

## AERONAUTICAL CIRCULAR CIVIL AVIATION AUTHORITY – MACAO, CHINA

**SUBJECT:** Low Visibility Operations

**EFFECTIVE DATE:**

15 November 2016

**CANCELLATION:**

AC/OPS/031R00

**GENERAL:**

The President of Civil Aviation Authority – Macao, China, in exercise of his power under Paragraph 89 of the Air Navigation Regulation of Macao (ANRM) and Article 35 of the Statutes of Civil Aviation Authority, approved by the Decree-Law 10/91/M, established this AC.

### 1 Introduction

- 1.1 ANRM Part V Paragraph 28 (3) states the requirements specified in Part D of the Ninth Schedule in respect of the Aerodrome operating minima and meteorological conditions required for take-off, approach and landing shall be complied with in respect of every aircraft to which Paragraph 24 of the ANRM applies.
- 1.2 ANRM Part I Paragraph 2 states that the Aerodrome Operating Minima means the limits of usability of an aerodrome for: (a) take-off, expressed in terms of runway visual range and/or visibility and, if necessary, cloud conditions; (b) landing in 2D instrument approach operations, expressed in terms of visibility and/or runway visual range, minimum descent altitude/height (MDA/H) and, if necessary, cloud conditions; and (c) landing in 3D instrument approach operations, expressed in terms of visibility and/or runway visual range and decision altitude/height (DA/H) as appropriate to the type and/or category of the operation.
- 1.3 Paragraph 2.1.40 of Appendix 2 to Aeronautical Circular No. AC/OPS/002 states that the operations manual shall contain instructions and training requirements for the use of head-up displays (HUD) and enhanced vision systems (EVS) equipment as applicable.

- 1.4 Paragraph 2.3.5 of Appendix 2 to Aeronautical Circular No. AC/OPS/002 states that the operations manual shall contain instruction for determining aerodrome operating minima for instrument approaches using HUD and EVS.
- 1.5 Paragraph 26 of Appendix 1 to Aeronautical Circular No. AC/OPS/002 states that operators wishing to operate Low Visibility Operations shall pursue the approval process and regulatory requirements set forth in this AC for the issuance of LVO operational approval.
- 1.6 Paragraph 32.2 of Appendix 1 to Aeronautical Circular No. AC/OPS/002 states that when operators wish to use HUD and/or EVS to gain operational benefit, such as operating in visibilities lower than the normal aerodrome operating minima or heliport operating minima, approval must be obtained from AACM in writing prior to the use of such systems. To support such approval, the instructions and training requirements, and also the instructions for determining the aerodrome operating minima or heliport operating minima for instrument approaches using HUD and EVS shall be included in the operations and/or training manuals.
- 1.7 The purpose of this AC is to establish the requirements for Low Visibility Operations (LVO) including Category II, Category III, and Low Visibility Take-Off operations.

## 2 Applicability

This AC is applicable to operators of Macao registered aeroplanes flying for the purpose of commercial air transport, who intend to conduct Low Visibility Operations. Operators in possession of LVO operations approval prior to the effective date of this AC shall review this AC and ensure their operations are in compliance with the requirements contained herein.

## 3 Definitions

Terms and abbreviations in the context of this AC have the following meaning:

**Alert Height (AH).** The alert height is a specific radio height, based on the characteristics of the aeroplane and its fail-operational landing system.

**Category II (CAT II) Operation.** An instrument approach operation with a decision height lower than 60 m (200 ft), but not lower than 30 m (100 ft) and a runway visual range not less than 300 m.

**Category IIIA (CAT IIIA) Operation.** An instrument approach operation with a decision height lower than 30 m (100 ft) or no decision height and a runway visual range not less than 175 m.

**Category IIIB (CAT IIIB) Operation.** An instrument approach operation with a decision height lower than 15 m (50 ft), or no decision height and a runway visual range less than 175 m but not less than 50 m.

**Category IIIC (CAT IIIC) Operation.** An instrument approach operation with no decision height and no runway visual range limitations.

**Enhanced Vision System (EVS).** Enhanced vision system means a system to display electronic real-time images of the external scene achieved through the use of image sensors.

**Fail-Passive Flight Control System.** A flight control system is fail-passive if, in the event of a failure, there is no significant out-of-trim condition or deviation of flight path or attitude but the landing is not completed automatically. For a fail-passive automatic flight control system the pilot assumes control of the aeroplane after a failure.

**Fail-Operational Flight Control System.** A flight control system is fail-operational if, in the event of a failure below alert height, the approach, flare and landing, can be completed automatically. In the event of a failure, the automatic landing system will operate as a fail-passive system.

**Fail-Operational Hybrid Landing System.** A system which consists of a primary fail-passive automatic landing system and a secondary independent guidance system enabling the pilot to complete a landing manually after failure of the primary system.

**Head-up Display (HUD).** Head-up display means a display system that presents flight information into the pilot's forward external field of view.

**Head-up Display Landing System (HUDLS).** The total airborne system which provides head-up guidance to the pilot during the approach and landing and/or go-around. It includes all sensors, computers, power supplies, indications and controls. A HUDLS is typically used for primary approach guidance to decision heights of 50 ft.

**Hybrid Head-up Display Landing System (Hybrid HUDLS).** A system which consists of primary fail-passive automatic landing system and a secondary independent HUD/HUDLS enabling the pilot to complete a landing manually after failure of the primary system.

**Low Visibility Procedures (LVP).** Procedures applied at an aerodrome for the purpose of ensuring safe operation during Category II and III approaches, and Low Visibility Take-Offs.

**Low Visibility Take-Off (LVTO).** A take-off where the runway visual range (RVR) is less than 400 m.

## 4 General Requirements

### 4.1 Low Visibility Operations – Co-ordination Requirements

In establishing the aerodrome operating minima an operator must take full account of:

- a) the type, performance and handling characteristics of the aeroplane;
- b) the composition of the flight crew, their competence and experience;
- c) the dimensions and characteristics of the runways which may be selected for use;
- d) the adequacy and performance of the available visual and non-visual ground aids;

- e) the equipment available on the aeroplane for the purpose of navigation and/or control of the flight path, as appropriate, during the take-off, the approach, the flare, the landing, roll-out and the missed approach;
- f) the obstacles in the approach, missed approach and the climb-out areas required for the execution of contingency procedures and necessary clearance;
- g) the obstacle clearance altitude/height for the instrument approach procedures;
- h) the means to determine and report meteorological conditions; and
- i) the flight technique to be used during the final approach.

#### 4.2 Low Visibility Operations – Flight Crew Training

An operator shall ensure that, prior to conducting Low Visibility Take-off, Category II or Category III operations:

- a) Each flight crew member:
  - i) completes the training and checking requirements prescribed in Paragraph 6 including flight simulator training in operating to the limiting values of RVR and decision height appropriate to the operator's approval;
  - ii) meets the recency requirements specified in Paragraph 6; and
  - iii) is qualified in accordance with Paragraph 6;
- b) The training and checking is conducted in accordance with a detailed syllabus approved by the AACM and included in the Operations Manual; and
- c) The flight crew qualification is specific to the operation and the aeroplane type. The operator shall document these qualifications in a manner acceptable to the AACM.

