WELCOME

The publishers of this Aviation Maintenance Technician Certification Series welcome you to the world of aviation maintenance. As you move towards EASA certification, you are required to gain suitable knowledge and experience in your chosen area. Qualification on basic subjects for each aircraft maintenance license category or subcategory is accomplished in accordance with the following matrix. Where applicable, subjects are indicated by an "X" in the column below the license heading.

For other educational tools created to prepare candidates for licensure, contact Aircraft Technical Book Company.

We wish you good luck and success in your studies and in your aviation career!

REVISION LOG

VERSION	EFFECTIVE DATE	DESCRIPTION OF CHANGE
001	2022 03	Module Creation and Release
001.1	2022 03	Label Correction for Figure 2-1; Page 2.2
001.2	2022 10	Inclusion of Measurement Standards for clarificaton, page iv. Enhanced or modified content within the following Sub-Modules: 12.9(A) - Moved content on emergency escape lighting from page 9.14 to 9.5. 12.13 - Expanded content on Wiper Systems. 12.14 - Expanded content on Emergency Pop-out Floats. 12.19 - Added section; Miscellaneous Information Systems.

MODULE EDITIONS AND UPDATES

ATB EASA Modules are in a constant state of review for quality, regulatory updates, and new technologies. This book's edition is given in the revision log above. Update notices will be available Online at www.actechbooks.com/revisions.html
If you would like to be notified when changes occur, please join our mailing list at www.actechbooks.com

MEASUREMENT STANDARDS

SI Units

Measurements in this book are presented with International System of Units (SI) standards in all cases except when otherwise specified by ICAO (for example, altitude expressed in feet or performance numbers as specified by a manufacturer). The chart below can be used should your studies call for conversions into imperial numbers.

Number Groups

This book uses the International Civil Aviation Organization (ICAO) standard of writing numbers. This method separates groups of 3 digits with a space, versus the European method by periods and the American method by commas. For example, the number one million is expressed as:

ICAO Standard	1 000 000
European Standard	1.000.000
American Standard	1,000,000

Prefixes

The prefixes in the table below form names of the decimal equivalents in SI units.

MULTIPLICATION FACTOR	PREFIX	SYMBOL
1 000 000 000 000 000 000 = 10^{18}	exa	E
1 000 000 000 000 000 = 10^{15}	peta	P
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto	h
10 = 10^{1}	deca	da
0.1 = 10^{-1}	deci	d
0.0 1 = 10^{-2}	centi	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	µ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

COMMON CONVERSIONS

IMPERIAL SYSTEM	TO	SI (METRIC)
Distance		
1 Inch	is equal to	2.54 Centimeters
1 Foot	is equal to	0.304 Meters
1 (Statute) Mile	is equal to	1.609 Kilometers
Weight		
1 Pound	is equal to	0.454 Kilograms
Volume		
1 Quart	is equal to	0.946 Liters
1 Gallon	is equal to	3.785 Liters
Temperature		
˚0 Fahrenheit	is equal to	(-)17.778 Celsius (˚C)
˚0 Fahrenheit	is equal to	255.37 Kelvin (K)
Area		
1 Square Inch	is equal to	6.451 Square Centimeters
1 Square Foot	is equal to	0.093 Square Meters
1 Square Mile	is equal to	2.59 Square Kilometers
Velocity		
1 Foot Per Second	is equal to	0.304 Meters Per Second
1 Mile Per Hour	is equal to	1.609 Kilometers Per Hour
1 Knot	is equal to	1.852 Kilometers Per Hour

