



1.1. AIRPLANE AND GENERAL LIMITATIONS

1.1.1. MINIMUM FLIGHT CREW.

Three persons.

1.1.2. MAXIMUM OPERATING ALTITUDE.

The maximum altitude reached during certification flights is :

39.300 ft.

1.1.3. OPERATIONAL LIMITS.

Operation is certificated within the following limits :

a. TAKE-OFF AND LANDING :

TAKE-OFF	LANDING
<u>SAT limits (ambient air) :</u> from -35°C to Standard +35°C.	
<u>Altitude limits (press.alt.) :</u> -500 ft. to + 8.300 ft.	
<u>Runway slope limits :</u> <u>Uphill slope :</u> + 2% : if $\frac{\text{weight}}{\text{max. weight}} \leq 0,92$ + 1,5% : if $\frac{\text{weight}}{\text{max. weight}} = 1$ <u>Downhill slope :</u> - 2% : (all conditions)	<u>Runway slope limits :</u> <u>Uphill and downhill slopes:</u> + 2%
<u>Limiting tail-wind component :</u> 10 kts	
<u>Maximum Cross-wind</u> On dry runway : 24 kts On slippery runway : 20 kts	

b. EN ROUTE :

<u>SAT limits (ambient air) :</u> from -71,5°C to Standard +35°C
<u>Altitude limits (press. alt.) :</u> 39.300 ft.

c. WIND LIMITATIONS FOR OPERATION OF THE BRAKE CHUTE :

Max. cross-wind components for utilization of the brake chute : 20 kts
Max. wind velocity for taxiing with the drag chute hooked : 20 kts

d. MAXIMUM TAXI SPEED DURING SHARP TURNS.

It has been revealed that the maximum stress on the main landing gear attachment occurs during taxi turns. It is recommended to reduce to a minimum the velocity during sharp turns:

NOT EXCEEDING - 15 km/hr nose gear full deflection.
- 25 km/hr nose gear half deflection.

1.1.4. FLIGHT LOAD ACCELERATION LIMITS.

Maneuver	Flight conditions	Load factor (g.)	
		Max. in normal conditions	Never exceed
<u>Pitch</u> (Flaps up)	All weights, loading and fuel conditions	+1,87 -0,75	+2,5 -1
<u>Pitch</u> (Flaps down)	All weights, loading and fuel conditions.	+1,5 -0	+2 -0
<u>Roll</u> (Flaps up)	All weights, loading and fuel conditions.	+1,25 -0	+1,667 -0
<u>Gusts</u> (Flaps up)	Weight = 48.000 kg.	+2,6 -1,09	+3,46 -1,46
	Weight = 45.700 kg.	+2,68 -1,18	+3,57 -1,57
	Weight = 37.500 kg.	+3,03 -1,53	+4,04 -2,04
	Weight = 29.200 kg.	+3,56 -2,06	+4,75 -2,75

NOTE: Maximum negative accelerations described above only allowed for 15 sec. due to engine requirements.



1.2. AERODYNAMIC & STRUCTURAL LIMITATIONS

1.2.1. WEIGHT LIMITATIONS - STRUCTURAL.

a. TAKE-OFF :

Maximum taxi weight : 48.500 kg.
Maximum weight at brake release: 48.000 kg.

b. LANDING :

Maximum landing weight : 45.700 kg.

c. ZERO FUEL WEIGHT :

Maximum zero fuel weight : 36.000 kg.

1.2.2. WEIGHT LIMITATIONS - PERFORMANCES : see chapter 4.

1.2.3. CENTER OF GRAVITY LIMITATIONS : see chapter 7.

1.2.4. AIRSPPEED AND MACH LIMITATIONS :

All airspeed and Mach number limitations given below are in terms of indicated values.
All indicated values are applicable to both pilot and copilot instruments.
However, distinction has been made between normal and alternate static sources.