#### 4.3 Low Visibility Operations – Operating Procedures

- a) An operator must establish procedures and instructions to be used for Low Visibility Take-Off, Category II and Category III operations. These procedures must be included in the Operations Manual and contain the duties of flight crew members during taxiing, take-off, approach, flare, landing, roll-out and missed approach as appropriate.
- b) The Pilot-in-Command (PIC) shall satisfy himself/herself that:
  - i) The status of the visual and non-visual facilities is sufficient prior to commencing a Low Visibility Take-Off, a Category II or III approach;
  - ii) Appropriate LVPs are in force according to information received from Air Traffic Services, before commencing a Low Visibility Take-Off, or a Category II or III approach; and

- iii) The flight crew members are properly qualified prior to commencing a Low Visibility Take-Off, a Category II or III approach.

#### 4.4 Low Visibility Operations – Aerodrome considerations

- a) An operator shall not use an aerodrome for Category II or III operations unless the aerodrome is approved for such operations by the State in which the aerodrome is located.
- b) An operator shall verify that LVPs have been established, and will be enforced, at those aerodromes where low visibility operations are to be conducted.

#### 4.5 Low Visibility Operations – Certification and Authorization

- a) An operator shall not conduct Category II or Category III operations unless:
  - i) each aeroplane concerned is certificated for operations with decision heights below 200 ft, or no decision height, and equipped in accordance with Paragraph 5 on low visibility operations or an equivalent accepted by the AACM;
  - ii) a suitable system for recording approach and/or automatic landing success and failure is established and maintained to monitor the overall safety of the operations;
  - iii) the operations are approved by the AACM;
  - iv) the flight crew consists of at least two pilots; and
  - v) decision height is determined by means of a radio altimeter.
- b) An operator shall not conduct Low Visibility Take-Offs operations unless approved by the AACM.

#### 4.6 Low Visibility Operations – Minimum Equipment

- a) An operator must include in the Operations Manual, where applicable, the minimum equipment that has to be serviceable at the commencement of a Low Visibility Take-Off, a Category II or III approach in accordance with the Aircraft Flight Manual (AFM) or other approved document.
- b) The Pilot-in-Command shall satisfy himself/herself that the status of the aeroplane and of the relevant airborne systems is appropriate for the specific operation to be conducted.

## 5 The Aeroplane

### 5.1 The Aeroplane

- a) The requirements to be met for the certification of Macao registered aeroplanes for Category II and III operations are specified in FAR-25 or EASA CS-25/CS-AWO.

### 5.2 In Service Proving

- a) The operator should carry out a proving programme to demonstrate that, in line service, the performance and reliability of the aeroplane and its systems meet the criteria on which the airworthiness certification was based. For aeroplanes registered in Macao, this programme should be agreed in detail with the AACM before it commences.

### 5.3 Airborne Equipment

The following items of equipment will be required for operations to the decision heights specified unless it is shown that the intended level of safety is achieved with alternative equipment or the deletion of some items.

- a) Category II

- i) Autopilot with ILS coupling mode.

*Note: A flight director system (head up or down) with an ILS coupling mode may be approved for use following failure or disconnect of the autopilot.*

- ii) Autothrust, unless it can be shown that speed control does not add excessively to the crew work load.
- iii) Radio altimeter.
- iv) Excess ILS deviation warnings.

- b) Category IIIA

- i) Equipment required in 5.3 a) above.
- ii) Autopilot with an automatic landing mode.

- c) Category IIIB

- i) Equipment required in 5.3 a) i), 5.3 a) iii), and 5.3 a) iv).
- ii) Autothrust.
- iii) Autopilot with a fail-operational automatic landing system and an automatic missed approach mode.

- d) Category IIIC

- i) Equipment required in 5.3 a) i), 5.3 a) iii), and 5.3 a) iv).
- ii) Equipment required in 5.3 c) ii) and 5.3 c) iii).
- iii) Autopilot with a fail-operational ground roll mode.
- iv) Anti-skid braking system, as required by the aircraft certification.

- e) Aeroplane Categories – Low Visibility Operations

- i) Classification of aeroplanes

The criteria taken into consideration for the classification of aeroplanes by categories is the indicated airspeed at threshold ( $V_{AT}$ ) which is equal to the stalling speed ( $V_{SO}$ ) multiplied by 1.3 or 1G stall speed ( $V_{S1G}$ )

multiplied by 1.23 in the landing configuration at the maximum certified landing mass. If both  $V_{SO}$  and  $V_{SIG}$  are available, the higher resulting  $V_{AT}$  shall be used. The aeroplane categories corresponding to  $V_{AT}$  values are in the table below:

Aeroplane Category	$V_{AT}$ (IAS)
A	Less than 91 kt
B	91 kt or more but less than 121 kt
C	121 kt or more but less than 141 kt
D	141 kt or more but less than 166 kt
E	166 kt or more but less than 211 kt

The landing configuration which is to be taken into consideration shall be defined by the operator or by the aeroplane manufacturer.

- ii) Permanent change of category (maximum certified landing mass)
  - (a) An operator may impose a permanent, lower, landing mass, and use this mass for determining the  $V_{AT}$  if approved by the AACM.
  - (b) The category defined for a given aeroplane shall be a permanent value and thus independent of the changing conditions of day-to-day operations.

## 6 Flight Crew Training

### 6.1 General

An operator must ensure that flight crew member training programme for low visibility operations include structured courses of ground, flight simulator and/or flight training. The operator may abbreviate the course content as prescribed by Paragraphs 6.1 b) and 6.1 c) below provided the content of the abbreviated course is acceptable to the AACM.

- a) Flight crew members with no Category II or Category III experience must complete the full training programme prescribed in Paragraphs 6.2, 6.3 and 6.4 below.
- b) Flight crew members who have been previously qualified in accordance with training programme approved based on this AC and with Category II or Category III experience with a similar type of operation (auto-coupled/auto-land, HUDLS/Hybrid HUDLS or EVS) or Category II with manual land if appropriate may undertake an:
  - i) abbreviated ground training course if operating a different type/class from that on which the previous Category II or Category III experience was gained;



