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## GENERAL

The aircraft is certified in accordance with the relevant regulations for a three engine ferry flight with non revenue load provided such a flight is authorized in the AFM. It is the airline responsibility to obtain operational approval from its own national authorities.

## TECHNICAL CONDITION OF THE AIRCRAFT

If not affected by inoperative engine, the following systems must be fully operative (the associated MMEL references are reminded for information only).

|          |                                                  |
|----------|--------------------------------------------------|
| 27-22-01 | Rudder Trim System                               |
| 27-23-01 | Rudder Travel Limiter System                     |
| 27-51-01 | Flaps System                                     |
| 27-64-01 | Spoilers                                         |
| 27-81-01 | Slats system                                     |
| 27-93-01 | PRIM                                             |
| 27-94-01 | SEC                                              |
| 28-42-01 | Fuel Quantity Indication                         |
|          | A) OUTER                                         |
|          | B) INNER                                         |
| 29-22-01 | Blue elec pump in case of engine 2 rotor locked. |

**Note :** *In case of blue elec pump inoperative, ensure that blue accumulator pressure is in the green range before dispatch.*

|          |                                        |
|----------|----------------------------------------|
| 32-42-01 | Main Wheel Brakes                      |
| 32-51-01 | Nose Wheel Steering Control System     |
| 73-25-01 | FADEC (on the remaining engines)       |
| 74-31-01 | Ignition system                        |
|          | A) System A (on the remaining engines) |
|          | B) System B (on the remaining engines) |
| 80-11-01 | Start valve (on the remaining engines) |

With one engine inoperative, the following associated systems are lost and then the corresponding MMEL requirements must be fulfilled.

|          |                                                |
|----------|------------------------------------------------|
| 24-22-01 | A/C Main generation (IDG, GCU, Line contactor) |
| 36-11-01 | Bleed air supply system (Engines).             |

|                                                                                                                                   |                                  |  |         |        |
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## **ENGINE**

All four engines with complete cowlings must be installed. Any one engine may be unserviceable. Prior to ferry flight the unserviceable engine has to be conditioned in accordance to the engine manufacturer maintenance manual in either of the following configurations :

- Windmilling. Fan rotor and core engine freely rotating in the airflow.
- Locked rotor. Fan rotor and core engine locked by maintenance measures.

Depending upon whether rotating part, vanes, abradable seals etc. have sustained damage it is the airline responsibility to choose the correct engine configuration.

## **OPERATING LIMITATIONS**

### **GENERAL**

The following gives only the additional restrictions applicable to three engine operation.

Where not explicitly mentioned, the basic limitations remain valid throughout three engine ferry flight.

### **FLIGHT DURATION**

#### **FERRY FLIGHT WITH ROTOR LOCKED :**

No flight duration limitation.

#### **FERRY FLIGHT IN WINDMILLING :**

The duration of the ferry flight depends on :

- the flight time performed after the engine failure during the previous flight
- the status of the lubrication system during this period of time (which depends on the type of failure).

The total flight time (with engine failed during the previous flight plus the ferry flight) must not exceed :

- 7 hours without lubrication,
- 9 hours with lubrication.

During the ferry flight, the lubrication system is always considered inoperative, so, the duration of the ferry flight itself is in all cases limited to 7 hours.

### **FLIGHT CREW**

Ferry flights are carried out by crews acquainted with the special requirements and procedures by specific training.

|                                                                                 |                                                               |  |         |        |
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## **WEIGHT AND CG LIMITATIONS**

For ferry flights the operating weight is limited to the minimum necessary for each particular leg. The maximum aft CG at takeoff is limited to 35%. This permits to keep sufficient nose wheel steering capability in combination with special power application procedure and to limit the tendency of auto-rotation at high speeds on ground.

Refueling of trim tank is not allowed for three engine ferry flight.

## **TAKEOFF AND LANDING CONFIGURATION**

For maximum performance at takeoff the packs and anti ice must be switched off. Slat/flap configuration for takeoff is CONF 2 only. Slat/flap configuration for landing is CONF 3 only.

## **WEATHER CONDITIONS**

Icing conditions must be avoided because the associated engine anti ice system is not available on the inoperative engine.

Takeoff is only authorized on a smooth and hard-surfaced runway. The runway must be dry or wet. Takeoff on a runway covered with standing water, slush, snow or ice is not permitted.

## **X WIND**

The maximum crosswind allowed for takeoff is 10 knot.

## **LANDING GEAR**

Dispatch for a flight with landing gear down is not permitted.