<u>LIMITS</u> <u>IAS (kts)</u> or Mach	<u>NORMAL</u> static source	<u>ALTERNATE</u> static source	<u>REMARKS</u>
V_{MO}	325	310	The maximum operating limit speed and mach number shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent), except where a higher speed is specifically authorized for flight test or pilot training operations, or in approved emergency procedures.
M_{MO}	0.79	0.75	

LIMITS IAS (kts) or Mach	NORMAL static source	ALTERNATE static source	REMARKS
V_{NE}	351	335	<u>Never exceed speed.</u>
M_{NE}	0.83	0.79	
M_{AO}	M_{NO}	M_{NO}	Maximum Mach number with <u>auto-pilot</u> in <u>operation</u> .
V_{AO}	V_{NO}	V_{NO}	Maximum speed with <u>auto-pilot</u> in <u>operation</u> .
<p style="text-align: center;"><u>WARNING :</u></p> <p style="text-align: center;">IN CASE OF ARTIFICIAL FEEL FAILURE :</p> <p style="text-align: center;">- <u>Never exceed 200 kts IAS</u> (normal or altern.)</p> <p style="text-align: center;">- The auto-pilot must be disengaged.</p>			
V_{LO}	177	177	Max. limit for <u>landing gear operation</u> (extension or retraction).
V_{LE}	245	240	Max. limit with <u>landing gear extended</u> .
$V_{FO} = V_{FE}$			
5°	235	230	Normal limit for flaps operation (extension or retraction) and with flaps extended.
10°	225	220	
20°	172	172	
35°	160	160	
V_{FNE}			
5°	275	270	<u>Never exceed limit for flaps extension or retraction and with flaps extended.</u>
10°	260	255	
20°	200	200	
35°	190	190	



LIMITS IAS (kts) or MACH	NORMAL static source	ALTERNATE static source	REMARKS
V_{LL}	215	210	Max. for landing lights extension or retraction and with lights extended.
V_{BC}	115	115	<u>Normal limit</u> for brake chute extension.
V_{BCNE}	130	130	<u>Never exceed speed</u> for brake chute extension.

- NOTES:
1. There is no special speed or Mach number limit for speed brake extension and retraction or with speed brakes extended.
 2. The minimum control speed V_{MC} lies always below stalling speed.
 3. There is no special speed limit in case of operation with only one set of servodyne (blue or green).
However during voluntary shut-down of one set of servodyne for training or test, do not exceed V_{NO} and/or M_{NO} .

1.2.5. LIMITATIONS IN SEVERE TURBULENCE CONDITIONS.

a. RECOMMENDED SPEEDS.

In severe turbulence conditions, airspeed must be kept between two values $VB1$ and $VB2$:

- below $VB2$ for avoiding structural permanent deformations ;
- above $VB1$ to prevent stall; this speed gives the maximum comfort to passengers.

These two limits are calculated by considering the gust values given by the regulations. They vary with weight and altitude.

It exists of course an intermediate airspeed called VBO at which the aircraft can encounter a maximum gust while being equally preserved against stall and structural damage.

The following diagram gives $VB1$, $VB2$ and VBO vs altitude and weight.