- ii) abbreviated ground, flight simulator and/or flight training course if operating the same type or class and variant of the same type or class on which the previous Category II or Category III experience was gained. The abbreviated course is to include at least the requirements of Paragraphs 6.4 a), 6.4 b) i) or 6.4 b) ii) as appropriate and 6.4 c) i). With the approval of the AACM, the operator may reduce the number of approaches/landings required by Paragraph 6.4 b) i) if the type/class or the variant of the type or class has the same or similar properties including:
- (a) level of technology – flight control/guidance system;
  - (b) operator procedures;
  - (c) handling characteristics (See Paragraph 6.1 d) below);
  - (d) use of HUDLS/hybrid HUDLS; and
  - (e) use of EVS;
- as the previously operated type or class, otherwise the requirement of 6.4 b) i) has to be met in full.
- c) Flight crew members with Category II or Category III experience with the operator may undertake an abbreviated ground, flight simulator and/or flight training course.
- The abbreviated course when changing:
- i) aeroplane type/class is to include at least the requirements of Paragraphs 6.4 a), 6.4 b) i) or 6.4 b) ii) as appropriate and 6.4 c) i);
  - ii) to a different variant of aeroplane within the same type or class rating that has the same or similar properties, as stated in Paragraph 6.1 b) ii) (a) to (e), as the previously operated type or class, then a difference course or familiarisation appropriate to the change of variant fulfils the abbreviated course requirements;
  - iii) to a different variation of aeroplane within the same type or class rating that has a significantly different properties, as stated in Paragraph 6.1 b) ii) (a) to (e), then the requirements of Paragraphs 6.4 a), 6.4 b) i) or 6.4 b) ii) as appropriate and 6.4 c) i) shall be fulfilled. With the approval of the AACM the operator may reduce the number of approaches/landings required by Paragraph 6.4 b) i).
- d) An operator must ensure when undertaking Category II or Category III operations with different variant(s) of aeroplane within the same type or class rating that the differences and/or similarities of the aeroplanes concerned justify such operations, taking account at least the following:
- i) the level of technology, including the:
    - (a) flight control/guidance system and associated displays and controls;



- (b) the Flight Management System and its integration or not with the flight control/guidance system; and
- (c) use of HUD/HUDLS with hybrid systems and/or EVS.
- ii) operational procedures, including:
  - (a) fail-passive/fail-operational, alert height;
  - (b) manual landing/automatic landing;
  - (c) no decision height operations; and
  - (d) use of HUD/HUDLS with hybrid systems.
- iii) handling characteristics, including:
  - (a) manual landing from automatic HUDLS and/or EVS guided approach;
  - (b) manual go-around from automatic approach; and
  - (c) automatic/manual roll out.

## 6.2 Ground training

An operator must ensure (unless otherwise covered in its training syllabus) that the initial ground training course for low visibility operations covers at least:

- a) the characteristics and limitations of the ILS;
- b) the characteristics of the visual aids;
- c) the characteristics of fog;
- d) the operational capabilities and limitations of the particular airborne system to include HUD symbology and EVS characteristics, if appropriate;
- e) the effects of precipitation, ice accretion, low level wind shear and turbulence;
- f) the effect of specific aeroplane/system malfunctions;
- g) the use and limitations of RVR assessment systems;
- h) the principles of obstacle clearance requirements;
- i) recognition of the effect on minima caused by changes in the status of ground installations and action to be taken;
- j) the procedures and precautions to be followed with regard to surface movement during operations when the RVR is 400 m or less and any additional procedures required for take-off in conditions below 150 m (200 m for Category D aeroplanes);
- k) Emphasis should be placed on possible runway incursion during LVP taxiing. Details of LVP taxi procedures and knowledge of aerodrome lightings and stop-bar lightings etc. must be covered;

- l) the significance of decision heights based upon radio altimeters and the effect of terrain profile in the approach area on radio altimeter readings and on the automatic approach/landing system;
- m) the importance and significance of alert height, if applicable, and the action in the event of any failure above and below the alert height;
- n) the qualification requirements for pilots to obtain and retain approval to conduct Low Visibility Operations; and
- o) the importance of correct seating and eye position.

### 6.3 Flight simulator training and/or flight training

- a) An operator must ensure that flight simulator and/or flight training for low visibility operations includes:
  - i) checks of satisfactory function of equipment, both on the ground and in flight;
  - ii) effect on minima caused by changes in the status of ground installations;
  - iii) monitoring of automatic flight control systems and auto land status annunciators with emphasis on the action to be taken in the event of failures of such system;
  - iv) monitoring of HUD/HUDLS/EVS guidance status and annunciators as appropriate, to include head down displays;
  - v) actions to taken in the event of failures such as engines, electrical systems, hydraulics or flight control systems;
  - vi) the effect of known unserviceabilities and use of minimum equipment lists;
  - vii) operating limitations resulting from airworthiness certification;
  - viii) guidance on the visual cues required at decision height together with information on maximum deviation allowed from glide path or localiser; and
  - ix) the importance and significance of alert height if applicable and the action in the event of any failure above and below the alert height.
- b) An operator must ensure that its flight crew members are trained to carry out their duties and instructed on the coordination required with other crew members. Maximum use should be made of flight simulators.
- c) Training must be divided into phases covering normal operation with no aeroplane or equipment failures but including all weather conditions which may be encountered and detailed scenarios of aeroplane and equipment failure which could affect Category II or III operations. If the aeroplane system involves the use of hybrid or other special systems (such as HUD/HUDLS or enhanced vision equipment) then flight crew members

must practise the use of these systems in normal and abnormal modes during the flight simulator phase of training.

- d) Incapacitation procedures appropriate to Low Visibility Take-Offs and Category II and III operations shall be practised.
- e) For aeroplanes with no flight simulator available to represent that specific aeroplane, operators must ensure that the flight training phase specific to the visual scenarios of Category II operations is conducted in a specifically approved flight simulator. Such training must include a minimum of four approaches. The training and procedures that are type specific shall be practised in the aeroplane.
- f) Initial Category II and III training shall include at least the following exercises:
  - i) approach using the appropriate flight guidance, autopilots and control systems installed in the aeroplane, to the appropriate decision height and to include transition to visual flight and landing;
  - ii) approach with all engines operating, using the appropriate flight guidance systems, autopilots, HUDLS and/or EVS and control systems installed in the aeroplane down to the appropriate decision height followed by missed approach, all without external visual reference;
  - iii) where appropriate, approaches utilising automatic flight systems to provide automatic flare, landing and roll-out; and
  - iv) normal operation of the applicable system both with and without acquisition of visual cues at decision height.
- g) Subsequent phases of training must include at least:
  - i) approaches with engine failure at various stages on the approach;
  - ii) approaches with critical equipment failures (e.g. electrical systems, auto flight systems, ground and/or airborne ILS/MLS systems and status monitors);
  - iii) Approaches where failures of auto flight equipment and/or HUD/HUDLS/EVS at low level require either:
    - (a) reversion to manual flight to control flare, landing and roll out or missed approach; or
    - (b) reversion to manual flight or a downgraded automatic mode to control missed approaches from, at or below decision height including those which may result in a touchdown on the runway.
  - iv) failures of the systems which will result in excessive localiser and/or glide slope deviation, both above and below decision height, in the minimum visual conditions authorised for the operation; in addition, a continuation to a manual landing must be practised if a head up

display forms a downgraded mode of the automatic system or the head up display forms the only flare mode, and

- v) failures and procedures specific to aeroplane type or variant.
- h) The training programme must provide practice in handling faults which require a reversion to higher minima.
- i) The training programme must include the handling of the aeroplane when, during a fail-passive Category III approach, the fault causes the autopilot to disconnect at or below decision height when the last reported RVR is 300 m or less.
- j) Where take-offs are conducted in RVRs of 400 m and below, training must be established to cover systems failures and engine failure resulting in continued as well as rejected take-offs.
- k) The training programme must include, where appropriate, approaches where failures of the HUDLS and/or EVS equipment at low level require either:
  - i) reversion to head down displays to control missed approach; or
  - ii) reversion to flight with no, or downgraded, HUDLS guidance to control missed approaches from decision height or below, including those which may result in a touchdown on the runway.
- l) An operator shall ensure that when undertaking Low Visibility Take-Off, Category II and Category III operations utilising a HUD/HUDLS or hybrid HUD/HUDLS or an EVS, that the training and checking programme includes, where appropriate, the use of the HUD/HUDLS in normal operations during all phases of flight.

