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INTRODUCTION

Low visibility operations include:

1. manual take-off (with or without electronic guidance systems)
2. auto-coupled approach to below DH, with manual flare, landing and roll-out
3. auto-coupled approach followed by auto-flare, autolanding and manual roll-out
4. auto-coupled approach followed by auto-flare, autolanding and auto roll-out

when applicable RVR is less than 400 m.

As the amount and quality of external, visual information decreases with the lowering of operating minima, so the quality and quantity of instrument and equipment information as well as the proficiency of the flight crews must be increased in order to maintain the desired level of safety.

For this reason, a specific qualification is required to perform:

a) take-offs with RVR less than 150 m for category B and C aircraft (less than 200 m for category D aircraft) and
b) CAT II/III approaches.

Procedures and requirements for pilots to obtain and retain approval to conduct low visibility take-offs (LVTO) and CAT II/III approaches are contained in the Operations Manual - General Basic.

The training outline should include ground course training, simulator training, in-flight training.

This booklet is intended to satisfy JAR-OPS 1 requirements for ground training, providing information about:

- characteristics and limitations of the ILS
- characteristics of visual aids
- characteristics of fog
- operational limitations and characteristics of the airborne systems
- effects of precipitation, ice accretion, low level wind shear and turbulence
- effect of specific aircraft malfunction
- use and limitations of RVR assessment systems
- principles of obstacle clearance requirements
- recognition of and action to be taken in the event of failure of ground equipment
- 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 RVR (200 m for category D aircraft)
- significance of decision heights based on radio altimeters and effect of terrain profile in the approach area on radio altimeter readings and on the automatic approach/landing systems
- importance and significance of Alert Heights if applicable and the action to be taken in the event of any failure above and below the Alert Height
- human factors and task sharing
- importance of correct seating and eye position.
PART 1 - AERODROME INSTALLATIONS, PROTECTIONS AND PROCEDURES

Characteristics and limitations of ILS

ICAO Annex 10 gives the required performance criteria for a CAT II/III ILS.

Without going on into details the following general requirements apply:
- beam coverage
- limitations on beam bends
- power and transmission back-up
- switch-over time to stand-by system (max 5 sec; 2 sec for CAT III)
- automatic signal-in-space monitoring.

A category II ILS provides guidance information from the coverage limit to a height of 15m (50ft) or less above the runway, with a threshold crossing height not below 50 ft (max 60 ft).

A category III ILS provides guidance information from the coverage limit to and along the surface of the runway (with the aid of additional airborne equipment where necessary) with a threshold crossing height not below 50 ft (max 60 ft).

Temporary downgrading of an ILS to a lower performance category is usually made known by Notam, ATIS or directly by ATC.

Taxiing aircraft, ground vehicles, cranes, etc. can produce reflections which cause the ILS beams to move in space.

Among the most serious forms of interference of this kind is the one caused by aircraft taking off or going around and overflying the localizer antenna (the pulsation may result in a LOC warning flag appearing briefly which will disturb the automatic landing operation of a following aircraft on final).

To cope with this fact certain protective measures shall be taken against vehicles moving within ILS established protected areas on the ground (defined as ILS critical area and sensitive area) during low visibility operations; a departing aircraft shall not be cleared for take-off after an arriving aircraft has passed a specified point or height in final.

The ILS includes an Outer Marker and a Middle Marker (or equivalent position).

The OM is located so as to provide height, distance and aircraft equipment checks on intermediate and final approach.

The MM is located so as to indicate the imminence, in low visibility conditions, of visual approach guidance. The MM, however, is no longer required by the majority of the countries, and in some cases its implementation is being discontinued.

Obstacle clearance

ICAO specifies the areas, slopes and obstacle clearances that are applicable for CAT II/III operations.

For CAT II/III operations the Obstacle Free Zone principles applies.
**Obstacle free zone (OFZ)**

For CAT II/III operations, the obstacle protection will be assured within a volume of space defined as Obstacle Free Zone (OFZ).

**Fig. 1a - The obstacle free zone: perspective view**

The OFZ (Fig. 1a and b) shall be kept free from fixed objects other than lightweight frangible mounted aids to air navigation and from moving objects such as aircraft and vehicles when the runway is being used for CAT II/III approaches.
Obstacle clearance altitude/height (OCA/OCH)

For CAT II operations an OCH is specified as the lowest height (on the glide path) above the elevation of the relevant runway threshold which ensures compliance with the appropriate obstacle clearance criteria for missed approach.

For CAT III operations, an OCH is not established, subject to the OFZ being completely free of obstacles. The missed approach is protected from a point on the runway 900 m after the threshold.

Fig. 2 - OCH and missed approach

Runway length

In CAT III operations an extra margin on the required dry runway length applies; this margin corresponds to the one required for operations on wet runways and its purpose is to avoid excessive reversing and braking by giving the pilots the feeling that the runway length is not marginal. Therefore refer to landing performance relevant to such a condition.

Of course, in case of wet runway conditions this correction needs only to be applied once.

In any case, this requirement shall not be interpreted as a possibility for moving the touchdown point farther down the runway since there is no allowance for an intentional loss of runway length.

NOTE: For operations in USA aerodromes, the extra margin is required whenever RVR is less than 4000 ft (1200 m) / VIS less than 3/4 SM.

In case of contaminated runway, no additional margins are required for CAT III other than those applicable for contaminated runways as detailed in the O.M. General Basic.
Characteristics of visual aids

The visual aids requirements for CAT II/III operations are described in Fig. 3, 4 and 5. (Symbols and abbreviations are adopted in aerodrome charts for visual aids and are reported in the Route Manual).

Fig. 3 - Approach (inner 300 m) and runway lighting for precision approach runways categories II and III (perspective)

The following describes the lighting requirements for airport operating in CAT II/III and the prime functions of the various components of the lighting system.

CAT II/III approach light system

Standard length is 900 m. Reductions are allowed according to the applicable RVR (see table, page 40).

Of the two standard systems (ICAO and U.S.), the inner 300 m are substantially identical (Fig. 4).
**Runway lighting** (Fig. 4)

High intensity runway edge white lights are placed along the full length of either edge of the runway, equidistant from the centre line and at intervals of 60 m max.

A section of the edge lights of 600 m (or 1/3 of the runway length if less) at the end of the runway may show yellow.

Where the threshold is displaced, the runway edge lights from the beginning of the runway to the displaced threshold shall show red.

Runway threshold lights (RWY THR Lts) are located at the extremity of the runway at right angle to the runway axis. When the threshold is displaced, the threshold lights are positioned next to the displaced landing threshold.

Threshold lights are fixed lights showing green in the direction of the approach. The threshold light bar may be reinforced by additional lights each side (wingbars).

Runway centre line light system (RCL) marks the centre line of the runway from the threshold to the far end at uniform longitudinal spacing of 15 m (spacing of 7.5 m or 30 m could be provided).

In order to warn the pilot that aircraft is approaching the end of the runway in poor visibility, the last 900 m portion of the RCL system is coded by using alternating red and white lights over the first 600 m and red for the last 300 m of the segment.

Touch down–zone lights (TDZL) are installed on each side of the runway centre line within the first 900 m of the runway: the pattern is formed by a number of barrettes, each barrette consisting of 3-4 lights.

The longitudinal spacing between the barrettes is 30 m or 60 m. The color of the lights is white.

Runway end lights are placed at right angle with the runway axis as close as possible to the runway end and are considered, with the runway edge lights, part of the runway lights.

Runway end lights are fixed lights showing red in the direction of the runway; they should be not less than six.

**Runway markings**

Runway markings are as shown in Fig. 5.

**Taxiway lighting** (Fig. 6)

Taxiway centre line lights on a taxiway shall be fixed lights showing green with beam dimensions such that the light is visible only from an aircraft on or in the vicinity of the taxiway. Centre line lights on an exit taxiway shall be alternate green and yellow from their beginning near the runway centre line to the perimeter of the ILS critical/sensitive area or of the OFZ, whichever is the farthest from the runway; and thereafter all lights shall show green. The light nearest to the perimeter shall always show yellow.

Where aircraft may follow the same centre line in both directions, all the centre line lights shall show green to aircraft approaching the runway.
Fig. 4 - Approach (inner 300 m) and runway lighting for precision approach runways categories II and III (plan view)
Fig. 5 - Aiming point and touchdown zone markings (rwy length ≥ 2400 m)
Fig. 6 - Taxiway lighting
Specific taxiway markings, signs and stop bars

For low visibility operations, a taxi-holding position shall be established on a taxiway at an intersection with a precision approach runway if the intersection location or alignment is such that a taxiing aircraft or vehicle can infringe the obstacle free zone (OFZ) or interfere with the operation of the ILS.

The specific surface marking is as shown in Fig. 7 (pattern B), located farther from the runway than the normal taxi-holding marking.

![Fig. 7 - Taxi-holding position marking for precision approach runways](image)

The distance between the marking and the centre line of the runway corresponds to the boundary of the relevant critical/sensitive areas of the ILS.

The taxi-holding position markings shall be supplemented with a CAT I, II, II/III or III holding position sign (located on each side of the holding-position marking) with white inscription on a red background (Fig. 8).

*NOTE: In USA airports the sign supplementing the taxi-hold position marking at the boundary of the ILS critical area has the generic inscription “ILS”.*
One or more stop bars, as appropriate, should be provided at a taxiway intersection or taxi-holding position when it is desired to supplement marking with lights and to provide traffic control by visual means.

A stop bar shall be provided at every taxi-holding position serving a runway when it is intended that the runway be used in RVR conditions less than a value of 350 m, except where appropriate aids and procedures are available to assist in preventing inadvertent incursions of aircraft and vehicles onto the runway.

Stop bars shall consist of lights spaced at intervals of 3 m across the taxiway, showing red in the direction of approach to the runway.

Stop bars shall be interlocked with the taxiway centre line so that when the centre line lights beyond the stop bar are illuminated the stop bar is extinguished and vice versa.

Where stop bars are not installed, runway guard lights shall be provided; they consist of alternately flashing yellow lights either at each side of the taxiway or across it.

**Use and limitation of RVR assessment system**

The transmissometer is that part of the RVR system which senses the transmissivity of the atmosphere and provides an indication of the visibility known as “Runway Visual Range” in the vicinity of the instrument runway.

