal of a Flight Engineer's Licence (FEL) must satisfy the Civil Aviation Medical Board (CAMB) that he/she meets the Class 2 medical requirements as set out in the Fourteenth Schedule of the Air Navigation Order (ANO) and the SASP Part 9. The level of medical fitness to be met for the renewal of a Medical Certificate shall be the same as that for the initial assessment except where otherwise specifically stated.

Note: For the purposes of this SASP Part 5, a "*Medical Certificate*" means *the evidence issued by the Authority that the licence holder meets specific requirements of medical fitness*.

1.2 Prospective applicants must be free from any physical disabilities and defect of hearing, vision or colour perception.

1.3 Applicants are required to undergo the initial or renewal Licensing Medical Examination (LME) for the appropriate licence sought.

1.3.1 The LME is to be conducted by a Designated Medical Examiner (DME). All initial and every fourth renewal LME required by FEL holders shall be at the clinical premises of the CAMB.

1.3.2 The applicant shall sign and furnish to the DME a declaration, made in a form prescribed by the Authority, stating whether they have previously undergone such an examination and, if so, the date, place and result of the last examination. He/She shall indicate to the DME whether a previous medical assessment had been unsuccessful and, if so, the reason for such.

1.3.3 The report of the LME will be sent to the CAMB for assessment of the applicant's fitness to hold a FEL. It is the applicant's responsibility to ensure that he/she has been declared as fit by CAMB prior to exercising the privileges of the licence that he/she is applying for. He/She must hold a valid Medical Certificate for the initial issue or renewal of a licence. The validity period of the licence is subject in part to the validity period of the applicant's Medical Certificate.

1.4 The period of validity of the Medical Certificate is 12 months. The medical validity period may be reduced when clinically indicated.

1.5 An applicant is required to undergo another initial LME if he/she fails to revalidate his/ her Medical Certificate within 12 months after the expiry of the Medical Certificate.

1.6 FEL holders shall not exercise the privileges of their licences unless they hold a valid Medical Certificate and the licence bears a valid Certificate of Practical Ability appropriate to the functions to be performed on that flight.

2 THE CIVIL AVIATION MEDICAL BOARD (CAMB)

2.1 The CAMB is a board of medical specialists that advises the Authority on the regulation of medical standards of Singapore licensed flight crew and air traffic controllers and on the aeromedical requirements of Singapore in relation to international standards set by the International Civil Aviation Organisation (ICAO).

2.2 For the purpose of carrying out the necessary medical assessments, the Authority has appointed a panel of Medical Assessors, as part of the Office of CAMB, who are competent in evaluating and assessing medical conditions of flight safety. Licensing Medical Assessors' Boards (LMAB) are convened to assess the medical fitness of an applicant for the issue or renewal of a Medical Certificate in accordance with the Fourteenth Schedule of the ANO and the SASP Part 9.

3 DESIGNATED MEDICAL EXAMINERS (DMEs)

3.1 For the purpose of carrying out the necessary medical examinations for flight crew, the Authority has appointed a panel of Designated Medical Examiners (DMEs), to conduct LME for the initial issue and renewal of flight crew licences. The list of names and addresses of DMEs is published in the Aeronautical Information Circular which is available on the CAAS website at www.caas.gov.sg.

4 TIMELY REVALIDATION OF MEDICAL CERTIFICATE

4.1 The Medical Certificate will bear the date of the applicant's successful LME, its expiry date and other requirements e.g. Chest X-ray, ECG, Audiogram etc.

4.2 The licence holder is responsible for ensuring that his/her Medical Certificate is valid prior to exercising the privileges of his/her licence.

4.3 A licence holder shall arrange for his/her renewal LME to take place up to 45 days prior to the expiry of his/her existing Medical Certificate.

5 MEDICAL STANDARDS NOT MET

5.1 If the medical standards as presented in the ANO's Fourteenth Schedule and the SASP Part 9 for a particular licence are not met, the corresponding Medical Certificate for that particular licence will not be issued or renewed unless the following conditions are fulfilled:

(a) accredited medical conclusion arrived at by CAMB indicates that in special circumstances, the applicant's failure to meet any requirement, whether numerical or otherwise, is such that exercise of the privileges of the licence applied for is not likely to jeopardise flight safety.

(b) relevant ability, skill and experience of the applicant and operational conditions have been given consideration.

(c) the licence is endorsed with any special limitation or limitations when the safe performance of the licence holder's duties is dependent on compliance with such limitation or limitations.

5.2 A holder of a licence granted in part on the basis of medical fitness shall not be entitled to perform any of the functions to which his/her licence relates if he/she knows or has reason to believe that his/her physical condition renders him/her temporarily or permanently unfit to perform such function. Those who:

(a) suffers any personal injury involving incapacity to undertake the functions to which his/ her licence relates;

(b) suffers any illness involving incapacity to undertake those functions for a period extending beyond 20 days;

(c) knows or has reasons to believe that she is pregnant;

(d) developed a medical condition that requires continued treatment with prescribed medication; or

(e) has received medical treatment requiring hospitalisation;

is to report the issue or occurrence to CAMB as soon as possible. He/she shall not exercise the privileges of the licence and related ratings until he/she has satisfied the CAMB that his/her medical fitness has been restored to the standard as specified in the Fourteenth Schedule of the ANO and the SASP Part 9. If under any doubt, he/she is to seek clarification or guidance from a DME to ascertain if the medical issue or occurrence is of relevance to flight safety.

6 PAYMENT OF CHARGES

6.1 The fees to be charged by the DME for medical examinations may follow guidelines set by the Singapore Medical Council (SMC) or at rates as determined by the DME performing the medical examinations.

6.2 The fee to be paid by the applicant for a medical evaluation by the CAMB is laid down in the Twelfth Schedule of the Air Navigation Order (ANO).

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CHAPTER 7 LANGUAGE PROFICIENCY

1 LANGUAGE PROFICIENCY REQUIREMENTS

1.1 An applicant for a flight engineer licence shall demonstrate the ability to speak and understand the English language, used for radio-telephony communications.

1.2 A flight engineer licence shall not be valid unless the holder has been certified to at least the Operational Level (Level 4) of the ICAO Language Proficiency Rating Scale.

1.3 A flight engineer licence holder who demonstrates language proficiency below the Expert Level (Level 6) shall be evaluated at the following intervals:

(a) those demonstrating language proficiency at the Operational Level (Level 4) shall be evaluated at least once every three years; and

(b) those demonstrating language proficiency at the Extended Level (Level 5) shall be evaluated at least once every six years.

1.4 The evaluation and certification of language proficiency shall only be performed by persons authorised by or otherwise acceptable to the Authority.

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