#### 6.4 Conversion

Conversion training requirements to conduct Low Visibility Take-Off, Category II and Category III Operations. An operator shall ensure that each flight crew member completes the following low visibility procedures training if converting to a new type/class or variant of aeroplane in which Low Visibility Take-Off, Category II and Category III Operations will be conducted. The flight crew member experience requirements to undertake an abbreviated course are prescribed in Paragraphs 6.1 b), 6.1. c) and 6.1. d) above.

- a) Ground Training. The appropriate requirements prescribed in Paragraph 6.2 above, taking into account the flight crew member's Category II and Category III training and experience.
- b) Flight simulator training and/or flight training.
  - i) A minimum of six (eight for HUDLS with or without EVS) approaches and/or landings in a flight simulator, including at least one go-around. The requirements for eight HUDLS approaches may be reduced to six when conducting hybrid HUDLS operations.

- ii) Where no flight simulator is available to represent that specific aeroplane, a minimum of three approaches (five for HUD and /or EVS) including at least one go-around is required on the aeroplane. For hybrid HUDLS operations a minimum of three approaches are required, including at least one go-around.
- iii) Appropriate additional training if any special equipment is required such as head up displays or enhanced vision equipment.
- c) Flight crew qualification. The flight crew qualification requirements are specific to the operator and the type of aeroplane operated.
  - i) The operator must ensure that each flight crew member completes a check before conducting Category II or III operations.
- d) Line flying under supervision. An operator must ensure that each flight crew member undergoes the following line flying under supervision (LFUS):
  - i) For Category II, a minimum of one autoland except that when a manual landing or HUDLS approach to touchdown is normally required in the Aircraft Flight Manual (AFM), a minimum of three landings from autopilot disconnect; or four landings with HUDLS used to touch down;
  - ii) For Category III, a minimum of two autolands.
  - iii) Flight crew member, trained and qualified in accordance with Paragraph 6.4 d) i) and ii) above, is qualified to operate during the conduct of LFUS to the lowest approved DA(H) and RVR as stipulated in the Operations Manual except that the first autoland is to be carried out in weather conditions at, or above, Category I minima.
  - iv) For Category III approaches using HUDLS to touchdown a minimum of four approaches.

#### 6.5 Type and command experience

- a) Before commencing Category II operations, the following additional requirements are applicable to PICs, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type/class:
  - i) 50 hours or 20 sectors on the type, including line flying under supervision; and
  - ii) 100 m must be added to the applicable Category II RVR minima when the operation requires a Category II manual landing or use of HUDLS to touchdown until:
    - (a) a total of 100 hours or 40 sectors, including LFUS has been achieved on the type; or
    - (b) a total of 50 hours or 20 sectors, including LFUS has been achieved on the type where the flight crew member has been

previously qualified in accordance with training programme approved based on this AC for Category II operations.

- b) Before commencing Category III operations, the following additional requirements are applicable to PICs, or pilots to whom conduct of the flight may be delegated, who are new to the aeroplane type:
  - i) 50 hours or 20 sectors on the type, including line flying under supervision; and
  - ii) 100 m must be added to the applicable Category II or Category III RVR minima unless he has previously qualified in accordance with training programme approved based on this AC for Category II or III operations, until a total of 100 hours or 40 sectors, including line flying under supervision, has been achieved on the type.
- c) For HUDLS operations the sector requirement in Paragraph 6.5 a) and 6.5 b) should always be applicable, the hours on type class does not fulfill the requirement.
- d) A reduction in the command requirements (mentioned in Paragraphs 6.5 a) and 6.5 b)) for flight crew who have previously had Category II or Category III acceptable flight crew experience may be considered.

#### 6.6 Recency Requirements

- a) Operators and flight crew members are encouraged to use procedures developed for Category II or III operations, during normal operations, regardless of the weather operations, whenever the necessary ground facilities area available and traffic conditions permit.
- b) Every pilot included in the flight crew who is seated at the flying controls, before commencing Category II or III shall have performed a minimum of six approaches and landings on the appropriate Category in aeroplane, or in a flight simulator approved for the purpose, of the type to be used on the flight within the preceding 90 days.

#### 6.7 Low Visibility Take-Off with RVR less than 400 m

- a) All Low Visibility Take-Off in RVR less than 400 m requires AACM approval.
- b) An operator must ensure that a flight crew member has completed a check before conducting Low Visibility Take-Offs in RVRs of less than 400 m.

#### 6.8 Low Visibility Take-Off with RVR less than 150/200 m

- a) An operator must ensure that prior to authorisation to conduct take-offs in RVRs below 150 m (below 200 m for Category D aeroplane) additional training as below is carried out:
  - i) Normal take-off in minimum authorised RVR conditions;
  - ii) Take-off in minimum authorised RVR conditions with an engine failure between V1 and V2, or as soon as safety considerations permit; and

iii) Take-off in minimum authorised RVR conditions with an engine failure before V1 resulting in a rejected take-off.

- b) An operator must ensure that the training required by Paragraph 6.7 and 6.8 is carried out in a flight simulator. This training must include the use of any special procedures and equipment.
- c) An operator must ensure that a flight crew member has completed a check before conducting Low Visibility Take-Off in RVRs of less than 150 m (less than 200 m for Category D aeroplanes). The check may only be replaced by successful completion of the flight simulator and/or flight training prescribed in Paragraph 6.8 a) on conversion to an aeroplane type.
- d) Operator using HUD/EVS equipment wishing to conduct LVTO has to obtain further approval from AACM.

#### 6.9 Recurrent Training and Checking – Low Visibility Operations

- a) An operator must ensure that, in conjunction with the normal recurrent training and operator proficiency checks, a pilot's knowledge and ability to perform the tasks associated with the particular category of operation, for which he/she is authorised is checked. One missed approach and one landing at the lowest approved RVR shall be flown during the conduct of the operators proficiency check. If the operator is authorised to conduct LVTO then at least one LVTO to the lowest applicable minima shall be flown during the conduct of the operators proficiency check.
- b) For Category III operations an operator must use a flight simulator.
- c) An operator must ensure that, for Category III operations on aeroplanes with a fail passive flight control system, a missed approach is completed at least once over the period of three consecutive operator proficiency checks as the result of an autopilot failure at or below decision height when the last reported RVR was 300 m or less.
- d) AACM may authorise recurrent training and checking for Category II and LVTO operations in an aeroplane type where no flight simulator to represent that specific aeroplane or an acceptable alternate is available.

