Advisory Circular
AC66-2.12

Aircraft Maintenance Engineer Licence — Examination Subject 12 Avionics 2

Revision 1 (3)
05 February 2016

General

Civil Aviation Authority advisory circulars contain information about standards, practices, and procedures that the Director has found to be an acceptable means of compliance with the associated rule.

An acceptable means of compliance is not intended to be the only means of compliance with a rule, and consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate advisory circular.

An advisory circular may also include guidance material to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

This advisory circular is intended to be read with Part 66 Subpart B of the rule. If there are any conflicts between the advisory circular and the rule, the rule takes precedence.

Purpose

This advisory circular provides an acceptable means of compliance for the syllabus content in respect of written examinations for Subject 12 (Avionics 2).

This advisory circular also provides guidance material for recommended study material in respect of the examination syllabus in this advisory circular.

Related Rules

This advisory circular relates specifically to Civil Aviation Rule Part 66 Subpart B — 'Aircraft Maintenance Engineer Licence'.

Change Notice

Subject to "Memorandum for Technical Cooperation" between the CAA of Mongolia and New Zealand on mutual cooperation in implementation of the International Civil Aviation Organization Resolution of Global Rule Harmonization, which urges States to promote global harmonization of national rules, dated 6th of May, 1999, Mongolian Civil Aviation Safety Regulation has been reconciled to the Civil Aviation Regulation of New Zealand.

Amendment 164 of Annex 1 to the Chicago Convention on International Civil Aviation urges flight crew members, ATC personnel and aircraft maintenance engineers to comply with the language proficiency requirements; and

Under Article 14 of the Civil Aviation Law of Mongolia 1999, "Use of foreign language in civil aviation" the AC has been released in English version only, in order to prevent any mistranslation and misuse of the aviation safety related documents.

Table of Contents

66.53 Eligibility Requirements

Rule 66.53(a)(2) requires an applicant for an AMEL to have passed written examinations, that are acceptable to the Director, relevant to the duties and responsibilities of an aircraft maintenance engineer in the category of licence sought.

The written examinations acceptable to the Director for Subject 12 (Avionics 2) should comply with the syllabus contained in this advisory circular. Each examination will cover all topics and may sample any of the sub-topics.

The new syllabus has been developed after extensive industry consultation and the objectives reflect the knowledge required of current technology and international best work practice.

Examination Overview: Subject 12

The pass mark for Subject 12 (Avionics 2) is 70%.

Application to sit an examination may be made directly to PEL office.

General Examining Objective

The objective of the examination is to determine that the applicant for an AMEL has adequate knowledge of Subject 12 to permit the proper performance, supervision and certification of aircraft maintenance at a level commensurate with the privileges of the various AMEL categories.

Knowledge Levels

LEVEL 1: A familiarisation with the principal elements of the subject.

Objectives: The applicant should:

1. be familiar with the basic elements of the subject.
2. be able to give simple descriptions of the whole subject, using common words and examples.
3. be able to use typical terms.

LEVEL 2: A general knowledge of the theoretical and practical aspects of the subject.

An ability to apply the knowledge.

Objectives: The applicant should:

1. be able to understand the theoretical fundamentals of the subject.
2. be able to give a general description of the subject using, as appropriate, typical examples.
3. be able to use mathematical formulae in conjunction with physical laws describing the subject.
4. be able to read and understand sketches, drawings and schematics describing the subject.
5. be able to apply his/her knowledge in a practical manner using detailed procedures.

LEVEL 3: A detailed knowledge of the theoretical and practical aspects of the subject.

A capacity to combine and apply the separate elements of knowledge in a logical and comprehensive manner.

Objectives: The applicant should:

1. know the theory of the subject and the interrelationships with other subjects.
2. be able to give a detailed description of the subject using theoretical fundamentals and specific examples.
3. understand and be able to use mathematical formulae related to the subject.
4. be able to read, understand and prepare sketches, simple drawings and schematics describing the subject.
5. be able to apply his/her knowledge in a practical manner using manufacturer's instructions.
6. be able to interpret results and measurements from various sources and apply corrective action where appropriate.

