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GENERAL

This section presents the recommendations of Airbus Industrie for operations from wet runways or from runways which are covered with contaminants such as standing water, slush or snow.

CAUTION

Do not take-off on an icy runway.

DEFINITIONS

- DAMP : A runway is damp when the surface is not dry, but when the water on it does not give it a shiny appearance.
- WET : A runway is considered as wet when the surface has a shiny appearance due to a thin layer of water. When this layer does not exceed 3 mm depth, there is no substantial risk of hydroplaning.
- STANDING WATER : Is caused by heavy rainfall and/or insufficient runway drainage with a depth of more than 3 mm.
- SLUSH : Is water saturated with snow which spatters when stepping firmly on it. It is encountered at temperatures around 5°C and its density is approximately 0.85 kg/liter (7.1 lb/US GAL).
- WET SNOW : Is a condition where, if compacted by hand, snow will stick together and tend to form a snowball. Its density is approximately 0.4 kg/liter (3.35 lb/US GAL).
- DRY SNOW : Is a condition where snow can be blown if loose, or if compacted by hand, will fall apart again upon release. Its density is approximately 0.2 kg/liter (1.7 lb/US GAL).
- COMPACTED SNOW : Is a condition where snow has been compressed (a typical friction coefficient is 0.2).
- ICY : Is a condition where the friction coefficient is 0.05 or below.

The performance given in this chapter has been divided into two categories which are determined by the depth of the contaminant. For each of these categories an equivalent depth of contaminant has been defined for which the performance deterioration is the same.

1. WET RUNWAY and EQUIVALENT

Equivalent of a wet runway is a runway covered with less than :

- 2 mm (0.08 inch) slush
- 3 mm (0.012 inch) standing water
- 4 mm (0.16 inch) wet snow
- 15 mm (0.59 inch) dry snow

2. CONTAMINATED RUNWAY

A linear equivalence between depth of slush and snow has been defined :

Equivalents:

- 6.3 mm (1/4 inch) slush
- 12.7 mm (1/2 inch) wet snow
- 50.8 mm (2 inches) dry snow

- Note :** 1. On a damp runway no performance degradation should be considered.
2. To aid in the selection of correct chart use the following:-

USE CHART FOR

1/2 inch of water	1/2 inch of water
1/2 inch of slush	1/2 inch of slush
1/2 inch of wet snow	1/4 inch slush
2 inches of dry snow	1/4 inch slush
2 inches of dry compacted snow	Compacted snow

3. CAA limitations do not permit take-off from a runway covered with more than:-

Water, slush, or wet snow - 15mm

Dry snow - 60mm

4. Take-off is prohibited if the braking action is reported as "POOR".

OPERATIONAL CONDITIONS - TAKE OFF

ASSUMPTIONS FOR WET RUNWAYS

- Antiskid and spoilers are operative
- The friction coefficient is based on studies and checked by actual tests
- The screen height at the end of the takeoff segment is 15 feet, not 35 feet.

In addition, for contaminated runways only :

- The contaminate is in a layer of uniform depth and density of the contaminant layer over the entire length of the runway.
- There is drag due to rolling resistance of the wheels
- There is drag due to spray on the airframe and gears
- Reverse thrust is used for the deceleration phase
- Maximum thrust is used for takeoff.

Note : . The net flight path clears obstacles by 15 feet instead of 35 feet.

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TAKEOFF PERFORMANCE

CAUTION

The method is based on the use of the RTOW charts established at optimum V2/VS, at optimum V1/VR and V1 min (minimum V1 in the V1 range). It should not be used with takeoff charts computed with other conditions.

Correct the determined maximum takeoff weight on dry runway to take into account QNH and bleed effects, then apply the corrections given on the following pages.

- Note :**
1. The results obtained with this method may be different from the influence given at the bottom of the RTOW chart.
 2. On contaminated runway, in some cases, no MTOW can be determined with this method (box dashed below a given weight). A specific RTOW chart must then be computed.

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TAKEOFF FROM A WET RUNWAY

1. Determine the maximum takeoff weight or flexible temperature and associated speeds on dry runway.
2. Four sets of three tables are given depending on the use of thrust reversers, configuration and the presence of clearway.

Select the table applicable to your case. The runway length in the table corresponds to the available takeoff run (TORA).

Do not interpolate for runway length. Use the shorter runway length.

3. Apply the corrections shown in the following tables :
 - The first two lines give the weight or flexible temperature corrections and the associated speeds corrections to be applied when OAT (for maximum takeoff weight determination) or flexible temperature is below or equal to the temperature value given in line 3 (TVMC).
 - The fourth and fifth lines give the weight, flexible temperature and speed corrections when OAT or flex temperature is above TVMC.

The above corrections are valid for airfields up to 2000 feet pressure altitude. Above 2000 feet pressure altitude TVMC must be decreased by 1°C per 300 feet above 2000 feet.

4. Check that the corrected V1 is greater than the minimum V1 (V1 limited by VMCG) value shown on the RTOW chart.

If the corrected V1 is below minimum V1 :

- Actual TOW is limited by maximum TOW, retain minimum V1 as V1 and further decrease weight by 5000 kg per 1 knot difference between V1 values.
- Actual TOW lower than maximum TOW
 - * If the maximum TOW has a corrected V1 equal to or above minimum V1, retain minimum V1 as V1 and decrease flexible temperature by 2°C per knot difference between minimum V1 and V1 corresponding to actual TOW.
 - * In the rare cases when the corrected V1 corresponding to maximum TOW falls below minimum V1, retain minimum V1 as V1 and either decrease maximum TOW by 5000 kg per knot difference between V1 values or decrease flexible temperature by 2°C per knot difference between minimum V1 and V1 corresponding to corrected actual TOW.