SI (METRIC)	TO	IMPERIAL SYSTEM
Distance		
1 Centimeter	is equal to	0.394 Inches
1 Meter	is equal to	3.28 Feet
1 Kilometer	is equal to	0.621 Miles
Weight		
1 Kilogram	is equal to	2.204 Pounds
Volume		
1 Liter	is equal to	1.057 Quarts
1 Liter	is equal to	0.264 Gallons
Temperature		
˚0 Celsius (˚C)	is equal to	33.8˚ Fahrenheit
˚0 Kelvin (K)	is equal to	(-)437.87 Fahrenheit
Area		
1 Square Centimeter	is equal to	0.155 Square Inches
1 Square Meter	is equal to	10.764 Square Feet
1 Square Kilometer	is equal to	0.386 Square Miles
Velocity		
1 Meter Per Second	is equal to	3.281 Feet Per Second
1 Kilometer Per Hour	is equal to	0.621 Miles Per Hour
1 Kilometer Per Hour	is equal to	0.540 Knots

Pressure		
pounds per square inch (psi)	kiloPascals (kPa)	6.895
pounds per square inch (psi)	Pascals (Pa)	6 895

- Batteries not having an airworthiness certificate when used in ELTs should be replaced or recharged when 50% of their useful life has expired.
- The battery useful life (or charge) criteria in (1) and (2) do not apply to batteries (such as water activated batteries) that are essentially unaffected during storage intervals.

The new expiration date for a replaced (or recharged) battery should be legibly marked on the outside of the equipment.

Types of ELTs
The ELT device must be one of the following:
- Automatic Fixed (ELT-AF). An automatically activated ELT that is permanently attached to an aircraft and is designed to aid search and rescue teams in locating the crash site.
- Automatic Portable (ELT-AP). An automatically activated ELT, which is rigidly attached to an aircraft but is readily removable from the aircraft after a crash. It functions as an ELT during the crash sequence. If the ELT does not employ an integral antenna, the aircraft mounted antenna may be disconnected and an auxiliary antenna (stored in the ELT case) attached to the ELT. The ELT can be tethered to a survivor or a life raft.
- Automatic Deployable (ELT-AD). An ELT that is rigidly attached and that is automatically deployed and activated by an impact, or in some cases by water sensors. This type of ELT should float and is intended to aid search and rescue teams in locating the crash site. An ELT-AD may be either a stand alone beacon or an inseparable part of a deployable recorder.

To minimize the possibility of damage in the event of a crash, the automatic ELT should be rigidly fixed to the aircraft structure, as far aft as is practicable, with its antenna and connections arranged so as to maximize the probability of the signal being transmitted after a crash.

EMERGENCY LIGHTING AND MARKING
Helicopters with a Maximum Operational Passenger Seating Configuration of more than 19 shall be equipped with an emergency lighting system having an independent power supply to provide a source of cabin illumination to facilitate the evacuation of the helicopter, and emergency exit markings and location signs visible in either daylight, or in the dark. Additional information on emergency lighting is given in *Sub-Module 08*.

SUPPLEMENTAL OXYGEN
For some helicopters supplemental oxygen equipment may be required. The EASA requirement for supplemental oxygen is that non-pressurized helicopters operated at pressure altitudes above 10 000 ft shall be equipped with supplemental oxygen equipment capable of storing and dispensing the oxygen supplies.

Determination Of Oxygen
The amount of supplemental oxygen for sustenance for a particular operation should be determined on the basis of flight altitudes and flight duration, consistent with the operating procedures, including emergency procedures, established for each operation and the routes to be flown as specified in the operations manual. ***Table 9-2*** is given for use in complex non-pressurized helicopters.

SUPPLY FOR	DURATION AND CABIN PRESSURE ALTITUDE
1. Occupants of flight crew compartment seats on flight crew compartment duty and crew members assisting flight crew in their duties.	The entire flying time at pressure altitudes above 10 000 ft.
2. Required cabin crew members.	The entire flying time at pressure altitudes above 13 000 ft and for any period exceeding 30 minutes at pressure altitudes above 10 000 ft but not exceeding 13 000 ft.
3. Additional crew members and 100 % of passengers(1).	The entire flying time at pressure altitudes above 13 000 ft.
4. 10% of passengers(1).	The entire flying time after 30 minutes at pressure altitudes above 10 000 ft but not exceeding 13 000 ft.
(1) Passenger numbers in Table 1 refer to passengers actually carried onboard including persons younger than 24 months.	