Recommended Study Material

The publication list below provides guidance material for suitable study references for the overall syllabus content. However, applicants may have to conduct further research using other references or sources (including the internet) or attend a formal course in order to gain a comprehensive understanding of all subtopics in the syllabus.

Publication references have not been assigned to individual topics in this syllabus.

Publication List

Study Ref	Book Title	Author	ISBN
1	Mechanics of Flight	AC Kermode	978-1-4058-2359-3
2	Aircraft Electricity & Electronics	TK Eismin	0-07-113286-4
3	Avionic Systems Operation & Maintenance	James W. Wasson	0-89100-436-X
4	Aircraft Engineering Principles.	L. Dingle & M. Tooley	0 7506 5015-X
5	Fibre Optics Communications and other Applications	Zanger	0-675-20944-7
6	Digital Electronic Systems	CR Spitzer	1-930665-12-1
7	Dictionary of Aeronautical Terms	Dale Crane	1-56027-287-2
8	Teach Yourself Electricity and Electronics	Stan Gibilisco	007-1377-301

Syllabus Layout

Topic Numbering - left hand column

The syllabus is set out by topics, each of which is identified by a single-digit number. Each topic is divided into a number of sub-topics, which are identified by two-digit numbers: the first and second digits of which refer to the topic and the sub-topic respectively.

Each sub-topic is further sub-divided into one or more sub-sub-topics, which are identified by three-digit numbers. Where applicable, sub-sub-topics may be further subdivided into paragraphs that are identified by four/five digit alphanumeric sequences.

The three-digit sub-sub-topic numbers shown in the left hand column are used in the 'knowledge deficiency reports' to provide feedback on individual examinations.

Objective description - middle column

The middle column objectively describes each sub-sub-topic by stating, in plain language, its subject matter and the type of performance or activity required. The objectives are intended to be simple, unambiguous, and clearly-focussed, outcomes to aid learning.

Knowledge levels - right hand column

The right hand column specifies the knowledge level for each sub-topic heading. The three levels of knowledge used in this syllabus are described above. Note that the knowledge levels indicate the depth of knowledge required NOT its safety importance.

Syllabus: Subject 12 (Avionics 2)

1	High Speed Flight	
1.1.1	Describe the following conditions and understand factors that affect them. a. Critical Mach number b. Mach cone c. Mach number d. Speed of sound e. Subsonic flight f. Supersonic flight g. Transonic flight	2
1.1.2	Describe the following high speed flight criteria and know what factors affect them: a. Aerodynamic heating. b. Area rule. c. Compressibility. d. Expansion waves. e. Shock induced drag. f. Shock induced stall. g. Shock waves (oblique and normal).	2
1.1.3	Describe the airflow in engine intakes of high speed aircraft and the factors which affect it.	2
1.1.4	Describe the effects of sweepback and fineness ratio on critical mach number.	2
1.1.5	Describe control problems encountered in transonic and supersonic flight and state the methods used to overcome these problems.	2
1.1.6	Describe aircraft structural monitoring (damage tolerance monitoring) systems and devices and the electrical systems that support them.	1

2	Flight Controls	
2.1.1	Describe the following flight control systems and devices: a. Trim control b. Active load control c. High lift devices d. Lift dump e. Speed brakes f. Artificial feel g. Yaw damper h. Mach trim i. Rudder limiter j. Gust locks k. Stall protection systems l. Manual, hydraulic and pneumatic power	1
2.1.2	Describe the construction, principles of operation, protection and maintenance of the following control systems: a. Digital fly-by-wire b. Analogue fly-by- wire c. Full authority systems d. Manual reversion systems	2