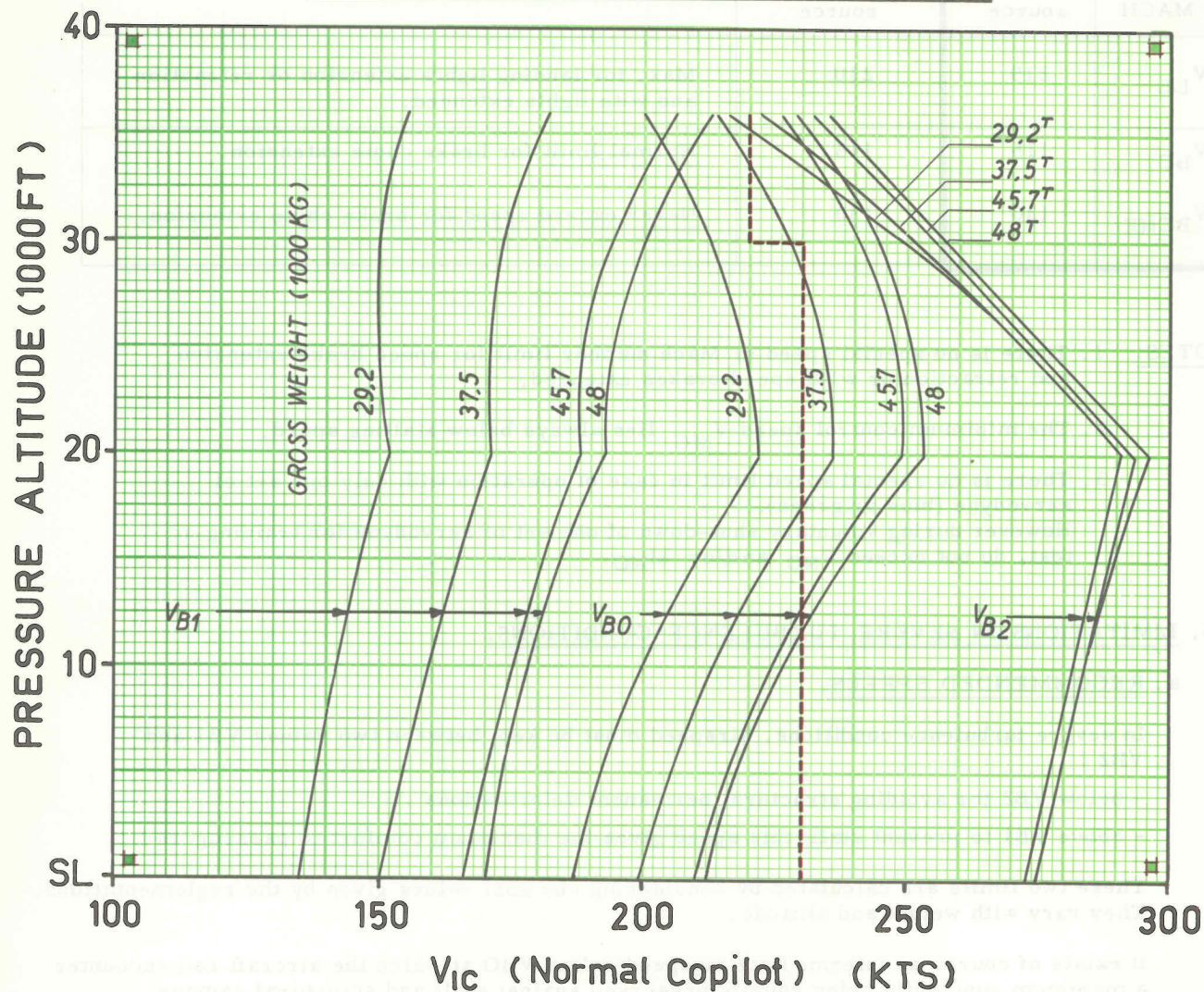
If the vertical acceleration reaches +1,5 g or 0,5 g, it is recommended to adopt the VBO speed.

When entering suddenly in severe turbulence, it will be helpful to remember the following mean values of VBO (represented on the graph by the red dotted line) :

below 30.000 ft. : 230 kts IAS
above 30.000 ft. : 220 kts IAS.

The airspeed can then be adjusted by consulting the graph on the following page :

AIRSPEED LIMITATIONS IN SEVERE TURBULENCE CONDITIONS



b. AUTO-PILOT LIMITATIONS.

If the vertical acceleration reaches $+1,5\text{ g}$ or $+0,5\text{ g}$:

- the use of the "Altitude Hold" and "Altitude Soft" modes is prohibited.
- the other modes of the auto-pilot can be utilized, provided the vertical acceleration remains in the following range : $+2$ to $+0,2\text{ g}$.

If the vertical acceleration reaches $+2\text{ g}$ or $+0,2\text{ g}$:

- the auto-pilot must be disconnected.