## 7 Operating Procedures

### 7.1 General

Low visibility operations include:

- a) manual take-off, with or without electronic guidance systems or HUDLS/Hybrid HUD/HUDLS;
- b) auto-coupled approach to below DH, with manual flare, landing and rollout;
- c) approach flown with the use of a HUDLS/Hybrid HUD/HUDLS and/or EVS;
- d) auto-coupled approach followed by auto-flare, auto landing and manual roll-out; and



- e) auto-coupled approach followed by auto-flare, auto landing and auto-roll-out, when the applicable RVR is less than 400 m.

*Note 1: A hybrid system may be used with any of these modes of operations.*

*Note 2: Other forms of guidance systems or displays may be certified and approved.*

## 7.2 Procedures and Operating Instructions

- a) The precise nature and scope of procedures and instructions given depend upon the airborne equipment used and the flight deck procedures followed. An operator must clearly define flight crew member duties during take-off, approach, flare, roll-out and missed approach in the Operations Manual. Particular emphasis must be placed on flight crew responsibilities during transition from non-visual conditions to visual conditions, and on the procedures to be used in deteriorating visibility or when failures occur. Special attention must be paid to the distribution of flight deck duties so as to ensure that the workload of the pilot making the decision to land or execute a missed approach enables him/her to devote himself/herself to supervision and the decision making process.
- b) An operator must specify the detailed operating procedures and instructions in the Operations Manual. The instructions must be compatible with the limitations and mandatory procedures contained in the Aeroplane Flight Manual and cover the following items in particular:
- i) checks for the satisfactory functioning of the aeroplane equipment, both before departure and in flight;
  - ii) effect on minima caused by changes in the status of the ground installations and airborne equipment;
  - iii) procedures for the take-off, approach, flare, landing, roll-out and missed approach;
  - iv) procedures to be followed in the event of failures, warnings to include HUD/HUDLS/EVS and other non-normal situations;
  - v) the minimum visual reference required;
  - vi) the importance of correct seating and eye position;
  - vii) action which may be necessary arising from a deterioration of the visual reference;
  - viii) allocation of crew duties in the carrying out of the procedures according to Paragraphs 7.2 b) i) to 7.2 b) iv) and 7.2 b) vi) above, to allow the PIC to devote himself/herself mainly to supervision and decision making;
  - ix) Callouts may be accomplished by the flight crew or may be automatic (e.g., using synthetic voice call-outs or a tone system). Typical call-outs acceptable for Category II include the following:

- (a) “1000 ft” [radio altitude (RA)],
- (b) “500 ft” [radio altitude (RA)],
- (c) “approaching minimums,”
- (d) “at minimums,” (as applicable),
- (e) any pertinent visual reference(s) observed, and resulting crew action, as applicable (e.g., “runway in sight,... landing”),
- (f) key altitudes during flare, (e.g., 50, 30, 10) or AFGS mode transitions (e.g., flare, rollout), and
- (g) as appropriate, auto spoiler, reverse thrust deployment and autobrake disconnect.

*Note 1: Combinations of these calls may also be used as appropriate. In any event, the calls made by the flight crew should not conflict with the automatic systems or auto call-outs of the aircraft, and conversely the configuration selected for the aircraft should not conflict with expected call-outs to be made by the flight crew. Compatibility between the automatic call-outs and the crew call-outs must be ensured.*

*Note 2: Also, call-outs should be specified to address any non-normal configurations, mode switches, failed modes, or other failures that could affect safe flight, continuation of the landing, or the accomplishment of a safe missed approach.*

- x) the requirement for all height calls below 200 ft to be based on the radio altimeter and for one pilot to continue to monitor the aeroplane instruments until the landing is completed. Any use of crew initiated call-outs at altitudes below 100 ft during flare should ensure that the call-outs do not require undue concentration of the non-flying pilot on reading of the radar altimeter rather than monitoring the overall configuration of the aircraft, mode switching, and annunciations. Automatic altitude call-outs or tones are recommended for altitude awareness, at least at and after passing DA(H).
- xi) the requirement for the ILS Sensitive Area (LSA) to be protected;
- xii) the use of information relating to wind velocity, wind shear, turbulence, runway contamination and use of multiple RVR assessments;

*Note: Category II and Category III instrument approach operations shall not be authorized unless RVR information is provided.*

- xiii) procedures to be used for:
  - (a) approaches utilising EVS; and
  - (b) practice approaches and landing on runways at which the full Category II or Category III aerodrome procedures are not in force;
- xiv) operating limitations resulting from airworthiness certification; and

- xv) information on excessive deviation alert and the maximum deviation allowed from the ILS glide path and/or localiser:
  - (a) ILS localiser and glideslope signals are the primary means currently used for the determination of deviation from the desired path for Category II or III operations;
  - (b) operator should be capable to detect excessive deviation of the aircraft laterally and vertically during approach, and laterally during rollout, as applicable;
  - (c) any unacceptable deviation (greater than 1 dot down to 300 ft on the PFD) from the final approach course or specified glide path should result in a go-around as a safety procedure.

## 8 Certification and Authorisation

### 8.1 The Aeroplane

- a) Approval of an aeroplane registered in Macao for Category II and III operations is effected by appropriate entries in the Flight Manual. The aeroplane's Certificate of Airworthiness remains valid for Category II and III operations only as long as compliance is established and maintained with all the conditions included in such entries.

### 8.2 The Aeroplane Operator

- a) A Macao operator's competence to adopt aerodrome operating minima for Low Visibility Operations is regarded as part of its general competence to secure the safety operation of the aeroplane and therefore subject to the normal Air Operator Certificate procedure.
- b) Low Visibility Operations operational approval will be issued when the results of technical evaluations on both airworthiness and flight operations are satisfactory, and after validation of the operator's maintenance and operations capability.
  - i) For operator in possession of an AOC, operational approval will be granted through the issuance of a variation of the AOC Operations Specifications.
- c) Before carrying out Category II or III operations at a foreign aerodrome, a Macao operator must have established that the ground installation and environment at the aerodrome, together with its airborne equipment and operating technique, comprise a system capable of supporting operations down to the proposed minima.