3	**Advanced AC Theory**	
3.1	**Resistive (R), Capacitive (C) and Inductive (L) Circuits**	
3.1.1	In relation to purely resistive, capacitive and inductive circuits: a. apply Ohm's Law to determine voltage, current and impedance. b. calculate inductive and capacitive reactance and state the factors that affect them. c. describe and calculate impedance and phase angle. d. describe the power dissipated and phase relationship between voltage and current.	2
3.2	**Series and Parallel Inductive, Capacitive and Resistive Circuits**	
3.2.1	In relation to series and parallel L, C and R circuits, describe the relationship between: a. voltage across circuit components. b. current across circuit components.	2
3.2.1	Calculate: a. applied and component voltage. b. current. c. impedance. (Z) d. phase angle. e. power factor.	3
3.2.3	Describe and calculate: a. true power. (Watts) b. apparent power. c. reactive power.	3
3.3	**Series and Parallel Resonance**	
3.3.1	Define resonance.	2
3.3.2	Specify how the properties of a reactive circuit change at resonance.	2
3.3.3	When the frequency of a series resonant circuit is varied, describe the effect on: a. current. b. impedance. c. phase angle.	2
3.3.4	From given information, calculate the resonant frequency.	3
3.3.5	Explain and calculate the voltage magnification factor (Q) of a circuit.	3
3.3.6	Describe the effect that resistance has on circuit Q and resonance curves.	2
3.3.7	Define bandwidth.	2
3.3.8	When the frequency of a parallel resonant circuit is varied, describe the effect on: a. current. b. impedance. c. phase angle.	2
3.3.9	Describe the operation and use of a tank circuit.	2

4	Transformers	
4.1	**General**	
4.1.1	Describe the two classes of transformer and where each may typically be used in aircraft systems.	2
4.1.2	Describe the basic functions of a transformer in respect of AC voltage and frequency.	2
4.1.3	Describe the following components of a transformer: a. Iron core b. Primary windings c. Secondary windings	2
4.1.4	Describe the principles of operation of a transformer.	2
4.1.5	Describe transformer losses and how they are overcome.	2
4.1.6	Describe the action of a transformer under load and no-load conditions.	2
4.1.7	Describe power transfer, efficiency and the relevance of polarity markings.	2
4.1.8	Given sufficient data calculate: a. efficiency. b. power. c. primary or secondary current. d. primary or secondary voltage. e. turns ratio.	3
4.1.9	Describe the types and ratings of transformers that would normally be used to produce the required power source for various components and systems in an aircraft, such as: a. instrument lighting. b. Instruments. c. servos. d. actuators. e. avionics equipment. f. pumps and motors. g. relays and valves. h. batteries.	2
4.1.10	Identify the symbol for a transformer on an electrical circuit diagram	2

5	AC Power Systems	
5.1	**Generation of AC**	
5.1.1	Describe waveform produced from a 360-degree rotation of a single loop in a magnetic field.	2
5.1.2	Describe the principle of operation and construction of the following types of AC generator: a. Single revolving armature b. Revolving field	2
5.1.3	List the factors that affect the frequency and voltage output.	1
5.2	**Multiphase Waveform Analysis**	
5.2.1	In relation to star and delta connected 3 phase systems describe, and given sufficient data, calculate line and phase voltages and currents.	2
5.2.2	Calculate power in a 3-phase system.	3
5.2.3	Compare star and delta 3 phase systems.	2
5.3	**Filters**	
5.3.1	Describe the operation, uses and applications of the following types of filters. a. Band pass b. Band stop c. High pass d. Low pass	2
5.3.2	Identify response curves applicable to the above filters.	2
5.3.3	Describe the operation of active filters	2
5.3.4	Compare the difference between active and passive filters.	2
5.4	**Synchros, Resolvers and Other Input Devices**	
5.4.1	Describe the construction, operation and uses of the following synchro systems and components: a. Capacitance transmitters. b. Control transformers. c. Differential. d. E and I transformers. e. Inductance transmitters. f. Resolvers. g. Linear Voltage Differential Transformers (LVDT).	2

5.5	**Servomechanism Operation and troubleshooting**	
5.5.1	Define the following terms and how they relate to servomechanisms: a. Analog b. Damping (various types) c. Deadband d. Feedback (various types) e. Follow up f. Hunting g. Null h. Servo motor. i. Tacho generator	2
5.5.2	Describe the operation and components of a typical servomechanism.	2
5.5.3	Describe: a. displacement and rate control: b. displacement/displacement. c. displacement/rate. d. rate/displacement. e. rate/rate.	2
5.5.4	Given data and diagrams, determine the causes of unserviceabilities in servomechanisms.	3
5.5.5	Specify the causes and methods of rectifying hunting.	2
5.5.6	Describe the effects of reversing the leads on a synchro receiver.	2
5.6	**AC Measuring Instruments**	
5.6.1	Describe the operation, use and construction of the following instruments: a. Ammeters b. Frequency meters c. Volt amps reactive (VAR) meters d. Voltmeters e. Watt meters	2