Table 9-2. EASA table for complex non-pressurized helicopters.

SEATS, HARNESSES, AND BELTS

SEATS
The manufacturer's seats must adhere to specific rules to receive certification from the regulatory authority. Indeed, this authority must equally approve the interior layouts of the cabin or the cargo holds of a helicopter. Each seat has a use-by date defined during the initial

WIPER SYSTEMS

Small helicopters have acrylic windshields that are easy to scratch, so windshield wipers are not used. Instead, rain is prevented from obstructing visibility by keeping the windshield waxed with a good grade of paste wax. Water does not spread out on the waxed surface, but balls up and is blown away by the propeller blast.

On larger helicopters, rain removal systems are used to keep the windshield free of water so the pilot can see during the approach and to maneuver the aircraft safely on the ground.

MECHANICAL WIPER SYSTEMS

Mechanical systems use windshield wipers similar to those on automobiles except that they are built to withstand the high air loads caused by the rotors and speed of the aircraft. (***Figure 13-23*** and ***Figure 13-24***)

ELECTRICAL WIPER SYSTEMS

In an electrical windshield wiper system, the blades are driven by an electric motor(s) that receives power from the aircraft electrical system.

WASH/WIPE SYSTEMS

A Windshield Wash/Wipe System is designed to clear accumulations of water, snow, slush, insects, dirt, sand, dust and/or salt spray from the aircraft windshield. A wash assembly is dedicated to supplying a sufficient quantity of cleaning liquid to the windshield, as needed, to aid the wiping system's cleaning of the windshield in the event of external contamination during flight.

In this example, shown in ***Figure 13-25*** the washing system is combined to the wiping system. It comprises of a washing pump, a refillable wash fluid storage reservoir fitted with a vent and containing a fluid low level sensor. Wash fluid is transferred from the pump to the wiper blades through a single flexible fluid distribution line which splits into two, one for each wiper blade. A refill connector is provided to refill the fluid in the reservoir. It comprises a self-sealing quick disconnect fitting with an attached dust cap and is connected to the vented reservoir via a pipe.

Figure 13-23. Eurocopter AStar 350 windshield wiper motor.

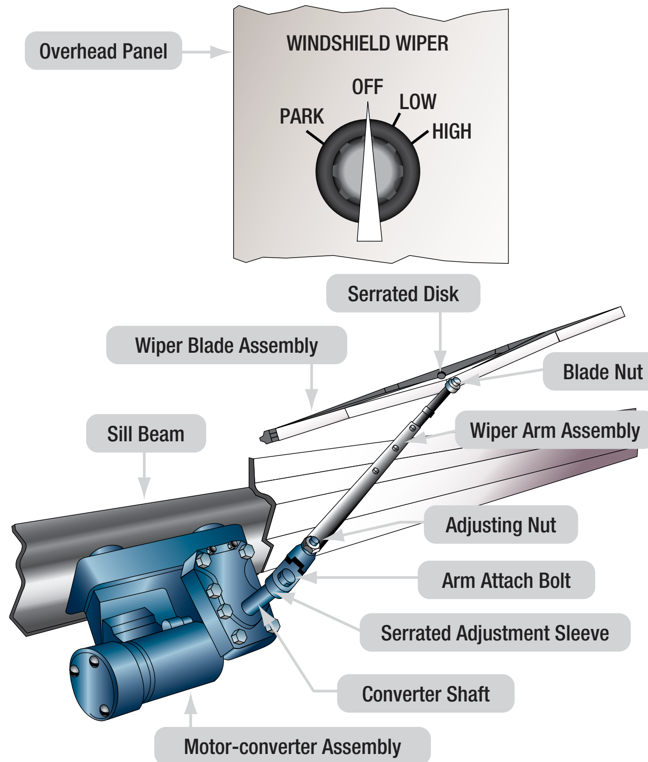

Figure 13-24. Windshield wiper assembly/installation. The motor/converter is mounted under the helicopter skin.