The unit consists of: a projector, a receiver (phototube), an indicator, a recorder and a computer (Fig. 9).

The transmissometer readings indicate and provide a continuous and automatic record of the ability of the air to transmit light (visibility).

This is accomplished by sensing the amount of light striking a phototube from a projector lamp of a constant and known intensity a fixed distance away.

On a very clear day, the transmissometer set is adjusted to indicate 100% transmission.

Should rain, fog, snow, etc. reduce the transparency of the air, the phototube senses a lower light intensity from the projector beam and the system computes a correspondingly lower percentage of transmission.

A sealed reflector lamp emits light of known constant intensity. This beam is projected toward the receiver phototube.

The receiver gathers the light transmitted, taking account for any visibility deterioration in the prevailing conditions, and measures its intensity by the photoelectric cell.

Pulsing electric signals produced by this detecting unit are strengthened by the receiver-amplifier unit, and after computation are sent to the indicator.

With a high degree of transmission (good visibility) the pulse rate is faster.

The electric current produced from the pulsing electric signals is proportional to the degree of transmission and actuates a tracing device (pen arm) in the recorder which provides a continuous record on a slowly moving chart. The recorder actually indicates in terms of percentage of transmitted power reaching the receiver.
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Tower display is referred to different transmissometer positions along the runways.

--- + = symbols indicate decreasing, increasing or stable data.

Fig. 9 – Transmissometer system for three runways with digits display for the runways simultaneously in use.

The RVR computer is that part of the RVR system which translates atmospheric light transmissivity into digital RVR readings.

Information of the transmissivity at the runway is continuously fed from the transmissometer to the computer.

Atmosphere transmissivity reading, with information for runway light intensity setting and day/night illumination are translated by the computer into stepped digital RVR readings, which appear on display units installed in the appropriate ATS unit.

These readings are finally transmitted by ATC to the pilot (Fig. 10).
RVR readouts have operational use in the following increments:
- 25 or 30 m (from a minimum value of 50 m) up to 300 m;
- 50 or 60 m from 300 m to 800 m;
- 100 m above 800 m.

**NOTE 1: In Europe:**
- 25 m up to 400 m
- 50 m from 400 m to 800 m
- 100 m above 800 m.

**In Canada/USA:**
- 100 ft (from a minimum value of 200 ft by day, 400 ft by night) up to 800 ft
- 200 ft from 800 ft to 3000 ft
- 500 ft from 3000 ft to 6000 ft.

RVR values which do not fit the reporting scale are rounded down to the next lower step in the scale (e.g.: a reported value of 180 m RVR, with increments of 30 m, means RVR 180 m or more but less than 210 m).

In the transmission of RVR values, reporting sites are identified as: TOUCH-DOWN ZONE, MID–POINT, STOP–END.

The value of touch-down zone report should always be given first, followed by mid-point and stop-end, when these RVR assessment sites are provided.

**NOTE 2: RVR values are transmitted to the pilot in the order specified above; the position of the related transmissometer is omitted except when one position is inoperative.**
ATC low visibility procedures

In order to ensure the necessary protection and regularity of low visibility take-offs and approaches, ATC applies specific procedures.

Pilots will be informed by ATIS or directly by APP control with the phrase: “Low visibility procedures in progress” (or “in operation”) or “Cat. II (or “III”) in progress”.

This procedure implies that:
- all the required radio and visual aids for the relevant RVR and consequent type of approach (CAT II/III) are properly operating;
- the OFZ (Obstacle Free Zone) surrounding the runway is actually sterile (from ground vehicles and/or aircraft) when an approaching aircraft is below 200 ft AGL;
- the protection areas established for localizer and glide path transmitting antennas is sterile from ground vehicles and/or taxiing aircraft when an approaching aircraft is on final or rolling out after landing;
- a departing aircraft has overflown the localizer antenna before an approaching aircraft is below 200 ft AGL;
- radar control, if available, will vector not closer than 8-10 NM from the runway threshold;
- longitudinal separation between two consecutive aircraft will be such as to enable the preceding one to clear the OFZ and ILS critical and/or sensitive areas when the following aircraft is not closer than 2 NM from threshold;
- no adjustment to the final approach speed will be required by ATC during intermediate and final approach;
- RVR values will be timely updated during the approach;
- ILS performance and/or sudden malfunction to its components and relevant visual aids will be immediately notified to pilots;
- aircraft taxiing out of the runway to the parking area and viceversa will follow specific routes that will not interfere with the ILS critical/sensitive areas.

NOTE: In USA airports, whenever conditions are less than reported ceiling 800 ft and/or visibility less than 2 miles, vehicles/aircraft are not authorized to operate in or over the ILS critical areas whenever an arriving aircraft is inside the ILS outer marker (or the fix used in lieu of the OM) unless the arriving aircraft has reported the runway in sight or is circling to land on another runway, with the exception of:
- a preceding arriving aircraft on the same or another runway that passes through the areas while landing or exiting the runway;
- a preceding departing aircraft or in missed approach on the same or another runway that passes over the areas.

Whenever conditions are less than reported ceiling 200 ft and/or RVR 2000 ft (600 m), vehicles or aircraft operations in or over the ILS critical areas are not authorized without exceptions when an arriving aircraft is inside the middle marker.

Aerodrome facilities required for low visibility operations

Aerodrome facilities requirements for low visibility operations mainly refer to: ILS system, approach lights system (ALS) and runway lights system, RVR assessment.
- ILS system: the performance category (II or III) shall match with the intended type of approach. The OM may be replaced by a published equivalent position otherwise the approach is not allowed. A stand-by ILS transmitter is required for CAT III operations.

- Approach light system (ALS): with DH in the order of 100 ft the ALS is only partially visible; therefore the innermost 420 m are sufficient; with DH below 100 ft the innermost 210 m are sufficient; with DH 50 ft or no DH the ALS is not required. If authorized by the State, use of CAT I ALS is allowed with CAT II RVR values higher than 300 m.

- Runway lights: the whole system (i.e. edge, threshold, runway end lights, centre line lights and TDZ lights) must be operative for day and night operations; for outage of single parts (e.g. edge lights, runway end lights, runway centre line lights or TDZ lights) see table on page 40 of this I.T.O. for approach or the OM General Basic, section 8.1, for take-off.

- RVR assessment: multiple RVR information required as per the OM General Basic, section 8.1, for take-off, table at page 40 of this I.T.O. for approach.
PART 2 - AIRCRAFT EQUIPMENT

For proper use of systems and their limitations refer to the relevant information contained in the Aeroplane Operating Manual.

Guidance systems

In order to achieve lower operating minima with the desired success rate and safety level, operational criteria have been established for the use of airborne lateral guidance systems for low visibility take-offs and of automatic flight control systems (including automatic landing and rollout systems) for cat. II/III approach and landing operations.

A take-off guidance system provides directional guidance information to the pilot during the take-off or abandoned take-off. Guidance normally takes the form of command information, but it may alternatively be situation (or deviation) information.

The purpose of the guidance system is to permit a reduction in take-off minima to a level where the pilot can normally line up on the runway centre line and carry out the take-off by visual reference, but

a. any further reductions in the visibility which may be encountered during take-off run would make difficult directional control by visual reference alone; or

b. significant deviations from the runway centre line may be difficult to correct by visual reference alone.

Visual reference remains the primary means of guidance, with the system providing reversionary guidance.

The Para-Visual Director (PVD) is a system providing a visual indication to enable the pilot to control the aircraft while using normal visual cues during LVTO.

The system is mounted on the glareshield, centrally in front of each pilot seat. The concept of the display is that the pilot is able to receive director information in his peripheral vision whilst his eyes are looking forward seeking visual cues.

As the aircraft is taxied to the runway threshold the PVD will be active as it responds to the localizer signals of the take-off runway and it will become ostensibly neutral when the aircraft is stationary on the runway centre line.

During the take-off roll, as long as the visibility remains above 50 meters, the pilot has sufficient visual cues to be able to keep the aircraft on the runway centre line. These cues are primarily the runway centre line markings and centre line lights, which achieve a strobe effect as the aircraft gathers speed.

The role of the PVD becomes important if the visibility deteriorates during the take-off roll. As the transmissometers are sited at distinct points along the runway it is possible, because the fog is not homogeneous, that there are patches where the visibility is less than the lower limit for take-off. Should this occur, the pilot is instinctively able to absorb information from the PVD which will direct him to steer the aircraft to the runway centre line and, when on the runway centre line, the PVD acts as a monitor should there be any tendency to diverge from that intended line.

The display moving to the left is a command to steer to the left and vice-versa; the faster the display moves, the larger is the command required. A stationary display indicates satisfactory centre line tracking.

The PVD turns off shortly after aircraft lift-off; for the subsequent climb-out normal flight instruments are used.
The requirements are based on the assumption that operational precautions are taken to ensure that the ILS localizer signal is suitable (e.g. in each case the ILS is cat. III or the airborne system has been shown to perform satisfactorily on that installation).

An **Automatic Flight Control System (AFCS)** is the airborne equipment which provides automatic control of the flight path of the aircraft by reference to the ILS. It includes all sensors, actuators and power supplies necessary to control the aircraft; it may include an automatic landing system, an automatic roll-out system and an automatic missed approach mode. An automatic throttle control may be provided for use with the AFCS.

In addition, it includes the indications and controls necessary for the management and supervision by the pilot.

The **Head-Up Flight Display System (HFDS)** selects and processes flight parameters received from the aircraft avionics and sensors and transforms them in signals which are projected through a lens and displayed on a screen high in front of the left-hand seat, providing the pilot with an image superimposed on the outside world in its field of view.

The use of HFDS, in conjunction with the AFCS, extends the aircraft capabilities to lower operating minima, subject to specific certification, including roll-out and go-around operations.

**Hybrid concept**

An autopilot in conjunction with a HFDS enables automatic approaches and landings with manual back-up in low visibility.

The system, defined “fail-operational hybrid”, consists of a primary fail passive automatic landing system and a secondary independent fail passive guidance system (HFDS) enabling the pilot to complete a landing manually in the event of a failure of the primary system below DH.