6	**Semiconductor Theory**	
6.1	**Semiconductor Materials**	
6.1.1	In relation to P and N semiconductor materials, describe: a. majority and minority carriers. b. the effects of impurities on conduction. c. the mechanism of electrical conduction in doped semiconductor material.	2
6.1.2	Describe the PN junction in a semiconductor.	2
6.2	**PN Junction Operation**	
6.2.1	Trace the development of a potential barrier across a junction which is: a. forward biased b. reverse biased c. unbiased	1
6.2.2	Describe the following diode parameters: a. Frequency b. Leakage current c. Maximum forward current d. Peak inverse voltage e. Power dissipation f. Temperature	2
6.3	**Diode Terminology and Identification, Function and Types**	
6.3.1	Describe terminology used and be able to analyse information supplied on diode data sheets and diagrams.	2
6.3.2	Describe the characteristic curves for the following diodes: a. Germanium b. Ideal c. Silicon d. Zener	1
6.3.3	Identify and describe the operation of the following circuits in which diodes are used: a. Bridge rectifiers (single and 3 phase) b. Clampers c. Clippers d. Full and half wave rectifiers e. Voltage doublers and triplers (multipliers)	2
6.3.4	Specify how an ohmmeter is used to check a diode for serviceability.	2
6.3.5	Specify the function and applications of the following devices: a. Diacs b. Light emitting diode (LED) c. Photoconductive diode d. Shottky diodes e. Triacs f. Varactor diode g. Varistor	2

6.4	**Junction Transistors**	
6.4.1	Describe the characteristics and properties of a transistor.	2
6.4.2	Describe the operation of PNP and NPN transistors.	2
6.4.3	Define the terms: a. Alpha b. Beta c. Distortion d. Saturation e. Frequency response f. I_B g. I_C h. I_E i. Input impedance j. Output impedance k. Power gain l. V_{be}	2
6.4.4	Describe the process of amplification (current, voltage and power).	2
6.4.5	Describe the effects of temperature on transistors.	2
6.4.6	Interpret terminology and evaluate data supplied on transistor specification sheets.	3
6.4.7	Identify from supplied information, the emitter, base or collector terminals on various types of transistors.	2
6.4.8	State how an ohmmeter can be used to check the serviceability of a transistor.	1
6.5	**Types of Transistors and Transistor Configurations**	
6.5.1	Describe the biasing methods required to operate as a: a. Class A amplifier. b. Class B amplifier. c. Class C amplifier. d. Switch.	2
6.5.2	Specify uses and characteristics of the above amplifiers.	2
6.5.3	Describe simple transistorised circuits with the following: a. Bias b. Decoupling c. Feedback d. Stabilisation	2
6.5.4	Describe the following methods of bias stabilisation: a. Diode b. Negative feedback c. Temperature stabilisation resistor d. Thermistor e. Transistor	2

6.5.5	Identify and describe the operation and relative characteristics of the following transistor configurations: a. Common base b. Common collector c. Common emitter	2
6.5.6	Describe the operation, characteristics and application of the following devices: a. Hall effect devices b. Opto isolator c. Photo transistor d. Power transistors e. Unijunction transistors	2
6.6	**Field Effect Transistors (FETs)**	
6.6.1	Outline the operation, characteristics and basic circuit configurations of the following FETs: a. Insulated gate (IGFET) b. Junction (JFET) c. Metal oxide silicon (MOSFET)	2