## **POWER PLANT**

Takeoff with flexible or derated thrust is not permitted.

## **NORMAL OPERATING PROCEDURES**

### **GENERAL**

The standard operating procedures given in FCOM 3.03 remain applicable for a three engine ferry flight. In addition specific actions due to the engine shut down are indicated by ECAM messages. The flight crew has to comply with the actions required by the ECAM.

|                                                                                 |                                                               |  |         |        |
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## **TAKEOFF PROCEDURE**

- Align with a 5 meters offset towards the two engine operative side
- Specific takeoff thrust setting procedures have been defined for the two following cases:

### **Takeoff procedure with an OUTER engine inoperative :**

- Set TOGA on the two inner engines and 50 % N1 on the operative outer engine prior to brake release
- After brake release, progressively accelerate the operative outer engine to reach 70 % N1 at 100 knots and TOGA at 130 knots.

**Note :** *Do not rush to increase power on operative outer engine. N1 target is 70 % at 100 knots.*

- Apply and maintain half forward sidestick until just prior to VR
- At VR, apply normal rotation technique
- After lift-off, follow  $\beta$ -target guidance.

### **Takeoff procedure with an INNER engine inoperative :**

- Set TOGA on the two outer engines and 50 % N1 on the operative inner engine prior to brake release.
- After brake release, accelerate the operative inner engine to reach TOGA by 100 knots.
- Apply and maintain half forward sidestick until just prior to VR
- At VR, apply normal rotation technique
- After lift-off, follow  $\beta$ -target guidance.

## **SYSTEM OPERATION**

### **– BLEED/AIR COND :**

#### **• Before takeoff**

The two packs must be switched OFF.

To avoid warnings occurring at takeoff power application :

|                                  |       |      |
|----------------------------------|-------|------|
| ENG BLEED (affected)             | ..... | OFF  |
| XBLEED                           | ..... | OPEN |
| PACK FLOW                        | ..... | LO   |
| FWD CARGO COOLING (if installed) | ..... | OFF  |

#### **• After takeoff**

PACK operation according to standard operating procedures.

|                                                                                                                                 |                                                        |                    |               |
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– **FMGS :**

It is recommended to set the ACCEL ALT at 1000 feet AGL if there is no performance and/or obstacle constraint.

– **ELEC :**

The generator associated with the inoperative engine must be switched off throughout the ferry flight. The complete AC and DC network remains supplied. No specific shedding of commercial loads is required.

– **FLT CTL :**

| UNSERVICEABLE ENGINE | CONSEQUENCE                                                                     |
|----------------------|---------------------------------------------------------------------------------|
| 2                    | Slats slow<br>Spoilers partially lost<br><br>Pitch trim 2 lost                  |
| 3                    | Flaps slow<br>Yaw damper 2 lost<br>Spoilers partially lost<br>Pitch trim 1 lost |
| 1 or 4               | Normal operation                                                                |

In case of spoilers partially lost the landing distance has to be increased according to ECAM indication on STATUS page.

With an outer engine inoperative,  $\alpha$  floor protection is inhibited when slats/flaps are extended.

– **ANTI ICE**

For takeoff, wing and engine anti ice must be selected at OFF.

– **FUEL :**

As for normal operation the fuel pumps are selected ON, including the one of the inoperative engine. After takeoff consider fuel imbalance, refer to FUEL IMBALANCE procedure (Refer to FCOM 3.02.28).

– **HYD :**

The engine driven pump of the inoperative engine must be selected OFF. Before takeoff the electric pump of the affected engine should be selected as follows :

| ENG INOPERATIVE | SWITCHING     | REMARKS                                                                                                             |
|-----------------|---------------|---------------------------------------------------------------------------------------------------------------------|
| 1 or 4          | G ELEC : AUTO | As for normal operation                                                                                             |
| 2               | BELEC : Off   | As for normal operation                                                                                             |
| 3               | Y ELEC : OFF  | To avoid transients when electric pump is started automatically at TO when passing 100 knot (not required by ECAM). |

**Note :** When the unserviceable engine is windmilling do not push ENG FIRE pushbutton since that may cause hydraulic pump damage.

|                                                                                 |                                                               |  |         |        |
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#### – **INDICATING/RECORDING :**

At application of TO power the «ENG 1(2)(3)(4) SHUT DOWN» caution is triggered on ECAM. Since the ignition system might be damaged due to prolonged activation, disregard the action «ENG START SEL . . . . . IGN», unless severe turbulence or heavy rain is encountered. Additionally when ENG 2 or 3 are inoperative «B (Y) SYS LO PR» caution is triggered. No action being displayed, ECAM can be cleared.