As an example of aircraft systems configuration and relevant operational criteria, the following table shows the MD-80 active systems for an ILS final approach below 1500 ft AGL, landing (or go-around) and roll-out, and for cases of system failure.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Active Systems</th>
<th>Operational criteria in case of failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 ft AGL to DH</td>
<td>Fail passive AFCS in command. Independent fail passive HFDS for flight path monitoring.</td>
<td>Should a failure occur above DH on either system, a go-around should be performed on the remaining system.</td>
</tr>
<tr>
<td>DH to touchdown</td>
<td>AFCS and HFDS constitute a fail operational/hybrid system.</td>
<td>Should a failure occur below DH on either system, the landing can be completed or a go-around executed on the remaining system.</td>
</tr>
<tr>
<td>Roll-out</td>
<td>AFCS and HFDS constitute a fail operational/hybrid system (1).</td>
<td>Should a failure occur on either system, the roll-out can be completed on the remaining system or visually.</td>
</tr>
<tr>
<td>Go-around</td>
<td>AFCS and HFDS constitute a fail operational/hybrid system.</td>
<td>Should a failure occur on either system, the go-around can be initiated or continued on the remaining system.</td>
</tr>
</tbody>
</table>

(1) Presently the AFCS roll-out function is not approved therefore the fail operational/hybrid concept does not apply to the roll-out phase.
Aircraft equipment required for low visibility operations

The lists of the required aircraft equipment and instruments and relevant authorized operating minima are included in the Aeroplane Operating Manuals.

For AFCS and guidance systems the lists comply with the following Company general criteria:

1. for low visibility take-offs: serviceability of a certified lateral guidance system for RVR less than 125 m (category B and C aircraft) / 150 m (category D aircraft).

2. for low visibility approaches:
   - CAT II operations:
     S serviceability of at least one autopilot system for ILS automatic approach. The autopilot must be certified to fly the aircraft into the CAT II minima gate from which manual landing is assured without essential corrections to heading and attitude; and
     S for category C/D aircraft, serviceability of an AFCS with automatic landing capability for CAT II RVRs less than 350 m down to 300 m; and
     S an AFCS go-around control and/or guidance;
     S use of autothrottle, if available, is recommended.
   - CAT III operations:
     S serviceability of an AFCS for automatic approach with automatic landing capability (fail passive, fail operational or fail operational-hybrid configuration). The system must be certified to fly and land the aircraft within the prescribed limits; and
     S serviceability of a roll-out control / guidance system (fail passive, fail operational or fail operational-hybrid) for RVR less than 200 m; and
     S serviceability of an autothrottle system; and
     S according to operating minima, an AFCS and/or HFDS go-around control and/or guidance.

Aural and visual warnings (for failures combinations not shown to be extremely improbable and which could result in an unsafe landing) must be available, including an immediate aural and/or visual warning of system disconnection.
PART 3 - THE ENVIRONMENT

Fog
Fog, in addition to reduce forward visibility, in general creates an illusion or false perception of distance and height.

A runway observed through fog appears to be farther than its real distance. There is also a tendency for a related height illusion.

In shallow fog conditions, especially at night, the whole of the approach and/or runway lighting may be visible from a considerable distance on the approach even if RVR or meteorological reports indicate the presence of fog.

On descent into such a fog layer, the visual reference available is likely to degrade rapidly, in extreme cases reducing from the full length of the approach lights to a very small segment.

This is likely to cause an illusion that the aircraft has pitched nose up, which may induce a pilot to make a corrective movement in the opposite direction.

The risk of striking the ground with a high rate of descent as a result of this erroneous correction is very real.

Fog structure
Even under stable conditions, a large variation with height of the concentration and size of water droplets is known to occur, with a tendency for the greater concentration to be at the higher heights.

These factors are responsible for the visual range within the fog to increase closer to the ground.

Despite its variability, the only fog parameter that currently lends itself to a rapid, accurate measurement is the RVR.

Fig. 11 - Effect of non-uniform fog on slant visual range (SVR)

Since it is a measure of the opacity of a horizontal sample of the atmosphere at a low height, it ignores vertical density changes.
Assuming the general case of fog density increasing with height, any Slant Visual Range (SVR) will be less than the RVR (Fig. 11).

Only at very low heights (less than 30 ft) SVR will be nearly the same as RVR.

Nevertheless, in certain conditions where fog density changes rapidly below 30 ft, poor correlation will be obtained and it is better to make no assumptions about visual reference from the reported RVR.

The dense and lifted fogs yield basically similar sequence where the visual segment, once obtained, increases. This sequence is to be expected when the approach is made through low clouds with or without fog underneath or into a fog where the pilot has been unable to see the ground beforehand (Fig. 12a/b).

![Fig. 12a - Visual segments in “conventional” fog](image)

Fig. 12a - Visual segments in “conventional” fog

![Fig. 12b - Visual segment in “conventional” fog as a function of height](image)

Fig. 12b - Visual segment in “conventional” fog as a function of height

Shallow fogs have a fundamentally different visual sequence as shown in Fig. 13a/b.
The limit to the pilot’s forward vision is the optical path through a length of fog equal to the SVR. So long as the aircraft is above the fog top, the angle of this path remains constant as height is decreased. The effect of this is to reduce the visual segment as height decreases, due to the geometry of the situation.

As soon as the aircraft is below the fog top, the angle will change and increase the visual segment as shown.

![Fig. 13a - Visual segments in shallow fog](image)

![Fig. 13b - Visual segment in shallow fog as a function of height](image)

Although a shallow fog is the usual cause of decreasing visual segment under stable fog conditions, a similar effect can be experienced in a dense fog where the density is the greatest near the surface.

In this case, as height decreases, the pilot is looking through fog of steadily increasing density and a reduction of visual segment may be experienced at quite a low height.
This applies more to CAT II than to CAT III operations since at 20 ft DH the aircraft will be below the worst of the fog, and the visual segment should be either increasing or constant, but not decreasing anymore.

Training for fog conditions is essentially performed in simulators. Although advanced technology is employed, the infinite variation of fog conditions cannot be reproduced; one of the most noticeable differences is that in the real world the visual cues appear progressively, while on simulators they appear more suddenly.

Anyway these considerations do not detract from the effectiveness of the training, which enables the crews to acquire the adequate experience in fog operation which would otherwise have been impossible.

**Changes in visual segment due to different brightness of lights**

Since the farthest visible object in the visual segment is generally a light, variations in the brightness of adjacent parts of the lighting pattern can produce changes in visual segment. This is particularly noticeable where high intensity approach lights are followed by less bright runway lights. This effect is noticeable in the CAT II/III lighting pattern as an apparent “wall of fog” at the threshold. This is because the approach lights are brighter and hence visible at a much greater distance than the runway centre line and edge lights.

Thus once the last (i.e. the innermost) approach lights have come into view, the pilot’s limit of forward vision could decrease until the relatively dim runway lights come into view.

Also after touch-down there may be an apparent reduction of visual segment after passing the touch-down zone lights. Although the centre line lights are just as bright as the TDZL, they are only in a single line and this decrease in the number of visible lights can appear to the pilot as a reduction in segment.

**Use of landing lights in fog**

When landing in reduced visibility, especially in fog, the use of landing lights may cause reduced forward visibility due to the blinding effect. It also may lead to disorientation.

For the above reasons, the use of landing lights in conditions with very low visibility is not recommended.

**Low level wind shear, precipitation, ice accretion**

Wind shear may require adjustments to heading, sink rate and thrust, or a missed approach during the approach or after the aircraft is properly flown to DH and visual reference is established.

Wind shear is the change in direction and/or velocity of the wind within vertical or horizontal distances traversed by an aircraft.

It is expressed in knots per hundred feet altitude. If a 20 kt headwind at 100 ft dropped to 10 kt at the surface, it would be termed a 10 kt shear.

Also, if a 10 kt crosswind component at 100 ft rotates to a 10 kt headwind or tailwind at the surface, it would also be a 10 kt shear.

A common case of wind shear is the one caused by earth surface friction.
Below about 3000 ft AGL and down to about 300 ft, surface friction will cause the wind to “back” (i.e. counter-clockwise rotation) the direction changing as much as 70 degrees.

This, in addition to airspeed variances, would cause a descending aircraft to have a constantly changing crab angle to track the localizer; however, this higher altitude phenomenon occurs slowly in a less critical area than the final phase of an ILS approach.

Although severe wind shears are rarely associated with CAT II/III operations, significant wind shear can occur.

In addition to sudden airspeed variations, a significant low level wind shear may considerably increase or decrease the crosswind component, requiring rapid crabbing or decrabbing to maintain alignment. This will probably prove to be the greatest cause of missed approaches after visual contact is established.

The comparison among ground speed and IAS, rate of descent and thrust required to the normal values and of the aircraft heading to localizer course can provide advance wind shear information. The same can be done by using the INS/FMS information on actual winds.

An automatic landing system approved for low visibility operations is not designed to cope with significant wind shear conditions. Therefore, should unexpected wind shear condition be encountered, the approach should be discontinued.

Other adverse weather conditions, such as icing, severe precipitation, turbulence capable to affect the aircraft performance and both the airborne and ground guidance equipment should be dealt with extreme caution, duly considering their impact with the low visibility operations.

Detailed information will be available in the adverse weather operations chapter of the appropriate Aeroplane Operating Manual.
PART 4 - HUMAN PERFORMANCE

During operations in fog the impact on human performance combines several aspects:
- heterogeneous visibility conditions, vertically as well as horizontally
- practically no attitude reference from the unlighted outside world
- reduced time for assessment of the visual cues and for maneuvering (even on ground)
- reduced margins to obstacles while still “on instruments”

A brief description of the problems of visual control, eye adaptation and decision making may help to have a better understanding of the factors influencing the behaviour of pilots during take-off, approach and landing with poor visibility conditions.

Take-off in low visibility

Take-off is generally possible in reported visibilities which are sufficient to ensure that the pilot will at all times have sufficient visibility to complete or abandon the take-off safely: the information available from external sources must be sufficient to enable the pilot to keep the aircraft within acceptable limits relative to the runway centre line throughout the take-off roll until it is either airborne or has been brought to a stop following discontinuation of the take-off. The basic information required by the pilot must enable him to judge the aircraft lateral position and rate of change of position. This is normally provided by external visual cues but these may be supplemented by instrument derived information. In establishing take-off minima due consideration must be given to the need for the pilot to continue to have adequate information in the event of abnormal situations or malfunctions of the aircraft systems.