### 8.3 Approval Procedure

- a) General. The approval process which results in the issuance of Low Visibility Operations operational approval consists of the following phases:
  - i) Pre-application
  - ii) Formal application

- iii) Technical Evaluation
  - iv) Demonstration/validation of operator maintenance and operations capability
  - v) Decision on application – issuance of operational approval
- b) Operator shall set up a pre-application meeting with AACM, to facilitate its details planning and work schedule for the proposed operation, prior to the submission of a formal application, in which AACM will make the operator fully aware of the regulatory requirements which must be met in order to obtain the desired operational approval.
- c) After the pre-application meeting, if the operator intends to proceed with the application process, a formal application including an application letter and the documentation required below, shall be submitted to AACM at least 3 months prior to the commencement of the proposed operations.
- i) Evidence of aircraft eligibility for proposed LVO operations;
  - ii) Minimum Equipment List;
  - iii) Operations Manual / Operating Policy, procedures and checklists;
  - iv) Training Programme;
  - v) Maintenance Programme; and
  - vi) Compliance matrix to this Aeronautical Circular and other relevant regulatory requirements.
- d) Operational demonstration. The purpose of the operational demonstration is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, including HUDLS if appropriate, training, flight crew procedures, maintenance programme, and manuals applicable to the Low Visibility Operations being approved and/or accepted.
- i) At least 50 approaches and landings must be accomplished in operations using the Category II/III systems installed in each aircraft type if the requested DH is 50 ft or higher. If the DH is less than 50 ft, at least 100 approaches and landings will need to be accomplished unless otherwise approved by AACM.
  - ii) If an operator has different variants of the same type of aircraft utilizing the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator must show that the various variants have satisfactory performance, but the operator need not conduct a full operational demonstration for each variant.
  - iii) If the number of unsuccessful approaches exceeds 5% of the total (e.g. unsatisfactory landings, system disconnects) the evaluation programme must be extended in steps of 10 approaches and landings until the overall failure rate does not exceed 5%.

- e) Data collection for operational demonstration. Each applicant must develop a data collection method (e.g. a form to be used by the flight crew) to record approach and landing performance. The resulting data and a summary of the demonstration data shall be made available to the AACM for evaluation.
- f) Data analysis. Unsatisfactory approaches and/or automatic landings shall be documented and analysed.
- g) Continuous monitoring.
  - i) After obtaining operational approval, the operations must be continuously monitored by the operator to detect any undesirable trends before they become hazardous. Flight crew reports may be used to achieve this.
  - ii) The following information must be retained for a period of 12 months:
    - (a) The total number of approaches, by aeroplane type, where the airborne Category II or III equipment was utilised to make satisfactory, actual or practice, approaches to the applicable Category II or III minima; and
    - (b) Reports of unsatisfactory approaches and/or automatic landings, by aerodrome and aeroplane registrations, in the following categories:
      - A. Airborne equipment faults;
      - B. Ground facility difficulties;
      - C. Missed approaches because of ATC instructions; or
      - D. Other reasons.
  - iii) An operator must establish a procedure to monitor the performance of the automatic landing system or HUDLS to touchdown performance, as appropriate, of each aeroplane.
- h) Transitional periods
  - i) Operators with no previous Category II or III experience.
    - (a) An operator without previous Category II or III operational experience may be approved for Category II or IIIA operations, having gained a minimum experience of six months of Category I operations on the aeroplane type.
    - (b) On completing six months of Category II or IIIA operations on the aeroplane type the operator may be approved for Category IIIB operations. When granting such an approval, AACM may impose higher minima than the lowest applicable for an additional period. The increase in minima will normally only refer to RVR and/or a restriction against operations with no decision height and must be selected such that they will not require any change of the operational procedures.

- ii) Operators with previous Category II or III experience. An operator with previous Category II or III experience may obtain authorization for a reduced transition period by application to AACM.
- iii) An operator approved for Category II or III operations using auto-coupled approach procedures, with or without auto-land, and subsequently introducing manually flown Category II or III operations using a HUDLS shall be considered to be a “New Category II/III operator” for the purposes of the demonstration period provisions.
- i) Maintenance of Category II, Category III and LVTO equipment. Maintenance instructions for the on-board guidance systems must be established by the operator, in liaison with the manufacturer, and included in the operator’s maintenance programme.
- j) Eligible aerodromes and runways
  - i) Each aeroplane type/runway combination must be verified by the successful completion of at least one approach and landing in Category II or better conditions, prior to commencing Category III operations.
  - ii) For runways with irregular pre-threshold terrain or other foreseeable or known deficiencies, each aeroplane type/runway combination must be verified by operations in standard Category I or better conditions, prior to commencing Category II or Category III operations.
  - iii) If an operator has different variants of the same type of aeroplane in accordance with Paragraph 8.3 j) iv) below, utilizing the same basic flight control and display systems, or different basic flight control and display systems on the same type of aeroplane in accordance with Paragraph 8.3 j) iv) below, the operator must show that the variants have satisfactory operational performance, but the operator need not conduct full operational demonstration for each variant/runway combination.
  - iv) For the purpose of Paragraph 8.3 j), an aeroplane type or variant of an aeroplane type is deemed to be the same type/variant of aeroplane if that type/variant has the same or similar level of technology, operational procedures, and handling characteristics as stated in Paragraph 6.1 d) i) to iii).

## **9 Aerodrome Operating Minima**

### **9.1 Take-off Minima**

#### **a) General**

- i) Take-off minima established by the operator must be expressed as visibility or RVR limits, taking into account all relevant factors for each aerodrome planned to be used and the aeroplane characteristics. Where there is a specific need to see and avoid obstacles on departure and/or

for a forced landing, additional conditions (e.g. ceiling) must be specified.

- ii) The PIC shall not commence take-off unless the weather conditions at the aerodrome of departure are equal to or better than applicable minima for landing at that aerodrome unless a suitable take-off alternate aerodrome is available.
  - iii) When the reported meteorological visibility is below that required for take-off and RVR is not reported, a take-off may only be commenced if the PIC can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.
  - iv) When no reported meteorological visibility or RVR is available, a take-off may only be commenced if the PIC can determine that the RVR/visibility along the take-off runway is equal to or better than the required minimum.
- b) Visual reference. The take-off minima must be selected to ensure sufficient guidance to control the aeroplane in the event of both a discontinued take-off in adverse circumstances and a continued take-off after failure of the critical power unit.
- c) Required RVR/visibility

For multi-engine aeroplanes, whose performance is such that, in the event of a critical power unit failure at any point during take-off, the aeroplane can either stop or continue the take-off to a height of 1,500 ft above the aerodrome while clearing obstacles by the required margins, the take-off minima established by an operator must be expressed as RVR/Visibility values not lower than those given in the following table except as provided in Paragraph 9.1 d), below:



RVR/visibility for take-off	
Facilities	RVR/Visibility (see Note 3)
Nil (day only)	500 m
Runway edge lighting and/or centreline markings	250/300 m (Note 1 and 2)
Runway edge and centreline lighting	200/250 m (Note 1)
Runway edge and centreline lighting and multiple RVR information	150/200 m (Note 1 and 4)
<p>Note 1: The higher values apply to Category D aeroplanes, unless Paragraph 6.8 is complied with.</p> <p>Note 2: For night operations at least runway edge and runway end lights are required.</p> <p>Note 3: The reported RVR/visibility values representative of the initial part of the take-off run can be replaced by pilot assessment.</p> <p>Note 4: The required RVR value must be achieved for all of the relevant RVR reporting points with the exception given in Note 3 above.</p>	
<p>i) When reported RVR, or meteorological visibility is not available, the PIC shall not commence take-off unless he can determine that the actual conditions satisfy the applicable take-off minima.</p> <p>d) Exceptions to Paragraph 9.1 c) i) above:</p> <p>The conduct of such operation by the operator using HUD/EVS system has to obtain a separate approval from AACM. Subject to the approval of the AACM, and provided the requirements in Paragraphs i) to v) below have been satisfied, an operator may reduce the take-off minima to 125 m RVR (Category A, B and C aeroplanes) or 150 m RVR (Category D) aeroplanes when:</p> <p>i) low visibility procedures are in force;</p> <p>ii) high intensity runway centreline lights spaced 15 m or less and high intensity edge lights spaced 60 m or less are in operation;</p> <p>iii) flight crew members have satisfactorily completed training in a flight simulator;</p> <p>iv) a 90 m visual segment is available from the cockpit at the start of the take-off run; and</p> <p>v) the required RVR value has been achieved for all of the relevant RVR reporting points.</p>	