#### – **BRAKES :**

Alternate braking is not available when engine 2 is inoperative.

### **ABNORMAL OPERATING PROCEDURES**

The abnormal operating procedures given in FCOM 3.02, remain applicable for three engine ferry flight. (Additional failures will be taken into account by the ECAM).

In case of dispatch with one outer engine inoperative, if the remaining outer engine fails during takeoff :

- do not select landing gear up (retraction is lost but landing gear doors would open).
- use VLS + 12 as final takeoff speed.

In case of ferry flight with engine 2 unserviceable.

- If blue brake accumulator pressure is low, recharge it by using the blue hydraulic electrical pump. If the blue hydraulic electrical pump is not available, check the brake accumulator pressure on the triple indicator, before slats extension. If it is not in the green range, select the blue (ENG 2) engine driven pump to recharge the blue accumulator. Check that the accumulator pressure is in the green range, then select engine driven pump to off.

**Note :** *The airspeed before slats extension is sufficiently high to allow recharging of the blue brake accumulator within approximately one minute.*

### **PERFORMANCE**

#### **REQUIREMENTS**

The following requirements replace, for the 3 engine ferry flight case, the regulatory requirements usually applicable.

#### **TAKEOFF**

- For takeoff distance and takeoff run determination, no additional engine failure is taken into account. The required TOD and TOR are equal to 1.15 the actual distances. No clearway may be taken into account.
- For acceleration-stop distance determination, the delay between VEF (speed at which an engine failure occurs) and V1 is 1 second.

|                                                                                                                                   |                                                            |             |        |
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- V1 is limited by VMCG–2  
VR must be above VMCG–2  
VR must be above 1.03 VMCA–2  
V2 must be above 1.07 VMCA–2
- There is no requirement concerning the first segment
- A gradient of 1.5%, at 400 feet height, is required, with both outer engines inoperative and landing gear down (most adverse condition, after failure of an additional engine).
- For final takeoff, a gradient of 1.2 % is required, with both outer engines inoperative and landing gear down. The en-route climb speed must not be less than 1.30 VS.
- The net takeoff flight path is the gross flight path with both outer engines inoperative and landing gear down reduced by a gradient of 0.5 %.

## APPROACH AND LANDING

- There is no requirement concerning the approach climb
- For landing climb, a gradient of 2 % is required (one engine inoperative, landing configuration, gear down).
- The approach speed must be above VMCL–1.

## EN ROUTE

The net climb gradient is the gross gradient decreased by 1 %.

## PERFORMANCE DATA

### TAKEOFF

A specific takeoff chart must be computed for each runway from which a three engine ferry flight is performed.

It is not recommended to take off with tailwind.

### FUEL PLANNING

The performance data are provided for the rotor locked case. Fuel consumption for the windmilling case is about 3 % lower.

The recommended speeds are 250kt/M.70 for climb, M.70 for cruise, M.70/250 kt for descent and green dot speed for holding.

Pages 8 to 12 give the corresponding performance tables.

The landing climb performance is never limiting for airports up to 4000 feet (5300 feet with air conditioning OFF). For higher airport elevations, the corresponding maximum limiting weight must be determined using the performance programs.

In case of a second engine failure, the aircraft will drift down to the ceiling drawn on page 13.

A flight planning table (page 19) allows the fuel and time required from brake release to landing to be determined. In cruise quick check (page 21) and alternate table (page 22) are also provided.

To be issued later

|                                                                                                                                                                  |                                  |  |         |        |
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## TWO ENGINES INOPERATIVE – ONE ROTOR LOCKED