It is believed that current minimum RVR values are higher than the absolute minimum required to control an aircraft during a normal take-off and incorporate margins to allow for unexpected fog banks, engine failures, etc.

Supplementary airworthiness criteria for directional guidance during the ground-portion of the take-off (i.e. from start to main wheel lift-off or to a standstill in the event of abandoned take-off) have been issued for lower visibilities because experience indicates that pilots are able to hold the centre line in very low visibilities (e.g. one or two lights visible at one time), and that this ability improves as the speeds increase. However, in such low visibilities the pilot may over-control in attempting to return to the centre line if the aircraft deviates for any reason, and the reducing speed of an abandoned take-off may be the most critical phase in this respect.

See to land – See to verify

In a “see-to-land” concept, part of the visual aids (of the approach and/or runway area) is in view for sufficient time to allow the pilot to make a thorough assessment of the aircraft position (and its rate of change), in relation to the desired flight path, and to maneuver should this be necessary.

In a “see-to-verify” concept, the part of the visual aids in view, when required, serves only to verify that the aircraft is in the correct position for a successful landing in the touch-down zone and for the subsequent roll-out.

Visual illusions

The control of an aircraft by visual reference is an extremely complex task requiring perception of even small changes of limited information available.
Since below DH the proper operation of the electronic aids is verified by visual references, the pilot has to be aware that visual illusions and - to a lesser extent - eye adaptation problems could arise.

Changes in visual segment have been found to have a marked effect on a pilot's visual judgment of flight path.

A sudden decrease of segment means that the forward limit of visibility moves closer, and thus further down the windscreen. This is similar to the visual effect of suddenly increasing pitch attitude, which could incorrectly be assumed as an autopilot fault.

The natural reaction is to lower the nose, thus disengaging the autopilot(s) and increasing the rate of descent and, of course, creating an undesired situation very close to the ground.

This confusion can best be avoided by establishing clear cockpit procedures (e.g. scanning of the basic flight instruments and the annunciators down to and including flare and roll-out by the Co-pilot and the CM 3).

When flying in rain, a refraction error may occur: the reduced windshield transparency and the deflection of the light beams due to water will cause objects to appear lower than they actually are in relation to the pilot. Therefore rain removal equipment is essential.

In addition, rain and fog adversely affect distance assessment.

Fascination occurs when a pilot does not succeed in perceiving clearly defined stimulus situations in an adequate way, his attention being too much focused to more than one object or one task. Fatigue, stress or emotional disturbances will increase this tendency.

Illusions as described above occur especially in reduced visibility and at night.

Darkness provides excellent camouflage and the eye loses much of its efficiency: lighting cues instead of daylight cues usually lack sufficient definition to provide more than a warning and outline.

Thus there is only one way to avoid the consequences of illusion and that is to continuously use and cross-check all available flight and navigation instruments during the whole approach.

Night naturally affects visual cues. A night contrasts are enhanced and afford better visual information than during daytime. During day operations the lights will be less discernible and the visual segment will seem shorter. Despite this, most pilots are more comfortable in daytime due to better cockpit visibility and cues available from runway contrast and markings.

More information on this subject is provided in the I.T.O. no. 48 "VISUAL ILLUSIONS".

**Eye adaptation**

Empty field myopia means the inability of the eye to be focused on long distance if no reference points are available.

A person with normal vision is usually able to see an object distinctly by the simple process of looking directly at it. Moreover, as the viewing distance changes, focus can be maintained by a process requiring little conscious effort.

A study carried out on pilots showed that the average adaptation time of the eye is in the order of less than half a second.
When all objects are removed from view, the individual is placed in an entirely different optical situation: the human visual mechanism can no longer focus on anything, and it is not self-evident how the eyes will respond.

It has been shown by experiment that a subject with normal eyesight is unable in these conditions to focus at points more than one to two meters away, and he becomes, in effect, short-sighted. The effect is possible in total darkness, in fog, in a uniformly clouded sky and in a cloudless sky. It is therefore of direct significance in aviation, where all these conditions occur.

The conditions causing empty field myopia can occur during an approach if the ground is obscured by haze, fog or darkness or covered with snow.

Note that the blinding effect of bright lights has much more serious effect on a pilot’s vision than the requirement to adapt the eyes to different distances within a short time.

The obscured ground segment - Seating position

Another important parameter related to visual control is the obscured ground segment, i.e. that part of visual range of no use for the pilot during take-off and approach because of the aircraft nose cut-off.

During take-off ground run the nose of the aircraft cuts off a segment (at $1^\circ$ pitch down attitude), which varies with aircraft type (Fig. 14a) and the associated cut-off angle.

For sake of simplicity, fixed average values of 15 m for category B and C aircraft and of 25 m for category D aircraft have been adopted as Company standard for the obscured segment at take-off.

![Fig. 14a - The obscured segment in take-off](image1)

In the final approach the nose of the aircraft cuts off up to 50% of the available visual range at the respective DH/RVR (eye height is 15+35 ft higher than DH according to the aircraft type) (Fig. 14b) due to different wheels/GP antenna vertical distance, which means different aircraft positions on the GP for a given RA value.

![Fig. 14b - The obscured segment during landing](image2)
The cut-off angle varies, in the final approach configuration on a normal glide path, from approximately 13° to 18°, depending on the aircraft type. Therefore, correct seat position is very important: use eye position indicator. As a rule, it can be said that sitting 1 cm too low results in a reduction of the cut-off angle of 1°, corresponding to a loss of 10 m of the visual ground segment at a height of 100 ft (Fig. 15).

![Correct Pilot's Eye Level](image)

**Fig. 15 - The correct eye level**

Further lowering of the seat position will aggravate the situation and the reduction of the visual ground segment will be as much as 35 m for 1°.

A pilot sitting too low will also have the tendency to pitch down the aircraft in order to acquire additional ground visibility: this will normally lead to a very dangerous situation: unstabilized aircraft with high rate of descent.

It is vital that pilots are well familiar with the contents of the visual ground segment.

Based on it, pilots shall be able to decide whether or not RVR is sufficient for take-off or visual references are adequate to continue the approach for a safe landing.

**Pilot's assessment of RVR for take-off**

In special circumstances, provision may be made for pilot’s assessment of RVR to determine compliance with take-off minima. A pilot may assess visibility at the take-off position in lieu of reported TDZ RVR (or equivalent) when:

1) TDZ transmissometer is inoperative, or RVR is not reported, or

2) Local visibility conditions as determined by the pilot indicate that a significantly different visibility exists than the reported RVR (e.g. patchy fog, blowing snow, RVR believed to be inaccurate due to snow cover or ice), and
   - pertinent markings, lighting, and electronic aids are clearly visible and in service (e.g. no obscuring clutter, etc.), and
   - the pilot’s assessment is made using an accepted method regarding identification of an appropriate number of centre line lights, or markings, of known spacing visible to the pilot when viewed from the flight deck when the aircraft is at the take-off point, and
   - the pilot assessment of visibility as a substitute for take-off RVR is authorized.

The assessed visibility value shall be transmitted to the TWR prior to departure.
Required visual references for landing

In a low visibility final approach, the required visual references “see-to-land” or “see-to-verify” have been determined as follows:

S CAT II (DH 100 ft)

It is generally agreed that the pilot needs a visual area corresponding to at least 3 seconds of distance traveled to be able to utilize the visual cues for manual maneuvering on the horizontal plane.

Three seconds of travel correspond to approx. 190-230 m depending on speed, and the visual ground segment at 100 ft is in the order of 200 m (according to pilot’s eye height) if the slant visual range is equal to an RVR of 300 m.

From 100 ft the time to touch-down is in the order of 10-12 seconds and the time to start of the flare of 5-7 seconds. This indicates that the pilot cannot afford much loss of the visual information.

A temporary loss of a visual cue significantly reduces the ability to maneuver and cannot be accepted.

Without regard to speed and distance traveled, a good CAT II/III lighting system give sufficient directional and roll guidance if a visual segment

i. of at least 3 consecutive lights (being the centre line barrettes of the approach lights, or touch-down zone lights, or runway centre line lights, or a combination of these); and

ii. a lateral element on the ground lights pattern, i.e. an approach lighting crossbar, or the landing threshold or a barrette on the touch-down zone lighting

is attained and can be maintained in sight.

In other words, at DH the pilot should determine that adequate visual reference is available to verify that the aircraft is in a position such as to permit a successful landing in the touchdown zone with manual control when necessary.

Should the visual reference be judged inadequate at DH, a go-around should be executed.

At 100 ft DH the approach lights provide good lateral and roll guidance, but there is not much information about pitch from the outside. The horizon is obscured and the crossbars are in motion.

What makes things still more difficult is that the visibility or, in other words, the distance to the farthest visible lights may be varying due to the fact that the fog is vertically non-homogeneous.

This condition could give the illusion that the aircraft is pitching up or down, and that this is the reason for the change in the visual segment.

Since normally the visibility improves closer to ground, the visual ground segment increases and this may be interpreted as a pitch down.

A more abnormal and severe case is when the visibility decreases closer to ground.

Then the illusion may falsely give an impression of a pitch up.

It is therefore quite clear that the decision to land must be only based on a fully stabilized and in-trim condition.

It is also clear that cockpit procedures must be such that a constant monitoring of pitch attitude is maintained (Fig. 16, related to MD-80).
Fig. 16 - Visual ground segment with 100 ft DH/300 m RVR

- CAT IIIA (DH 50 or 20 ft)

At DH with 200 m RVR the pilot sees only a few centre line lights and one or two barrettes of the TDZL. These visual cues are neither sufficient for roll nor for pitch guidance (Fig. 17 related to MD-80).

They deliver, however, good information about lateral position relative to the centre line. Adequate outside visual reference for an automatic landing is assumed to exist if at DH a segment of at least 3 consecutive lights (being the centre line barrettes of the approach lights, or touch-down zone lights, or runway centre line lights, or a combination of these) is attained and can be maintained in sight.