7	**Amplifiers and Circuits**	
7.1	**Operational Amplifiers**	
7.1.1	Specify the following parameters and their values for an ideal operational amplifier (OPAMP): a. Bandwidth b. Drift c. Input and output impedance d. Input offset voltage and current e. Open loop gain f. Slew rate	2
7.1.2	Describe the operation of an OP AMP when used as: a. a comparator. b. a differentiator. c. a voltage follower d. an integrator.	2
7.1.3	With respect to the following amplifiers, describe their operation and applications. a. Differential amplifier. b. Inverting amplifier. c. Non-inverting amplifier. d. Summing amplifier.	2
7.1.4	In regard to the above amplifiers, describe the effect of external components to determine gain and output voltage.	2
7.2	**Multistage Amplifiers**	
7.2.1	Identify and describe the operation of the following methods of connecting amplifier stages. a. Direct b. Inductive (transformer) c. Inductive restive (IR) d. Inductive capacitive (LC) e. Resistive capacitive (RC)	2
7.2.2	Compare the advantages and disadvantages of the methods listed above.	2
7.2.3	Identify positive and negative feedback, list the advantages and disadvantages of each and describe their applications.	2
7.2.4	Identify the cause of oscillation in an amplifier.	2
7.3	**Practical Transistorised Circuits**	
7.3.1	List the characteristics and describe the operation of the following devices: a. Complementary symmetry configuration b. Darlington pairs c. Push-pull amplifiers d. Cascade amplifier	2
	From given circuit diagrams, assess the serviceability of transistors and related devices.	2

7.4	**Multivibrators and Oscillators**	
7.4.1	Describe the operation and state the characteristics of the following types of multivibrators: a. Astable or free running. b. Bistable or flip flop. c. Monostable or one shot.	2
7.4.2	Identify and describe the operation of the following oscillators: a. Colpitts. b. Crystal. c. Hartley. d. Inductive capacitive (LC). e. Resistive capacitive (RC).	2
7.5	**Signal Processing Devices**	
7.5.1	Explain the basic operation and uses of the following processing devices: a. Demodulators b. Limiters c. Modulators d. Summing networks or points	3
7.6	**Printed Circuit Boards**	
7.6.1	Describe the construction, use, maintenance and testing of printed circuit boards.	2
7.6.2	Outline typical installation and removal procedures for printed circuit boards.	2
7.6.3	Diagnose common defects found in printed circuit boards.	3
7.6.4	Diagnose faults using circuit diagrams.	3

8	**Digital Techniques**	
8.1	**Digital Arithmetic Computation**	
8.1.1	Describe and compare the binary and decimal numbering systems.	2
8.1.2	Convert decimal into binary and vice versa.	2
8.1.3	Calculate the addition of two or more binary numbers.	2
8.1.4	Convert decimal into octal and hexadecimal, and vice versa.	2
8.1.5	Show addition and subtraction in a binary coded decimal (BCD) and hexadecimal form.	2
8.2	**Logic Gates and Circuits**	
8.2.1	Distinguish between: a. logic circuits. b. linear circuits.	2
8.2.2	Evaluate logic diagrams.	3
8.3	**Flip Flop Terminology, Operation and Application**	
8.3.1	In relation to flip flops, define the following: a. Asynchronous input b. Maximum clocking frequency c. Propagation delay d. Set-up and hold times e. Synchronous input f. Transition (positive and negative) g. Toggling	2
8.3.2	Identify the symbols used to indicate clocked inputs and negative going transition.	2
8.3.3	Describe the operation of and identify the symbols and truth tables for the following types of flip flops: a. D b. JK c. SC or RS	2
8.3.4	Describe the operation of digital: a. counters (including synchronous and semi-synchronous) b. data storage devices. c. shift registers.	2
8.3.5	In relation to serial and parallel data transfer: a. describe how each is generated and transferred from one to the other (UART). b. describe the uses; and list the advantages and disadvantages of each.	2

8.4	**Encoders and Decoders**	
8.4.1	Specify the operation and uses of encoders and decoders.	2
8.4.2	Identify the following types of encoders and decoders: a. binary coded decimal (BCD) to decimal or (4 to 10). b. decimal to BCD. c. binary to octal or (1 to 8). d. octal to binary or (8 to 3). e. hex to binary. f. binary to hex. g. decimal to binary. h. binary to decimal. i. priority encoders.	2
8.5	**Displays**	
8.5.1	Describe the operation of the following types of displays: a. Gas discharge. b. Light emitting diodes (LED). c. Liquid crystal. d. Plasma displays	2
8.5.2	Describe the operation and use of a typical BCD to decimal and BCD to seven segment decoder drivers.	2