In any case, check that the corrected flexible temperature is higher than OAT and Tref.

5. Check that VR and V2 are above the minimum VR and V2 values shown on the RTOW chart.
6. Check that V2 is above the minimum V2 value due to VMU (Refer to 2.02)

If V2 or VR are below the minimum values, this method is not valid, a specific takeoff chart must be computed.

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- Note :**
- Do not interpolate between values, always refer to the lower runway length.
 - Do not extrapolate below the shortest runway length provided in the tables.
 - When using the following tables, the flexible temperature is limited to a maximum of 51°C.
 - If no minimum speed value is available, use the conservative values provided on 2.02.25.

CAUTION

The following tables have been established for TOGA or FLEXIBLE thrust. Do not use them for BUMP or derated thrust.

To be issued later

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SPRAY PATTERN

There is a little chance of the engines ingesting fluid, which in any case should not jeopardize safety. The risk of ingestion is independent of the depth of the contaminant.

CROSSWIND

To optimize directional control during the low speed phase of the takeoff and landing roll and according to the reported braking action given by the control tower, it is not recommended to take off or to land with a crosswind component higher than :

Reported braking action	Reported runway friction coefficient	Maximum crosswind (kt)	Equivalent runway condition **
Good	≥ 0.4	27*	1
Good/medium	0.39 to 0.36	27	1
Medium	0.35 to 0.3	20	2/3
Medium/poor	0.29 to 0.26	20	2/3
Poor	≤ 0.25	15	3/4
Unreliable		5	4/5

* This is the maximum crosswind demonstrated for dry and wet runway.

** Equivalent runway condition (only valid for maximum cross wind determination) :

1. Dry, damp or wet runway (less than 3 mm water depth)
2. Runway covered with slush
3. Runway covered with dry snow
4. Runway covered with standing water with risk of hydroplaning or wet snow
5. Icy runway or high risk of hydroplaning.

TAXIING

- FOLLOWING TAXIING PROCEDURES.....**CONSIDER**
- Avoid high thrust settings.
 - When taxiing on slippery surfaces, stay well behind preceding aircraft.
 - Taxi at low speed. Note that antiskid does not operate at low taxi speeds.
 - Where the sides of the taxiways are contaminated with snow and ice, giving reduced clearance for the outboard engines, ensure that whilst taxiing the outboard engines are kept at idle power.
 - On slippery taxiways during turns with large nose wheel steering angles, noise and vibration may result from the wheels slipping sideways. Keep speed as low as possible to make a smooth turn with minimum radius. Differential power may be needed.
 - If taxiing in icing conditions with precipitation on runways and taxiways contaminated with slush or snow :
 - Before takeoff keep flaps/slats retracted until reaching the holding point on the takeoff runway to avoid contaminating the mechanism. Hold the BEFORE TO checklist at FLAP SETTING and finish it after extending flaps/slats.
 - When taxiing-in after landing, do not retract the flaps/slats to avoid damage of the structure. After engine shutdown make a visual inspection to determine that the flap/slat mechanism is free of contamination.
 - When the mechanism is clean, use the following procedure to retract the flaps/slats before the aircraft electric network is de-energized :
 - Select ON the GREEN and YELLOW ELEC PUMP.
 - Retract the FLAPS and monitor retraction on ECAM page.
 - Select OFF the GREEN and YELLOW ELEC PUMP and resume with normal procedure.

TAKEOFF

- FOLLOWING TAKEOFF PROCEDURES**CONSIDER**
- For contaminated runways, select MAX TO.
 - Do not abort takeoff for minor deficiencies even at low speeds.
 If you have to abort takeoff, maintain directional control with the rudder and small inputs to the nose wheel. If necessary, use differential braking to regain the center line when stopping distance permits.
 - Do not lift the nose wheel before VR in an attempt to avoid splashing slush on the aircraft, because this produces additional aerodynamic drag.
 - Rotate, lift off and retract gear and high lift devices in the normal manner.

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LANDING

- **FOLLOWING LANDING PROCEDURES**.....**CONSIDER**
- Avoid landing on contaminated runways if the antiskid is not functioning. The use of autobrake LOW or MED is recommended provided that the contamination is evenly distributed.
 - Approach at the normal speed.
 - Make a positive touchdown after a brief flare.
 - As soon as the aircraft has touched down, lower the nose wheel onto the runway and select maximum reverse thrust.
Do not hold the nose wheel off the ground.
 - If necessary, the maximum reverse thrust can be used until the aircraft is fully stopped.
 - If the runway length is limiting, apply the brakes before lowering the nose gear onto the runway, but be prepared to apply back stick to counter the nose down pitch produced by the brakes application. (The strength of this pitching moment will depend on the brake torque attainable on the slippery runway).
 - If the runway is reduced in width by snow and ice, and providing the landing distance allows it. It is recommended to select only the inboard engines into reverse thrust.
 - Maintain directional control with the rudder as long as possible, use nose wheel steering with care.
 - When the aircraft is at taxi speed, follow the recommendations for taxiing.

Note : If there is snow, visibility may be reduced by snow blowing forward at low speeds if reversers are not cancelled.