These limited visual cues are necessary to verify that the aircraft is in a position that will permit a successful landing in the touchdown zone, and that the initial landing rollout can be accomplished.
The Captain should not allow the automatic systems to carry on without adequate outside visual reference leaving him outside the "control loop".

The PNF should monitor the flight instruments throughout the rollout until the aircraft has been decelerated to taxi speed and can be controlled visually.

Fig. 17 - Visual ground segment with 50 ft DH / 200 m RVR

S CAT III B “hybrid” (DH 20ft)

In case of a fail operational/hybrid automatic landing system, at 20 ft a segment of at least 3 consecutive lights, as specified above for CAT IIIA, must be visible.

The guidance symbolism provided by the HFDS will be simplified below DH, in order to prevent that non relevant information for the flare and roll-out phase in progress may cause disturbance with the external visual reference.

After touch down, basic roll-out HFDS guidance only will be displayed.

S CAT III B (DH 20 ft)

The limited visual cues associated with DH 20 ft and RVR less than 200 m stress even more the need for the flight crew of complete confidence in the Automatic Flight Control System (AFCS), which will be strictly monitored from the commencement of the approach throughout the rollout or go-around.

The CAT IIIB concept does more than reduce landing minima: it requires the pilots to mostly rely on the Automatic Flight Control System and to be able to fully supervise it.

The Captain decision to land or go around will be based on continuous monitoring of the approach through the flight instruments.

Misalignment, excursion or mismatch of information provided by the flight instruments during the approach till the final phase will alert the Captain to the decision to execute a go around.

Aircraft position, attitude, height, speed and flight path vector can be determined more accurately by referring to the related instruments rather than by the limited visual cues available in CAT IIIB conditions.
At 100 ft the Captain may pick up approach lights glow; at 50 ft he may be able to see a limited portion of the touch down zone lights; at 20 ft at least one runway centre line light will be attained and maintained in sight.

S CAT IIIB with no DH

No visual cues are required prior to landing.

The minimum RVR 125 m will enable the Captain to carry out the roll-out in case of failure of a fail passive rollout system.

75 m RVR will enable the Captain to monitor a fail operational roll-out system.

The decision to land will be based on the A FCS status at 100 ft and announced by the Captain who will then go in search for whatever visual cues will be available.

The PNF should monitor the flight instrument throughout the rollout until the aircraft has been decelerated to taxi speed and can be controlled visually.

Fig. 18 - Visual ground segments under cat. II/III conditions (A321)
Decision-making process

The increased dependence on the use of automatic systems puts more emphasis on the role of the pilot as a supervisor of their operation and on the decision-making process involved.

The distribution of flight deck duties ensures that the workload of the pilot making the decision to land or execute a missed approach enables him to devote himself to supervision and the decision-making process.

The decision-making process begins at the initiation of the approach and continues while the approach is in progress.

In poor visibility conditions the visual cues come into play just above or at DH, leaving the pilot not much time for assessment to finalize his decision.

Pilot behaviour during low visibility instrument approaches can be split up in two: the continuous tracking behaviour necessary to control the aircraft, and the decision-making behaviour required to make the decision to continue the approach and landing or to execute a go-around.

It is the second behaviour the main concern during CAT II operations and, to a lesser extent in CAT III.

The difficulty of a decision making task is, in part, determined by doubtfulness of some of the data used to make a decision.

For example, the decision for a go-around is a relatively easy one if, at DH, there is nothing to be seen outside the aircraft.

It is when the approach or runway lights are barely visible, and then only intermittently, that the decision-making becomes more difficult: the pilot has to be aware of the fact that there are specific problems concerning decision-making under very poor visibility conditions.
PART 5 - OPERATING PROCEDURES

Authorized operating minima for low visibility operations are published
- for low visibility take-offs in each airport chart;
- for CAT II approaches in each approach chart;
- for CAT III approaches in each Aeroplane Operating Manual; in the “additional Company info” for the concerned aerodrome if higher due to local restrictions.

Their values are determined according to JAR OPS 1 and OM General Basic and shall be checked for every single flight in relation to aerodrome equipment completeness, aircraft systems efficiency status and flight crew qualifications if required.

Taxiing

In very low visibility conditions expect to see bright lights at a safe distance, but not unlighted or poorly lighted obstacles, such as aircraft tails or wing tips: from certain angles their navigation lights, if operating, do not show up well.

Since aircraft movement rates will be low in these conditions, taxi as slowly as necessary for safety. Do not hesitate to request from ATC the positions of other taxiing aircraft or to ask for a follow-me car.

Use extreme care to taxi according to the clearance issued. That is, use the correct taxiways to/from the runway.

Take-off

Low visibility procedures must be in force. In addition:
- maximum crosswind component: 10 knots for RVR £ 150 m (cat. B and C aircraft) / £ 200 m (cat. D aircraft);
- no reduced/flexible take-off thrust;
- no rolling take-off allowed.

In addition to their normal duties:
- the pilots should check conditions and ground equipment/aircraft systems;
- Captain and Copilot must be qualified for LVTO with applicable RVR less than 150 m (for category B/C aircraft) / less than 200 m (for category D aircraft);
- it is of primary importance for the crew members to review, by means of a dedicated pre-flight briefing, the peculiarities of the low visibility take-off, such as:
  - task sharing
  - RVR minima
  - standard call outs during the take-off run
  - rejected take-off
  - all other relevant items that may affect the LVTO;
- at night, eye accommodation to night vision should be preserved through an appropriate use of cockpit lights;
- TDZ and MID-POINT (and STOP END if within required runway length) RVR reported values must be equal to or above required RVR;
- when the TDZ transmissometer is inoperative, or the TDZ RVR is not reported, or local visibility conditions indicate that a significantly different visibility than the reported may exist (e.g. patchy fog, blowing snow, RVR believed to be inaccurate due to snow cover or ice), and pertinent markings, lighting, and electronic aids are clearly visible and in service (e.g. no obscuring clutter, etc.) the reported TDZ RVR value (representative of the initial part of the take-off run) may be replaced by pilots assessment, unless prohibited by State rules.

NOTE: The observed visual range from the cockpit can be estimated by counting the visible runway lights (either the edge or the centre line lights) multiplied by their spacing (as published in the aerodrome chart); to this value add 15 m or 25 m (obscured segment for category B/C and D aircraft; see page 29). The assessed visibility value shall be transmitted to the TWR.

- The PF will concentrate on outside vision from the moment the take-off thrust is applied;
- the PNF (CM 2) (and/or CM 3) will continuously monitor the instruments (from the moment the take-off thrust is applied), with particular care for the heading;
- use of landing lights is not recommended;
- all intermittent external aircraft lights (including anticollision lights) should be deactivated for the initial phase of the take-off;
- in case of rejected take-off, remember that if the centre line lights are color-coded, when they appear red and white there are 900 m of runway left; when all red, less than 300 m of runway are available.

In addition:

\[\text{S with RVR not less than 150 m (cat. B/C aircraft) or 200 m (cat. D aircraft):}\]
- the CM 1 should act as pilot flying;
- on both panels the ILS localizer indications ("front beam inbound") for the runway in use are recommended (except when a VOR frequency is to be used by C/M -1 for navigation purposes).

\[\text{S with RVR less than 150/200 m but not less than 125 m (cat. B/C aircraft) or 150 m (cat. D aircraft):}\]
- the C/M -1 should act as pilot flying;
- on both panels the ILS localizer indications ("front beam inbound") for the runway in use are available (except when a VOR frequency is to be used by C/M -1 for navigation purposes);
- if a certified lateral guidance system is installed, its use is recommended (provided both pilots have received relevant training).

\[\text{S with RVR less than 125/150 m:}\]
- the Captain should act as pilot flying;
- on both panels the ILS localizer (CAT III or CAT II) indications ("front beam inbound") for the runway in use are available;
- a certified lateral guidance system is used;
- runway protection and facilities equivalent to CAT III operations are in effect.
Approach

Low visibility procedures must be in force. In addition:

- factoring of the reported meteorological visibility is not allowed;
- maximum tailwind component: 10 knots (or 5 knots for braking action “poor”);
- maximum crosswind component: 15 knots with RVR less than 800 m but not less than 350 m, 10 knots with RVR less than 350 m. Further limitation may be required by AFCS certification as stated in the Aeroplane Operating Manual;
- for CAT II/III operations, the Company policy requires that the approach must be automatic (managed by the Captain acting as PF);
- for CAT II operations with RVR less than 350 m, autoland is required for category D and, for Company policy, category C aircraft;
- for CAT III operations, full autoland capability of the aircraft is required; in CAT III with DH, visual references are only requested to verify that the aircraft is in a position which will permit a successful landing in the touchdown zone and subsequent roll-out; with no DH there is no requirement for visual contact with the runway prior to touchdown.

The list of the required aircraft equipment and instruments for low visibility operations is included in each Aeroplane Operating Manual.

Airworthiness authority requires continuous maintenance monitoring of the AFCS /HFDS /PVD. Therefore it is of the utmost importance that the Captain always make an entry in the specific box of the Technical Log Book any time the system(s) is (are) used regardless of the weather conditions.

Failed/downgraded aerodrome equipment

Completeness of aerodrome equipment required for low visibility approaches must be considered. The table (not for operational use) at page 40 is a quick reference for this purpose: the table shows the effects on CAT II/III operating minima of failed or downgraded aerodrome equipment. For actual operations the table is enclosed in the aircraft “performance charts” booklet.