9	Computers and Electronic Devices	
9.1	**Data Conversion**	
9.1.1	In relation to analogue to digital and digital to analogue converters, be able to: a. define terminology relating to them. b. describe the operation and limitations of various types. c. state their inputs, outputs and factors affecting them. d. state their purpose and function.	2
9.2	**Computer Related Terminology**	
9.2.1	Define the following terms: a. Accumulator b. Address c. Assembly language programme d. Bit e. Byte f. CPU (Central Processor Unit) g. Firmware h. Instruction i. Instruction word j. Label k. Language l. Machine language m. Mnemonic n. Op code o. Operand p. Software q. Word	2
9.3	**Microprocessors**	
9.3.1	List the functions performed and overall operation of a microprocessor.	1
9.4	**Basic Microcomputers**	
9.4.1	Outline the layout, basic operation and interfacing of the major components of a microcomputer including their associated bus system.	2
9.4.2	Explain the information contained in single and multi address instruction words.	2

9.5	**Memory Devices**	
9.5.1	Define the following memory associated terms: a. Access time. b. Capacity c. Cycle time d. Memory cell e. Memory word f. Read operation g. Write operation h. RAM i. ROM j. PROM k. EPROM l. Volatile m. Non-volatile	2
9.5.2	Describe the operation of a typical memory device during READ and WRITE operations.	2
9.5.3	Define the following terms associated with the operation of PROMs: a. Burning. b. Erased. c. Non-volatile.	2
9.5.4	Describe the operation of the chip select line in order to perform the read operation.	2
9.5.5	Describe: a. the difference between static and dynamic RAMs. b. advantages and disadvantages between static and dynamic RAMs. c. the use and operation of RAMs. d. the reasons for dynamic RAM refreshing and how this is accomplished.	2
9.6	**Multiplexers, Demultiplexers and Tristate Devices**	
9.6.1	Describe the principles of time and frequency division multiplexing.	2
9.6.2	Specify the uses and operation of: a. multiplexers. b. demultiplexers. c. tristate devices.	2
9.6.3	Identify their symbols and logic diagrams.	2
9.7	**Codes**	
9.7.1	Describe the following codes and be able to convert binary and decimal numbers into them: a. BCD b. Grey	2
9.7.2	Outline the structure and uses of the ASCII code.	2
9.7.3	Describe the parity method of error detection.	2

9.8	**Electrostatic Sensitive Devices (ESD)**	
9.8.1	Specify the sources of ESD and the damage that can occur.	2
9.8.2	Describe the special handling, identification packaging and protection requirements.	2
9.8.3	Identify ESD sensitive devices.	2
9.8.4	Identify dangerous situations for generating static charge build-ups.	2
9.8.5	Describe component and personal anti-static protection devices.	2
9.9	**Electromagnetic Environment**	
9.9.1	Describe the following phenomena on maintenance practices for electrical systems: a. EMC - Electromagnetic Compatibility b. EMI - Electromagnetic Interference c. HIRF - High Intensity Radiated Field d. Lightning and lightning protection	2
9.10	**Data Buses**	
9.10.1	Describe the operation of different data bus systems as they apply to aircraft avionic systems. These systems include but not limited to the following: a. ARINC 429 b. ARINC 629 c. ASCB (Avionics Standard Data Bus) d. CSBD (Commercial Standard Data Bus) e. MIL-STD 1553 f. MIL-STD 1773 g. Either net local area network h. Token ring local area network	2