Maintenance performed on wiper systems consists of operational checks, adjustments, and troubleshooting. An operational check should be performed whenever a system component is replaced or whenever the system is suspected of not working properly. During the check, make sure that the windshield area covered by the wipers is free of foreign matter and is kept wet with water. Adjustment of a windshield wiper system consists of adjusting the wiper blade tension, the angle at which the blade sweeps across the windshield, and proper parking of the wiper blades.

Figure 13-25. An advanced helicopter wash/wipe system by Aerosystems.it depicting dual washer/wiper arms.

Skid and Wheels
To move the helicopter on the ground, additional wheels can be installed and used by the technician, or the helicopter can land on a cart that can be moved electrically to move the helicopter in and out of the hangar. (***Figure 14-125***)

Figure 14-125. Wheels on skids.

FLOATS
There are two main types of flotation systems available:
- Fixed Utility Floats
- Emergency Pop-Out Floats

Each type has a very different purpose and depending on what the helicopter operator requires will depend on which type of flotation system is installed.

Fixed Utility Floats
Utility floats are fitted to an aircraft when work over water or swampy areas requires the temporary use of floats. These floats are designed to allow the aircraft to land and shut down without the chance of the helicopter overturning. These floats are easily filled using a simple air pump with pressure relief valves to prevent over pressurization when altitude or temperature changes.

Although fixed utility floats are great for specialized work, depending on the model they can limit the speed of the helicopter and the weight it can carry inside. Sling loads are prohibited from being carried on the belly hook while they are fitted. Fixed floats may be of the skid-on-float or the float-on-skid design. (***Figure 14-126***)

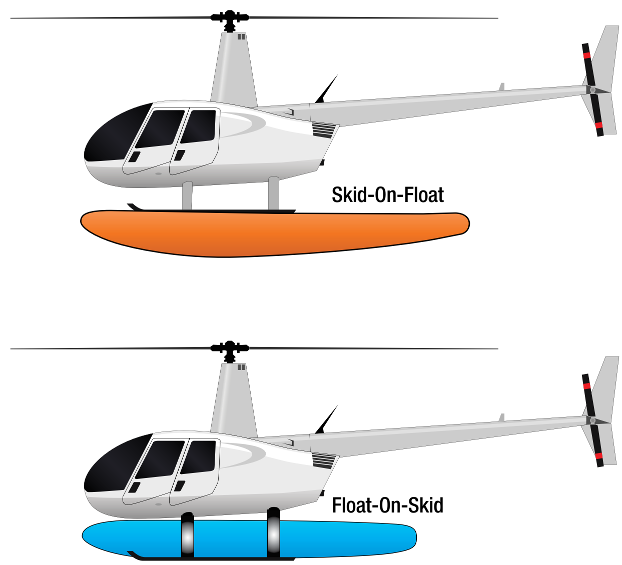

Figure 14-126. Fixed floats on a helicopter.

A skid-on-float landing gear has no rigid structure in or around the float. The float rests on the hard surface and supports the weight of the helicopter. With this type, be aware of differences in float pressure. While the pressures are usually low, a substantial difference can cause the helicopter to lean while on a hard surface making it more susceptible to dynamic rollover.

A float-on-skid landing gear has modified skids that support the weight of the helicopter on hard surfaces. The floats are attached to the top of the skid and only support the weight of the helicopter in water. A float with low pressure or one that is completely deflated will not cause any stability problems on a hard surface.