The table is intended for use both pre-flight and in-flight. It is not expected however that the Captain would consult such instructions after passing the outer marker or equivalent position. If failures of ground aids are announced at such a late stage, the approach could be continued at Captain’s discretion. If, however, failures are announced before, their effect on the approach should be considered and the approach may have to be abandoned to allow this to happen.
### Effect on Operating Minima (see Note 1)

<table>
<thead>
<tr>
<th>Failed or Downgraded Equipment</th>
<th>Cat. IIIB Without DH</th>
<th>Cat. IIIB With DH</th>
<th>Cat. IIIA</th>
<th>Cat. II</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILS Stand-by Transmitter</td>
<td>Not allowed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outer Marker</td>
<td>No effect if replaced by published equivalent position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle Marker</td>
<td>No effect (see Note 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RVR Assessment Point</td>
<td>Touch Down Zone</td>
<td>May be temporarily replaced with midpoint RVR if approved by the State of the aerodrome (see Note 3). RVR may be reported by human observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mid Point or Stop End</td>
<td>No effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anemometer for Runway in Use</td>
<td>No effect if other ground source available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach Lights System (ALS)</td>
<td>U/S except the last 420 m</td>
<td>No effect</td>
<td></td>
<td>Not allowed</td>
</tr>
<tr>
<td></td>
<td>U/S except the last 210 m</td>
<td>No effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>U/S</td>
<td>No effect</td>
<td>Not allowed if DH &gt; 50 ft</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Standby Power</td>
<td>No effect</td>
<td>RVR as for cat. I with basic facilities (see Note 5)</td>
<td></td>
</tr>
<tr>
<td>Whole Runway Light System</td>
<td>Not allowed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edge Lights</td>
<td>Day only: RVR 200 m</td>
<td>Day only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centre Line Lights</td>
<td>Day only: RVR 200 m</td>
<td>Day only: RVR 300 m</td>
<td>Day: RVR 300 m</td>
<td>Night: RVR 550 m</td>
</tr>
<tr>
<td></td>
<td>spacing increased to 30 m</td>
<td>RVR 150 m</td>
<td>No effect</td>
<td></td>
</tr>
<tr>
<td>Touch Down Zone Lights</td>
<td>No effect</td>
<td></td>
<td>Day: RVR 200 m</td>
<td>Night: RVR 300 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Day: RVR 300 m</td>
<td>Night: RVR 550 m</td>
</tr>
<tr>
<td>Standby Power for Runway Lights</td>
<td>Day only: RVR 200 m</td>
<td></td>
<td>Not allowed</td>
<td></td>
</tr>
<tr>
<td>Taxiway Light System</td>
<td>No effect</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Multiple failures to runway lights in addition to those mentioned in table are not allowed.
(2) Required in some States: in such a case the relevant approach charts specify corrections to minima for MM u/s.
(3) In such condition cat. II/III operations are allowed also without TDZ RVR; the minimum RVR of charts shall be related to mid-point RVR.
   One RVR reporting point only is required for cat. IIIB operations with no DH.
(4) Cat. II/III operations are not allowed when failure affects both the runway lights system and the RVR assessment system.
(5) Cat. B,C,D aircraft:

<table>
<thead>
<tr>
<th>DH(ft)</th>
<th>RVR (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200-250</td>
<td>800</td>
</tr>
<tr>
<td>251-300</td>
<td>900</td>
</tr>
<tr>
<td>301 and above</td>
<td>1000</td>
</tr>
</tbody>
</table>
Task sharing

Task sharing for CAT II/III operations is based on the automatic approach procedure. Peculiarities of this procedure for CAT II/III operations are:

- use of the autopilot coupled to the ILS in the proper mode;
- Captain acting as pilot flying (PF) from not later than the OM;
- automatic landing in CAT III; automatic or manual landing in CAT II. For a manual landing the autopilot shall be left engaged until visual cues related to the runway touchdown zone have been completely acquired, but not below the minimum height allowed in the Aeroplane Operating Manual;
- landing monitored or carried out by the Captain, while the Copilot continues exclusively the instrument monitoring down to and including flare and rollout.

Before commencing a CAT II/III approach, in addition to their normal duties, the pilots should check:

- conditions and ground equipment/aircraft systems;
- seating position; and
- Captain and Copilot must be CAT II/III qualified: the lowest applicable minima are those for which both Captain and Copilot are authorized.

The Captain shall conduct a briefing in order to verify that crew members are fully familiar with:

- sterile cockpit procedure;
- actions in case of loss of CAT II/III capability above DH;
- DH/RVR for the approach and reversion to higher approach minima;
- HFDS procedure when applicable;
- autopilot disconnect height (for aircraft with no autoland capability);
- go around technique (automatic or manual, when or if applicable);
- expected wind shear/adverse weather if applicable.

Instrument approach should be conducted applying normal procedures and certified limitations of AFCS.

In order to achieve the optimum performance from AFCS, rudder and aileron trim should be checked before engaging the autopilot in the landing configuration.

ILS localizer should be intercepted at the proper angle, speed, distance from the runway to allow stabilization of the flight path and avoid the risk of false localizer capture.

The Copilot will continuously monitor the flight instruments throughout the approach, landing and rollout.

The Copilot and CM-3 will advise the Captain of any abnormal indication exceeding acceptable tolerances.

The Captain will monitor the flight progress and when approaching DH, will mainly concentrate on outside scanning to acquire the necessary visual references.
After the Captain has acquired the required visual cues and announced “LAND”, the Copilot should remain on instruments, ready to call out deviations and/or discrepancies.

For CAT III approaches with no DH, the Captain will be head--up, taking advantage of any available visual cue for landing. However, as no visual reference is required before touchdown, the decision to land will be taken at RA 100 ft, based on the A FCS status.

During final approach, once the decision for a go--around has been taken it must never be abandoned.

It is important that the crew follow the established standard operating and coordination procedures during low visibility operations.

MD--80 HFDS CAT IIIB approaches

The specific tasks requested for this approach should be performed in addition to the ones requested for CAT IIIA operations.

The relevant procedure is contained in the Aeroplane Operating Manual.

In darkness conditions, above 500 ft, set HFDS brightness at the maximum level acceptable to the Captain.

When “AUTOLND” and “20 G/A” is annunciated on the FMA, the Captain should transition head--up to HFDS image and monitor the progress of the flight through the system.

At DH + 100 ft the Captain should be prepared for decision--making upon the availability of adequate visual reference and upon correct position of the FPV (Flight Path Vector symbol) relative to the runway: he should take care not to concentrate only upon HFDS symbols, but start searching for external visual cues through the combiner lens.

At DH, if adequate visual reference are available and FPV symbol is correctly positioned on the touchdown zone, the Captain will continue with the landing procedure. If not, a go--around will be initiated with HFDS procedure.

Should AFCS or HFDS failure be annunciated above DH, a go around should be initiated.

At or below DH with adequate visual cues, the Captain may decide to continue on the remaining system to touch down and roll--out.

**WARNING:** Maximum care should be taken to avoid fixation on HFDS symbology on final approach. Eye focusing on the HFDS combiner information may cause loss of depth perception, thus putting in jeopardy the pilot capability to execute a proper flare.

Alert height (AH)

The Alert Height applies to the CAT III fail--operational case; it is generally established between 100 and 300 ft RA.

If a failure occurs in one of the required redundant operational systems above the AH, the approach will be discontinued and a go--around executed.

Below AH, any single failure of one of the required redundant systems will not affect autoland capability and the approach may be continued. The Captain will announce “CONTINUE”.

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Informazione Tecnico Operativa Nr. 58
Visual phase

The visual phase is considered more demanding than the instrument phase specially in CAT II operations.

While the Copilot continues to stay on instruments and warns the Captain of any major deviation (attitude, speed, G/P, LOC, sink-rate), the Captain will take all references from outside. He has to counteract any tendency to leave the “corridor”. In doing so he has to be very careful because the interpretation of visual references may be misleading and may not be fully correct.

It is possible that a pilot introduces a correction which is not appropriate or that a correction is necessary and the pilot does not react.

The pilot has to be extremely careful applying any pitch down correction, because it is very difficult for him to realize in due time the new path of the aircraft.

The landing phase as such with due regard to the limited forward visibility, does not present any extraordinary problems.

- During the visual phase a deterioration of visibility is possible.
- Don’t land at all costs.
- Don’t hesitate to take an early and clear decision for a go-around.
- In CAT II operations if at 100 ft the aircraft is slightly right or left of the centre line, do not apply too large lateral corrections.
  It is better to land slightly offside the runway centre line than to have an aircraft touching down exactly on the centre line, however not tracking parallel to the runway axis.
  For a safe landing, the aircraft should be tracking within the red barrettes of the approach lights last 300 m.
- Let the aircraft land with crab on. With the crab angle necessary for the maximum allowed crosswind it is better to induce an acceptable stress to the landing gear than to decrab.
- In manual landing do not go out for a smooth touchdown.
- Use of landing lights is not recommended.

Touch down and braking

The PNF will continue to monitor the automatic function of the system by mode annunciators.

- Use normal braking technique.
- The use of autobrake is recommended; however monitor its effectiveness. As soon as the first red/white centre line light passes under the nose of the aircraft there are 900 m of runway left and ground-speed should in no case be higher than 100 kt. If the aircraft enters the last 900 m of runway above 100 kt, the Captain will apply maximum braking (either automatic or manual).
  If all centre line lights are red, there are less than 300 m of runway available and action should be taken accordingly.
- Most pilots are anxious to decelerate the aircraft to a stop as soon as possible. However, a complete familiarity with the runways lighting and markers, location of turnoffs,
etc., will help to alleviate any apprehension on stopping capability and reduces the possibility of undue inputs for heavy braking.

- When entering a fog patch after landing, the visibility can deteriorate to almost zero. As a general rule: never make a go-around out of this condition but apply full brakes and reverse.

**Roll-out in low visibility**

If the visibility is very limited, directional control with reference to the runway lights will become progressively more difficult as speed is reduced, especially with brake application.

During automatic rollout, the expanded localizer and the yaw command pointer (if available) are of primary importance in assessing the performance of the auto-rollout system in combination with the visual cues; the use of HFDS if available, is recommended. Be aware that the nearer centre line lights and TDZ lights cannot be as clearly seen as those further away because of the different angle with the pilot’s eyes.

**Go around**

Due to the terrain proximity, the go-around manoeuvre should be performed with good accuracy. Especially during the visual phase, the crew should be alert for a possible go-around. Mental readiness, with due regard to the actions to be executed, is a must.

A CAT II/III approach shall be discontinued if:

- so required by ATC;
- at DH the Captain has not established the required visual reference (only for operations with DH);
- at 100 ft for CAT III approaches, if the reported RVR is below the required value for the “mid point” and/or “stop end” (if applicable);
- maximum localizer or glide slope deviations are exceeded;
- the aircraft position is such that it will not touchdown within the TDZ.

A go-around will also be initiated if, after visual contact is established and before touchdown, adequate visual reference is lost or the alignment with the runway becomes unsatisfactory.