## 9.2 Category II Operations

- a) General. A Category II operation is an instrument approach operation with:
- i) A decision height lower than 60 m (200 ft) but not lower than 30 m (100 ft); and
  - ii) A runway visual range not less than 300 m.
- b) Decision height. An operator must ensure that the decision height for a Category II operation is not lower than:
- i) The minimum decision height specified in the AFM, if stated;
  - ii) The minimum height to which the approach aid can be used without the required visual reference;
  - iii) The OCH/OCL for the category of aeroplane;
  - iv) The decision height to which the flight crew is authorised to operate; or
  - v) 100 ft.
- c) Visual Reference. A pilot may not continue an approach below the Category II decision height determined in accordance with Paragraph 9.2 b) above unless visual reference containing a segment of at least THREE consecutive lights being the centre line of the approach lights, or touchdown zone lights, or runway centre line lights, or runway edge lights, or a combination of these is attained and can be maintained. This visual reference must include a lateral element of the ground pattern, i.e. an approach lighting crossbar or the landing threshold or a barrette of the touchdown zone lighting.
- d) Required RVR. The lowest minima to be used by an operator for Category II operations are:

Category II Operations Minima		
Decision height	Category II operations minima auto-coupled to below DH ( <i>Note 1</i> )	
	RVR Aeroplane Category A, B and C	RVR Aeroplane Category D
100 ft – 120 ft	300 m	300/350 m ( <i>Note 2</i> )
121 ft – 140 ft	400 m	400 m
141 ft and above	450 m	450 m

Note 1: The reference to “auto-coupled to below DH” in this table means continued use of the automatic flight control system down to a height which is not greater than 80% of the applicable DH. Thus airworthiness requirements may, through minimum engagement height for the automatic flight control system, affect the DH to be applied.

Note 2: 300 m may be used for a Category D aeroplane conducting an autoland.

### 9.3 Category III Operations

a) General. Category III operations are subdivided as follows:

- i) Category IIIA operation. An instrument approach operation with:
  - (a) A decision height lower than 30 m (100 ft) or no decision height; and
  - (b) A runway visual range not less than 175 m.
- ii) Category IIIB operation. An instrument approach operation with:
  - (a) A decision height lower than 15 m (50 ft) or no decision height; and
  - (b) A runway visual range less than 175 m but not less than 50 m.
- iii) Category IIIC operation. An instrument approach operation with:
  - (a) no decision height; and
  - (b) no runway visual range limitation.

*Note 1.- Where decision height (DH) and runway visual range (RVR) fall into different categories of operation, the instrument approach operation would be conducted in accordance with the requirement of the most demanding category (e.g. an operation with a DH in the range of CAT IIIA but with an RVR in the range of CAT IIIB would be considered a CAT IIIB operation or an operation with a DH in the range of CAT II but with an RVR in the range of CAT I would be considered a CAT II operation.)*

*Note 2.- The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach the required visual reference is the runway environment.*

- b) Decision height. For operations in which a decision height is used, an operator must ensure that the decision height is not lower than:
  - i) The minimum decision height specified in the AFM, if stated;
  - ii) The minimum height to which the approach aid can be used without the required visual reference; or
  - iii) The decision height to which the flight crew is authorised to operate.
- c) No decision height operations. Operations with no decision height may only be conducted if:
  - i) The operation with no decision height is authorised in the AFM;
  - ii) The approach aid and the aerodrome facilities can support operations with no decision height;
  - iii) The operator has an approval for CAT IIIB or CAT IIIC operations, with no decision height; and

iv) The flight crew is qualified to operate with no decision height.

*Note: In the case of a CAT III runway it may be assumed that operations with no decision height can be supported unless specifically restricted as published in the AIP or NOTAM.*

d) Visual reference

i) For Category IIIA operations, and for Category IIIB operations with either fail-passive flight control systems or with the use of an approved HUDLS, a pilot may not continue an approach below the decision height unless a visual reference containing a segment of at least three consecutive lights that depict the centreline of the approach lights, or touchdown zone lights, or runway centreline lights, or runway edge lights, or a combination of these is attained and can be maintained.

ii) For Category IIIB operations with fail-operational flight control systems or with a fail-operational hybrid landing system (comprising, for example, an HUDLS), using a decision height a pilot may not continue an approach below the decision height unless a visual reference containing at least one centreline light is attained and can be maintained.

iii) For Category III operations with no decision height there is no requirement for visual verification prior to landing.

e) Required RVR. The lowest minima to be used by an operator for Category III operations are:

<b>Category III Operations Minima</b>			
Category	Decision height ( <i>Note 1</i> )	Roll-out control/guidance system	RVR
IIIA	Less than 30 m (100 ft)	Not required	175 m
IIIB	Less than 30 m (100 ft)	Fail-passive	150 m
IIIB	Less than 15 m (50 ft)	Fail-passive	125 m
IIIB	No decision height	Fail-operational ( <i>Note 2</i> )	50 m
Note 1:	Flight control system redundancy is determined under CS-AWO on all weather operations by the minimum certificated decision height.		
Note 2:	The fail operational system referred to, may consist of a fail operational hybrid system.		

## 9.4 Failed or downgraded equipment – effect on landing minima

<b>Failed or downgraded equipment – effect on landing minima</b>			
Failed or downgraded equipment ( <i>Note 1</i> )	Effect on landing minima		
	CAT IIIB ( <i>Note 2</i> )	CAT IIIA	CAT II
ILS stand-by transmitter	Not allowed		No effect
Outer marker	(No effect if replaced by published equivalent position)		
Middle marker	No effect		
Touchdown zone RVR assessment system	May be temporarily replaced with midpoint RVR if approved by the State of the aerodrome. RVR may be reported by human observation		
Midpoint or stop end RVR	No effect		
Anemometer for runway in use	No effect if other ground source available		
Ceilometer	No effect		
Approach lights	Not allowed for operations with DH > 50 ft	Not allowed	
Approach lights except the last 210 m	No effect		Not allowed
Approach lights except the last 420 m	No effect		
Standby power for approach lights	No effect		
Whole runway light system	Not allowed		
Edge lights	Day only; Night – not allowed		
Centreline lights	Day – RVR 300 m Night – not allowed	Day - RVR 300 m Night – RVR 550 m	
Centreline lights spacing increased to 30 m	RVR 150 m	No effect	
Touchdown zone lights	Day – RVR 200 m Night – RVR 300 m	Day – RVR 300 m Night – RVR 550 m	
Standby power for runway lights	Not allowed		
Taxiway light system	No effect – except delays due to reduced movement rate		
Note 1:	Conditions applicable to this table:		
	(a) Multiple failures of runway lights other than indicated in this table are not acceptable.		