Emergency Pop-Out Floats
The second kind of system that allows helicopters to land on water is the emergency pop-out flotation kits. These kits are like airbags in a car. The deflated airbags are tucked away in interior compartments or exterior pouches and are connected to a gas bottle (generally compressed nitrogen or helium) and a firing system. The system consists of two or more floats with one or more individual compartments per float, depending on the size of the helicopter. (***Figure 14-127***)

In case of an emergency landing on water the pilot can either arm the system so that the detection of water automatically inflates the airbags, or activate the inflation via a button on the collective or cyclic controls. When the system activates, a valve opens on the pressurization bottle and the gas rapidly fills the airbags.

Figure 14-127. Emergency pop-out floats on a helicopter.

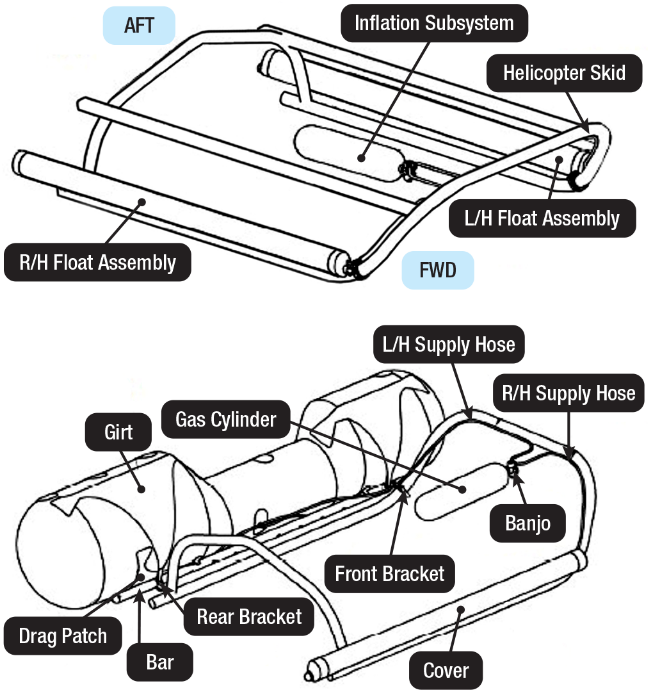

Figure 14-128. A drawing of two symmetrical floats to give buoyancy in emergencies.

Just like with fixed utility floats, each individual airbag is made up of two chambers. If one chamber develops a leak, the other chamber will prevent that part of the helicopter from sinking.

Because of the narrow width between the floats, it is not uncommon for a helicopter to overturn, especially in rough water. The whole purpose of the pop-out float system is to provide time for the occupants to escape. With luck and in calm water, and if the helicopter remains upright it may be possible for a recovery of the aircraft to take place.

When the inflation subsystem is activated, gas contained in the cylinder is freed and the floats inflate. The pressure in the floats opens the covers assemblies and the floats continue to inflate until they take their final shape.

In the ***Figure 14-128*** drawing are two symmetrical floats to give buoyancy. Each float is attached by textile girts to a metallic bar which is attached to the helicopter skid. A helium filled cylinder fixed by a banjo style mounting. The cylinder is fitted with an inflation valve which opens rapidly when electrical power is applied to an electrical fuse disc. The cylinder is connected to the floats by couplings and supply hose assemblies.

Some more details on floats are given in *Sub-Module 12.09(b) - Emergency Flotation Systems*.

MISCELLANEOUS INFORMATION SYSTEMS

New information systems are introduced from time to time, and improvements to current systems are constantly being developed. Whether the information is used by the flight crew, by maintenance personnel, or any other user, the basics of an information system are the same:

- Each system contains digital memory to store the desired information.
- There is a set of user controls, which allow the user to locate and retrieve the information.
- There must also be a means of displaying the information to the user.
- The system must have a means to update the information, to ensure that the most up-to-date version is being used.

These will be the core features that are present in any information system. When compared with previous kinds of information systems, an electronic information system provides the advantages of reduced weight, reduced bulk, and ease of update.