As far as AFCS malfunctions are concerned, a CAT II/III approach shall be discontinued in case of:

- a failure above DH which prevents an auto-coupled approach;
- with an AFCS “fail operational”, a failure in one of the redundant operational systems above AH in CAT III;
- a failure which prevents an automatic landing in CAT II with RVR below 350 m (cat. C and D aircraft only) or in CAT III; however, at or below DH, the Captain may elect to land manually, announcing “CONTINUE”, if, in the circumstances, he recognises that the safest action is to continue to land.

Pushing the relevant switches on the throttles, the AFCS goes to go-around mode and the go-around will be performed manually or automatically, according to the available system capability.
For CAT III operations, a go-around initiated from very low heights may result in an inadvertent touchdown during the go-around manoeuvre. However the go-around should not be interrupted. The PNF will closely monitor the flight instruments also throughout the go-around manoeuvre.

**CREW CONCEPT AND CREW COORDINATION ARE THE PASSWORDS THROUGHOUT THE LOW VISIBILITY PROCEDURES.**

**A SUCCESSFUL LOW VISIBILITY OPERATION MAY BE ACHIEVED ONLY IF THE CREW MEMBERS ARE A WELL TRAINED AND COORDINATED TEAM.**
### Normal sequence of actions for CAT II/III approaches

**NOTE:** The Captain must act as PF not later than the OM.

<table>
<thead>
<tr>
<th>CONDITION</th>
<th>CM</th>
<th>DUTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>ALL</td>
<td>Follow S.O.P. as per Ops Manual - General Basic.</td>
</tr>
<tr>
<td></td>
<td>PF</td>
<td>Provides all inputs on the AFCS related to the aircraft flight path and verifies the sequence of modes</td>
</tr>
<tr>
<td></td>
<td>PNF</td>
<td>Verifies the sequence of AFCS modes</td>
</tr>
<tr>
<td>Localizer indicator leaves the full scale deflection</td>
<td>PNF</td>
<td>Calls “Loc alive”</td>
</tr>
<tr>
<td>Glide path indicator leaves the full scale deflection</td>
<td>PNF</td>
<td>Calls “Glide alive”</td>
</tr>
<tr>
<td>Outer Marker altitude</td>
<td>PF</td>
<td>Verifies that aircraft position is correct and starts timing</td>
</tr>
<tr>
<td></td>
<td>PNF</td>
<td>Verifies that aircraft position is correct, calls “Outer marker” and starts timing</td>
</tr>
<tr>
<td>1500 ft RA</td>
<td>ALL</td>
<td>For fail operational-hybrid CAT IIIB approach, verify AFCS CAT III capability</td>
</tr>
<tr>
<td></td>
<td>PF</td>
<td>For fail operational-hybrid CAT IIIB approach, transitions to HFDS image</td>
</tr>
<tr>
<td></td>
<td>PNF*</td>
<td>Verifies AFCS CAT II/III capability</td>
</tr>
<tr>
<td>1000 ft RA</td>
<td>PF</td>
<td>For aircraft with no auto-callout system, calls “1000 ft Radioaltimeter”</td>
</tr>
<tr>
<td></td>
<td>PNF*</td>
<td>For aircraft with no auto-callout system, calls “500 ft Radioaltimeter” and starts standard radio altimeter callouts.</td>
</tr>
<tr>
<td>500 ft RA</td>
<td>PNF</td>
<td>Calls “Approaching minima” and continues to stay on instruments</td>
</tr>
<tr>
<td></td>
<td>PNF*</td>
<td>For aircraft with no auto-callout system, calls “Approaching minima” and continues to stay on instruments</td>
</tr>
<tr>
<td>DH + 100 ft</td>
<td>PF</td>
<td>Starts looking for visual cues</td>
</tr>
<tr>
<td>Adequate visual cues or 100 ft RA (CATIII with no DH)</td>
<td>PF</td>
<td>Calls “LAND” and continues for landing.</td>
</tr>
<tr>
<td>DH (if applicable)</td>
<td>PNF</td>
<td>Calls “MINIMA”</td>
</tr>
<tr>
<td></td>
<td>PF</td>
<td>If adequate visual cues are not established calls “GO AROUND” and performs the go - around</td>
</tr>
<tr>
<td>Landing</td>
<td>PF</td>
<td>Verifies the visual cues and monitors autoland performance or carries out manual landing</td>
</tr>
<tr>
<td></td>
<td>PNF</td>
<td>Continues to stay on instruments</td>
</tr>
<tr>
<td>Go Around</td>
<td>ALL</td>
<td>Perform the procedure as per Ops Manual - General Basic.</td>
</tr>
</tbody>
</table>

* In three-crew member aircraft: CM3.
PART 6 - INTERPRETATIVE AND EXPLANATORY MATERIAL

Commencement and continuation of approach

Before commencing an approach to land, the Commander must satisfy himself that, according to available information, the weather at the aerodrome and the condition of the runway intended to be used should not prevent a safe approach, landing or missed approach, having regard to the performance information contained in the Aeroplane Operating Manual.

An instrument approach may be commenced regardless of the reported RVR/Visibility but shall not be continued beyond the outer marker or equivalent position or, where no outer marker or equivalent position exists, before descending below 1000 ft AGL on the final approach segment, if the reported RVR/Visibility is less than the applicable minima.

It is considered that the approach commences when speed is reduced and aircraft configuration progressively changed, with respect to speed and configuration used for descent or holding, in order to achieve the final approach speed/configuration.

If, after passing the outer marker or equivalent position or 1000 ft AGL, the reported RVR/Visibility falls below the applicable minimum, the approach may be continued to DA / DH or MDA.

The approach may be continued below DA / DH or MDA and the landing may be completed provided that the required visual reference is established at the DA / DH or MDA and is maintained.

It is in addition required that at the “mid point” (and at the “stop end point” if located within the required runway length) the RVR value be at least 50 m with runway centre line lights (RCL) available or 200 m without runway centre line lights.

Establishment of minimum RVR for category II and III operations

The method adopted to resolve the DH/RVR relationship in respect of Category II and III operations utilizes a fairly complex computer programme to take account of a wide range of variables. It has been found that with the improvement in the performance of visual aids, and the increased use of automatic equipment in the many different types of new aircraft, most of the variables cancel each other out and a simple tabulation can be constructed which is applicable to a wide range of aircraft. The basic principles which are observed in establishing the values in such a table are that the scale of visual reference required by a pilot at and below decision height depends on the task that he has to carry out, and that the degree to which his vision is obscured depends on the obscuring medium, the general rule in fog being that it becomes more dense with increase in height. Research using flight simulators coupled with flight trials has shown the following:

a. most pilots require visual contact to be established about 3 seconds above decision height though it has been observed that it reduces to about 1 second when a fail-operational automatic landing system is being used;

b. to establish lateral position and cross-track velocity most pilots need to see not less than a 3 lights segment of the centre line of the approach lights, or runway centre line, or runway edge lights;

c. for roll guidance most pilots need to see a lateral element of ground pattern, i.e. an approach lighting crossbar, the landing threshold, or a barrette of the touchdown zone lighting;
d. to make an accurate adjustment to the flight path in the vertical plane, such as the flare, using purely visual cues, most pilots need to see a point on the ground which has a low or zero rate of apparent movement relative to the aircraft;

e. with regard to fog structure, data gathered in the United Kingdom over a twenty-year period have shown that in deep stable fog there is a 90% probability that the slant visual range from eyes heights higher than 15 ft above the ground will be less that the horizontal visibility at ground level, i.e. RVR. There are at present no data available to show what the relationship is between the slant visual range and RVR in other low visibility conditions such as blowing snow, dust or heavy rain, but there is some evidence in pilot reports that the lack of contrast between visual aids and the background in such conditions can produce a relationship similar to that observed in fog.

**Category II operations**

The length of the required visual segment for Category II operations is based on the following requirements:

a. a visual segment of not less than 90 metres will need to be in view at and below DH for pilot to be able to monitor an automatic system; and

b. a visual segment of not less than 120 metres will need to be in view for a pilot to be able to maintain the roll attitude manually at and below DH; and

c. for a manual landing using only external visual cues, a visual segment of 225 metres will be required at the height at which flare initiation starts in order to provide the pilot with sight of a point of low relative movement on the ground.

**Category III fail passive operations**

During an automatic landing the pilot needs to monitor the performance of the aircraft system, not in order to detect a failure which is better done by the monitoring devices built into the system, but so as to know precisely the flight situation. In the final stages he should establish visual contact and, by the time DH is reached, he should have checked the aircraft position relative to the approach or runway centre-line lights. For this he will need sight of horizontal elements (for roll reference) and part of the touchdown area. He should check for lateral position and cross-track velocity and, if not within the pre-stated lateral limits, he should carry out a go-around. He should also check longitudinal progress and sight of the landing threshold is useful for this purpose, as is sight of the touchdown zone lights.

In the event of a failure of the automatic flight guidance system at or below decision height, if a go-around is mandatory the visual reference requirements will be less because there is no need to provide for the possibility of a manual landing. However, this option is only acceptable if it can be shown that the probability of a system failure below decision height is acceptably low. It should be recognised that the inclination of a pilot who experiences such a failure would be to continue the landing manually but the results of flight trials in actual conditions and of simulator experiments show that pilots do not always recognise that the visual cues are inadequate in such situations and present recorded data reveal that pilots’ landing performance reduces progressively as the RVR is reduced below 300 metres. It should further be recognised that there is some risk in carrying out a manual go-around from below 50 ft in very low visibility and it should therefore be
accepted that if an RVR lower than 300 metres is to be authorised, the flight deck procedure should not normally allow the pilot to continue the landing manually in such conditions and the aircraft system should be sufficiently reliable for the go-around rate to be low. However there may be circumstances where the safest action is to continue the landing. Such circumstances include the height at which the failure occurs, the actual visual references, and other malfunctions. This would typically apply to the late stages of the flare.

In conclusion the landing may be completed when the Captain determines that this is the safest course of action.

These criteria are obviously fully applicable without concern in the case of a fail-passive automatic landing system supplemented by a head-up display (i.e. a fail-operational hybrid system which gives guidance to complete a landing in the event of a failure of the automatic landing system).