9.11	**Optical Theory and Fibre Optics**	
9.11.1	Compare the advantages and disadvantages of fibre optical data transmission over electrical wire.	2
9.11.2	Define the following terms and effects relating to fibre optics: a. Absorption b. Active medium c. Black body d. Coherent bundle e. Coherent light f. Diffraction g. Dispersion h. Flux rise time i. Multimode fibres j. Optical attenuators k. Two state modulation	2
9.11.3	Describe procedures and safety precautions to be observed during optical fibre cable terminations with particular regard to the following: a. Cleaving b. Stripping c. Splicing d. Termination losses	2
9.11.4	Describe the following devices: a. Couplers b. Control terminals c. Remote terminals	2
9.11.5	Describe optical fibre data bus transmissions - transmissions and receiving of information.	2
9.11.6	Define what is meant by a “Collimated Light Source”, when this light source would be used, and the advantages of using one.	1
9.11.7	Describe the following topology: a. Passive star b. Active star c. Transmissive star	2
9.11.8	Specify the application of fibre optics in aircraft systems.	2
9.12	**Software Management Control**	
9.12.1	Specify the design requirements for aircraft software.	2
9.12.2	Specify the necessary restrictions, airworthiness requirements and possible catastrophic effects of unapproved modifications or alterations to manufacturer’s software programmes.	2

10	Master and Central Warning Systems	
10.1.1	Describe the operation and indications (oral and visual) provided by typical master and central warning systems including inputs, output warnings and priority philosophy.	2
10.1.2	Describe the layout and location of a typical annunciator panel.	2
10.1.3	Identify the units and systems that would typically be monitored by a central warning system.	3

11	Electrical Diagrams and Identification Schemes	
11.1.1	Understand thoroughly the symbols, terminology, coding systems and other information contained on a: a. circuit diagram. b. wiring diagram. c. routing chart.	3
11.1.2	Describe the operating mode (or state) that relays or contactors would normally be shown in on a circuit diagram.	3
11.1.3	Interpret the data contained in ATA 100 codes for cable installations.	3

12	Soldering	
12.1.1	Explain the chemical combination of solder and the effect that varying the tin/lead content has on the melting point.	3
12.1.2	Describe the types, uses and purpose of flux and the reason why flux must be removed after soldering.	2
12.1.3	Define tinning. Describe the result excessive tinning has on wire; state the tool used to prevent it and why soldering iron tips are tinned.	2
12.1.4	Define the differences between soft and silver soldering and know the advantage of using either.	2
12.1.5	Identify cold joints.	3
12.1.6	Describe the reasons for and the uses of heat sinks, thermal shunts and solder removing devices (suckers, braid).	2
12.1.7	Describe the correct amount of wrapping to be used on various types of terminals.	2
12.1.8	Describe the maintenance of soldering irons and soldering tools.	2

13	Cable Connection	
13.1.1	Be able to identify the various aspects of an electrical connector by its identification code.	2
13.1.2	Describe the components of a typical British type plug and socket assembly.	3
13.1.3	Describe the following American type connectors and where each would typically be used: a. Bulkhead receptacle b. Cable receptacle c. Box receptacle d. Quick disconnect plug e. Straight plug f. Bulkhead plug	2
13.1.4	Describe the methods used and precautions associated with attaching connectors to coaxial cables.	2
13.1.5	Describe the procedure for the complete replacement of an electrical connector. List the tools required (removal/insertion tools and/or appropriate soldering tool).	2
13.1.6	Describe the “potting” technique for connector sealing.	2
13.1.7	Describe the following types of crimp end and give examples of where each may be used: a. Inline b. Lug c. Bayonet d. Twist joint e. Blind end f. Terminal	3
13.1.8	Describe the following factors relating to the identification of crimp joints: a. Colour code b. Identification marks c. Insulation grip d. Crimp form	2
13.1.9	Assess a crimped joint for serviceability.	3
13.1.10	Describe the following tests relating to crimp joints: a. Millivolt drop test b. Crimp pull test	2
13.1.11	Describe the use and precautions regarding hand operated crimping tools.	2
13.1.12	Describe the following factors relating to crimping tools: a. Types b. Colour codes c. Ratchet devices d. Jaws and chucks e. Testing f. Go and no-go gauges	2

13.1.13	Describe the use of copper and aluminium cable connections with particular regard to the following criteria: a. Interchangeability copper and aluminium b. Advantages and disadvantages of each type c. Corrosion protection of aluminium d. Pre Sealing e. Filling of the cartridge f. Use of flat washers for aluminium connections	2

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