### M.70

| GROUND | AIR DISTANCE (NM) |      |                      |      |      |           |      |
|--------|-------------------|------|----------------------|------|------|-----------|------|
| DIST.  | TAIL WIND         |      | WIND COMPONENTS (KT) |      |      | HEAD WIND |      |
| (NM)   | +150              | +100 | + 50                 | 0    | -50  | -100      | -150 |
| 100    | 73                | 80   | 89                   | 100  | 114  | 133       | 159  |
| 200    | 146               | 160  | 178                  | 200  | 228  | 266       | 318  |
| 300    | 219               | 240  | 267                  | 300  | 342  | 399       | 478  |
| 400    | 292               | 321  | 356                  | 400  | 457  | 532       | 637  |
| 500    | 364               | 401  | 445                  | 500  | 571  | 665       | 796  |
| 600    | 437               | 481  | 534                  | 600  | 685  | 798       | 955  |
| 700    | 510               | 561  | 623                  | 700  | 799  | 931       | 1114 |
| 800    | 583               | 641  | 712                  | 800  | 913  | 1064      | 1273 |
| 900    | 656               | 721  | 801                  | 900  | 1027 | 1197      | 1433 |
| 1000   | 729               | 801  | 890                  | 1000 | 1141 | 1329      | 1592 |
| 1100   | 802               | 882  | 979                  | 1100 | 1256 | 1462      | 1751 |
| 1200   | 875               | 962  | 1068                 | 1200 | 1370 | 1595      | 1910 |
| 1300   | 948               | 1042 | 1157                 | 1300 | 1484 | 1728      | 2069 |
| 1400   | 1021              | 1122 | 1246                 | 1400 | 1598 | 1861      | 2228 |
| 1500   | 1093              | 1202 | 1335                 | 1500 | 1712 | 1994      | 2388 |
| 1600   | 1166              | 1282 | 1424                 | 1600 | 1826 | 2127      | 2547 |
| 1700   | 1239              | 1362 | 1513                 | 1700 | 1940 | 2260      | 2706 |
| 1800   | 1312              | 1442 | 1602                 | 1800 | 2055 | 2393      | 2865 |
| 1900   | 1385              | 1523 | 1691                 | 1900 | 2169 | 2526      | 3024 |
| 2000   | 1458              | 1603 | 1779                 | 2000 | 2283 | 2659      | 3183 |
| 2100   | 1531              | 1683 | 1868                 | 2100 | 2397 | 2792      | 3343 |
| 2200   | 1604              | 1763 | 1957                 | 2200 | 2511 | 2925      | 3502 |
| 2300   | 1677              | 1843 | 2046                 | 2300 | 2625 | 3058      | 3661 |
| 2400   | 1750              | 1923 | 2135                 | 2400 | 2739 | 3191      | 3820 |
| 2500   | 1822              | 2003 | 2224                 | 2500 | 2854 | 3324      | 3979 |
| 2600   | 1895              | 2084 | 2313                 | 2600 | 2968 | 3457      | 4139 |
| 2700   | 1968              | 2164 | 2402                 | 2700 | 3082 | 3590      | 4298 |

# LONG RANGE CRUISE

| GROUND | AIR DISTANCE (NM) |      |                      |     |     |           |      |
|--------|-------------------|------|----------------------|-----|-----|-----------|------|
| DIST   | TAIL WIND         |      | WIND COMPONENTS (KT) |     |     | HEAD WIND |      |
| (NM)   | +150              | +100 | + 50                 | 0   | -50 | -100      | -150 |
| 100    | 67                | 75   | 86                   | 100 | 120 | 150       | 200  |
| 120    | 80                | 90   | 103                  | 120 | 144 | 180       | 240  |
| 140    | 93                | 105  | 120                  | 140 | 168 | 210       | 280  |
| 160    | 107               | 120  | 137                  | 160 | 192 | 240       | 320  |
| 180    | 120               | 135  | 154                  | 180 | 216 | 270       | 360  |
| 200    | 133               | 150  | 171                  | 200 | 240 | 300       | 400  |
| 220    | 147               | 165  | 189                  | 220 | 264 | 330       | 440  |
| 240    | 160               | 180  | 206                  | 240 | 288 | 360       | 480  |
| 260    | 173               | 195  | 223                  | 260 | 312 | 390       | 520  |
| 280    | 187               | 210  | 240                  | 280 | 336 | 420       | 560  |
| 300    | 200               | 225  | 257                  | 300 | 360 | 450       | 600  |
| 320    | 213               | 240  | 274                  | 320 | 384 | 480       | 640  |
| 340    | 227               | 255  | 291                  | 340 | 408 | 510       | 680  |
| 360    | 240               | 270  | 309                  | 360 | 432 | 540       | 720  |
| 380    | 253               | 285  | 326                  | 380 | 456 | 570       | 760  |
| 400    | 267               | 300  | 343                  | 400 | 480 | 600       | 800  |
| 420    | 280               | 315  | 360                  | 420 | 504 | 630       | 840  |
| 440    | 293               | 330  | 377                  | 440 | 528 | 660       | 880  |
| 460    | 307               | 345  | 394                  | 460 | 552 | 690       | 920  |
| 480    | 320               | 360  | 411                  | 480 | 576 | 720       | 960  |
| 500    | 333               | 375  | 429                  | 500 | 600 | 750       | 1000 |

Left intentionally blank