“Fail operational” Cat. III operations with Decision Height

For Category III operations utilising a fail-operational landing system with DH, the pilot should be able to see at least 1 centre line light.

For Category III operations utilising a fail-operational hybrid landing system with DH, the pilot should have a visual reference containing a segment of at least 3 consecutive lights of the runway centre line lights.

“Fail operational” Cat. III operations with No Decision Height

For Category III operations with no Decision Height the pilot is not required to see the runway prior to touchdown. The permitted RVR is dependent on the level of aircraft equipment.

Pilot’s assessment of flight visibility at DA / DH or M DA

The JAA rule allows the Commander to assess that the required visual reference exists at DA / DH or M DA to continue and land; the rule reflects the years-old FAA rule (FAR 91.189 and 121.651) according to which if a pilot has begun the final approach segment of an instrument approach procedure and after that he receives a later weather report indicating below-minima conditions, the pilot may continue the approach to DH or M DA. Upon reaching DH or at M DA, and at any time before the missed approach point, the pilot may continue the approach below DH or M DA and land if the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers that will allow touchdown to occur within the touchdown zone of the runway and the flight visibility is not less than the visibility prescribed for the instrument approach procedure being used.

The above-said FAR sections give also the detailed list of the runway lights and/or markings, at least one of which must be distinctly visible and identifiable to the pilot for ILS cat. III, II, I and non precision approaches.

Introducing the rule, the FAA commented:

“The rule specifies that no pilot may operate an aircraft below DH or M DA unless the flight visibility is not less than the visibility prescribed for the instrument approach procedure being used. This requirement is necessary to make it clear that the visibility referred to is the visibility from the aircraft: the pilot must have this flight visibility from descent below DH or M DA until touchdown.
The rule specifies the visual references which are intended to allow descent below DH or MDA and precludes use of references not listed. In low visibility operations visual references could rarely be considered clearly visible in the strict sense of the word due to factors such as the distortion of rain on the windshield, backscattered light of landing lights and other reasons. The words “distinctly visible and identifiable” have been adopted because they appropriately denote the intention that the visual references be discrete and unmistakably identifiable; “distinctly visible and identifiable” should not be taken to mean that descent below DH or MDA can be based on general glow of approach lights through a layer of fog or other obscurations where the visual references themselves are not discretely identifiable.

The FAA does not agree with the view that assessment of flight visibility is impossible for pilots to do: for many years pilots have been making such judgments to safely operate aircraft, even though such judgments may not be numerically exact.

If horizontal visibility at altitude may be less than the authorized reported visibility at ground level, this is not sufficient reason to remove the requirement for assessment of flight visibility from the aircraft.

A variety of sources suggest instances where slant visibility as seen by the pilot can be very much less than the horizontal visibility at ground level. Thus if the requirement for flight visibility assessment by the pilot is removed, it would be permissible to continue a descent below DH or MDA in the unsafe situation where visibility is reported above minimums and one or more listed visual references may be distinctly in sight but the flight visibility is much less than the visibility specified in the procedure and inadequate to safely complete the landing.

For example, in a case where weather is reported to be above minima, if the requirements regarding visual references alone was met by having one or more of the listed visual references distinctly in sight, a pilot could have continued the approach even though the flight visibility was very poor and much less than published minimums. This situation is unsafe because the necessary visual reference for assessment or control of the aircraft approach path may not be present. Other alternatives such as making ground-reported weather exclusively controlling, would require unnecessary missed approaches and diversions to alternate airports also when weather is better than reported and safe for an approach and landing. The suggestion to make ground-reported RVR or meteorological visibility exclusively controlling for continuation of a descent below DH or MDA could lead to restrictions on operations with little or no overall benefit to safety. An example of this would be the case where the pilot has the listed references distinctly in sight and has determined that the flight visibility is at or above the published minimums, but the visibility or RVR is reported below minimums due to commonly recognized weather measuring and reporting inaccuracies. This case requires an unnecessary missed approach and a diversion to an alternate airport.

Once a pilot has passed the OM or final approach fix, no provision supersedes the pilot’s responsibility to assess visual reference below the DH or MDA. Thus even though a report of RVR may indicate that weather is above minimums, when below DH or MDA the pilot must, in his judgment, determine that the actual weather conditions are at least equal to the prescribed minimums to continue an approach. Conversely, once past the OM or final approach fix, if the pilot determines that the visual requirements are met, the approach may continue and a landing may be made.

It is important to note that the provision to continue an approach below DH or MDA if flight visibility is considered by the pilot to be above minima and one of the acceptable visual references is in sight, is not an encouragement for pilots to deliberately misestimate visibility to land in unsafe conditions with ground reporting prevailing visibility or RVR reported below minima.
In the case where visual references may be temporarily lost while below DH or MDA, the pilot is expected to initiate a missed approach. When below DH or MDA, any deliberate delay in initiation of a missed approach in the hope that visual references will soon reappear, is not appropriate, such as in the case of deliberate descent through low cloud, scud, or fog in which the requirements cannot be met. If the pilot uses normal procedures, however, and does not deliberately delay taking action to transit the intermittent condition, but still has not initiated the missed approach when the visual references reappear, a missed approach is not required.”

**RVR assessment vs RVR measurement**

ICAO Annex 3 contemplates the concept of “assessment” of RVR along the runway with the following rationale.

“Since, in practice, the runway visual range cannot be measured directly on the runway and in view of other limitations imposed by observation methods, a runway visual range observation should be the best possible assessment of the range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line. For this assessment a height of approximately 5 m (15 ft) should be regarded as corresponding to the average eye level of a pilot in an aircraft.”

The limitations imposed by the observation methods (which may consist of computerized means or human observators) introduce a certain degree of approximation in the measurement of RVR and therefore the concept of “assessment” in the operational terminology.

The operationally desirable accuracy of RVR observation should be ± 10 m up to 400 m; ± 25 m between 400 and 800 m; ± 10 % above 800 m.

**NOTE:** In 1994 the attainable accuracy with computerized means was ± 25 m up to 150 m; ± 50 m between 150 and 500 m; ± 10 % above 500 m up to 2.000 m.
PART 7 - DEFINITIONS

Alert Height (AH): a specified radio-altimeter height, based on the characteristics of the aircraft and its fail-operational landing system. In operational use, if a failure occurred above the alert height in one of the required redundant operational systems in the aircraft (including, where appropriate, ground roll guidance) the approach would be discontinued and a go-around executed unless reversion to a higher decision height is possible. If a failure in one of the required redundant operational systems occurred below the alert height, it would be ignored and the approach continued to an automatic landing.

All Weather Operations: a taxi, take-off, landing and roll-out operation carried out with visual reference limited by meteorological conditions.

Automatic Flight Control System (AFCS): the airborne equipment which provides automatic control of the flight path of the aircraft by reference to the ILS. It includes all of the sensors, actuators and power supplies necessary to control the aircraft; it may include an automatic landing system, an auto roll-out system and an automatic missed approach mode. An automatic throttle control may be provided for use with the AFCS. Indications and controls necessary for the management and supervision by the pilot are included.

Automatic Landing System: the airborne equipment which provides automatic control of the aircraft during the approach and landing to touchdown.

Fail-Operational Automatic Landing System: an automatic landing system is fail operational if, in the event of a failure, the approach, flare and landing can be completed by the remaining part of the automatic system. In the event of a failure, the automatic landing system will operate as a fail passive system. An AH is associated to a fail-operational automatic landing system (see “alert height”).

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 or execute a safe go around after a failure of the primary system below DH.

NOTE: A typical secondary independent guidance system consists of a monitored head-up display providing guidance which normally takes the form of command information but it may alternatively be situation or deviation information.

Fail-Passive Automatic Landing System: an automatic landing 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 will not be completed automatically. For a fail passive automatic landing system the pilot assumes control of the aircraft after a failure.

Automatic roll-out control/guidance system: additional function of an automatic landing system to provide control of the aircraft along the runway after touch-down. An automatic roll-out control may be fail-passive or fail-operational (definitions as for the automatic landing system, as applicable).

The ground guidance system should be a Category III ILS or a Category II ILS which complies with the Category III Standards of ICAO Annex 10 in respect of all significant performance parameters.

CAT II operation: an ILS approach and landing with a Decision Height below 200 ft but not lower than 100 ft and a minimum RVR of 300 m.
**CAT III operation:** an ILS approach and landing with a Decision Height lower than 100 ft, or no Decision Height and a RVR lower than 300 m but not less than 75 m. CAT III operations are subdivided as follows:
- CAT IIIA : DH lower than 100 ft and RVR not less than 200 m
- CAT IIIB : DH lower than 100 ft or no DH, and RVR less than 200 m but not less than 75 m.

**ILS critical area:** area of defined dimensions about the localizer and glide path transmitter antenna in which environment change, including the presence of vehicles and aircraft, will cause disturbance to the ILS signals for automatic landing and/or roll-out guidance.

**ILS sensitive area:** an area extending beyond the critical area in which the parking and/or movement of vehicles and aircraft will affect the ILS signals when used for automatic approach or roll-out guidance.

**Low Visibility Operation:** a take-off conducted when the applicable RVR is less than 400 m or an approach and landing conducted in CAT II/III conditions.

**Low Visibility Procedures (LVP):** procedures applied at an aerodrome for the purpose of ensuring safe operations during CAT II and CAT III approaches and low visibility take-offs.

**Low Visibility Take-Off (LVTO):** a take-off where the applicable RVR is less than 400 m.

**Runway Visual Range (RVR):** the range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runway or identifying its centre line. Runway visual range observations should be representative of the touchdown zone and, as may be selected by the authority concerned, of the middle and far sections of the runway, and should be made on all runways intended for use during periods of reduced visibility and in particular on:
- precision approach runways;
- runways used for take-off and having high-intensity edge lights and/or centre line lights.

**Slant Visual Range (SVR):** the distance between the pilot’s eye while in flight and the farthest point on the ground he can see.
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Airworthiness Technical Manual / doc. 9051

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JAR-OPS 1 Subpart E - All Weather Operations

Alitalia Group: Company Operations Manual:
- General Basic
- Aeroplane Operating Manual
- Route Manual

ENAV: All Weather Operations, DOP 2/97