- (b) Deficiencies of approach and runway lights are treated separately.
- (c) Category II or III operations. A combination of deficiencies in runway lights and RVR assessment equipment is not allowed.
- (d) Failures other than ILS affect RVR only and not DH.

## Note 2:

For CAT IIIB operations with no DH, an operator shall ensure that, for aeroplanes authorised to conduct no DH operations with the lowest RVR limitations, the following applies in addition to the content of this table:

- (a) RVR. At least one RVR value must be available at the aerodrome: unless specified otherwise by the State requirements.
- (b) Runway lights
  1. No runway edge lights, or no centre lights – Day – RVR 200 m; night – not allowed;
  2. No TDZ lights – no restrictions;
  3. No standby power to runway lights – Day – RVR 200 m; night – not allowed.

### 9.5 Table of Operationally Equivalent Value

The following metres (m) to statute miles (mile (statute)) or feet (ft) values are deemed to be equivalent for operational purposes.

Visibility		RVR	
400 m	= ¼ mile (statute)	50 m	= 150 ft
800 m	= ½ mile (statute)	75 m	= 250 ft
1,200 m	= ¾ mile (statute)	100 m	= 300 ft
1,600 m	= 1 mile (statute)	150 m	= 500 ft
2,000 m	= 1¼ mile (statute)	175 m	= 600 ft
2,400 m	= 1½ mile (statute)	200 m	= 700 ft
2,800 m	= 1¾ mile (statute)	300 m	= 1,000 ft
3,200 m	= 2 mile (statute)	350 m	= 1,200 ft
3,600 m	= 2¼ mile (statute)	500 m	= 1,600 ft
4,000 m	= 2½ mile (statute)	550 m	= 1,800 ft
4,400 m	= 2¾ mile (statute)	600 m	= 2,000 ft
4,800 m	= 3 mile (statute)	800 m	= 2,400 ft
4,800 m	= 3 mile (statute)	1,000 m	= 3,000 ft
4,800 m	= 3 mile (statute)	1,200 m	= 4,000 ft
4,800 m	= 3 mile (statute)	1,600 m	= 5,000 ft

## 10 Maintenance Requirement

### 10.1 Required Equipment

- a) An operator, in liaison with the aeroplane manufacturer, must include in the Operations Manual a complete list of equipment/systems that must be installed and serviceable at the commencement of a Low Visibility Take-Off or a Category II or III approach.
- b) If this requirement is to be satisfied by the Minimum Equipment List (MEL), then such equipment/system must be clearly identified within that document, so that both the flight crew and maintenance personnel are under no uncertainty as to the capability of the aeroplane prior to dispatch.

### 10.2 Control of Required Equipment

- a) The operators maintenance organisation must publish procedures that clearly set out the control of “critical equipment” in terms of low visibility operations.
- b) Such controls should take account of the modification or repair of the above equipment.
- c) Any modification embodied in critical equipment must be done in agreement with the manufacturer and therefore would be covered by a Service Bulletin (S.B.). On some occasions this might not be possible (e.g. older aeroplanes).
- d) These cases will require the involvement and approval of AACM and would be classified as major modifications in accordance with MAR-1 AP-5. Adequate and appropriate justification would have to be supplied by the operator for AACM to adopt the latter option.
- e) Any repair accomplished on critical equipment must be undertaken by approved or accepted maintenance organisations in the appropriate category and carried out to approved maintenance instructions.

### 10.3 Identification of Required Equipment

- a) The equipment classified as critical in Paragraph 10.1 must be clearly identified to maintenance personnel.
- b) Whilst it is accepted that modern jet transports have a fully integrated autoflight/autoland system installed at build and included in type certification, older aeroplanes have varying capabilities of autoland and greater attention should be paid to these aeroplanes.
- c) Identification is especially important when operating a mixed fleet (with regard to autoland capability) or when an operator contracts out its maintenance to a third party maintenance organisation.
- d) Third party maintenance organisations, by their very nature, undertake work for several operators often simultaneously thus increasing the possibility of inappropriate equipment finding its way onto an aeroplane.



- e) Operators should individually identify all applicable pieces of equipment or put in place a procedure/system that ensures maintenance personnel only install appropriate equipment onto their aeroplane.

#### 10.4 Current Operational Status of System

- a) There will be occasions when the autoland system will have to be downgraded from Category III to Category II or I.
- b) Such occasions would be poor performance of the aeroplane, integrity or serviceability of the aeroplane systems and the non availability of appropriately trained and qualified maintenance personnel.
- c) The regarding of the autoland system can be looked at as two distinct activities, the “downgrading” as mentioned above and the subsequent “upgrading” after corrective actions have been accomplished.
- d) It is very important that provisions should be made to inform the flight crew of the Category II or III status of the aeroplane before dispatch. There will be occasions when the system has been downgraded but the automatic flight deck display systems indicate a Category III capability so this, in isolation, cannot be accepted as meeting the requirement.
- e) The operator must publish procedures that fully details when and how regarding should take place.

#### 10.5 System Reliability

- a) Aeroplanes certificated in accordance with EASA CS-25 cross reference CS-AWO or FAR-25 is an acceptable basis for showing compliance with the particular aspect of low visibility operations.
- b) As part of the In Service Proving (see Paragraph 5.2) the system has to demonstrate a reliability equal to or better than that detailed in CS-AWO.
- c) This reliability monitoring (continuous monitoring), in actual fact, is required to be a continuous process even after initial approval (See Paragraph 8.3 e)).
- d) The operator must establish a procedure to monitor the performance of the autoland system components of each aeroplane that detects any undesirable trend before it becomes hazardous. When setting alert levels in system reliability monitoring, consideration must be given to the levels or reliability assumed in qualifying the aeroplane for Category II or III operations.
- e) Maintenance instructions for the Category II or III autoland equipment must be incorporated by the operator, in liaison with the manufacturer, and included in the Approved Maintenance Schedule (AMS) for the aeroplane.

#### 10.6 Maintenance Personnel Qualification

- a) MAR-145 requires that for any aeroplane operated for Commercial Air Transport, a Certificate of Release to Service (CRS) must be issued by personnel authorised in accordance with MAR-145.30 in association will form the basis of such an authorisation to issue certifications in respect of

instruments or automatic pilots on aeroplanes which have an automatic landing capability.

- b) Operators must ensure that when their maintenance organisation undertakes any work on the autoland system their personnel are appropriately qualified and authorised.
- c) Many maintenance organisations have approved procedures that allow licensed/authorised personnel to undertake limited tasks normally associated with other trades. It is acceptable for the downgrading of the autoland system to be classified as a limited task.
- d) The upgrading of an autoland system, however, must be performed and certified by an engineer specifically authorised and qualified as detailed above.

- END -