1.3. POWER PLANT LIMITS.

1.3.1. ENGINE THRUST RATINGS.

RATINGS	Engine speed setting	CONDITIONS
Take-off	8050 + 50 RPM max. or "Full throttle" whichever occurs first.	Normally used for take-off. Used in certain emergencies (go-around on approach or landing). Time limited to 5 min.
Max. Continuous	7950 RPM	May be used continuously in emergency. No time limit. However, the duration and reason for the use of Max. continuous power must be recorded in the T.R.
Climb	7800 RPM	Normally used for climb, may be used at cruise altitude level to accelerate from final climb speed to initial cruise speed. No time limit.
Maximum cruise	7750 RPM	Maximum setting for cruise conditions. No time limit.

1.3.2. RPM LIMITS.

CONDITIONS	Min.	Normal	Max.
Take-off (see notes 1 and 2)	-	-	8050
Maximum Continuous	-	-	7950
Ground idling (SL) (see note 4)	2850	3000	3250
Approach (anti-icing OFF)	4600	-	-

Ground operation: When taxiing and maneuvering on the ground set the throttles to avoid sustained running in the RPM band of 5000 - 5780 . Only the minimum traversing of this band should be employed.
When holding both engines should preferably be at idling.

In flight : Where possible avoid sustained running in the 5000-5780 RPM band during all flight conditions except approach.

CONDITIONS	Min.	Normal	Max.
<u>Engine RPM minimum limits with airfoil & engine anti-icing operating: (see note 5)</u>			
<u>Normal icing conditions :</u>			
- 5 minutes descent (2 eng.)	5600 *	-	-
- continuous flight or approach (2 eng.)	6000 *	-	-
<u>Severe icing conditions :</u>			
- continuous flight or approach (2 eng.)	6200	-	-
- continuous flight or approach (1 eng.)	6800	-	-

* As much as possible avoid these settings taking into account the critical RPM band of 5000 - 5780.

NOTES : 1. Take-off setting :

Especially in ambient air temperature higher than standard, it may be necessary to exceed 8050 RPM temporarily in order to actuate the two position nozzle closure mechanism. Thrust lever adjustment should be performed after the nozzle indicator light has illuminated. The overspeed limitations should be observed (see note 3).

2. Adjustment during take-off run :

During take-off run, the engine RPM may be allowed to exceed specified 8050 limit by up to 50 RPM before thrust lever adjustment is required.

3. Overspeed.

Engine speeds between 8100 and 8450 are permitted for 20 seconds in any one flight. If either 8450 RPM or the 20 seconds limit is exceeded, the engine should be shut-down.

4. Ground idling.

If idle RPM during ground operation at sea level static conditions is below 2850 RPM or above 3250 RPM, note it in the trouble report. Ground idling RPM should be checked with generators, alternators, air conditioning and servodyne heating ON, engine and airfoil anti-icing OFF, and fuel heating in AUTO. The ground idling RPM increases with altitude: for altitude variation: add approximately 60 RPM to the S.L. value per 1000 ft. elevation.

5. Protection against flame-out when using the airfoil and the engine anti-icing systems during low RPM operation.

It is very important to keep the engine speed above or at least at the RPM minimum limit mentioned in the preceding chart when the engines are to be operated at low RPM and the airfoil and engine anti-icing systems are ON. If the engines are inadvertently operated in such conditions below the minimum limit, it is possible that a flame-out may result.



1.3.3. STATIC THRUST LIMITS FOR TAKE-OFF.

These limits apply only to ground static conditions :

Static thrust indication for take-off : min. 96%.

1.3.4. TEMPERATURE LIMITS.

Limitations (°C)	Min.	Normal	Max.
<u>JPT indications :</u>			
JPT during starting (note 4)	-	-	700
JPT during ground idling	-	-	600
JPT during take-off (note 3)	-	-	670
JPT during approach	-	-	480
JPT during in-flight relight (note 3)	-	-	670
JPT during all other flight conditions (note 1)	-	-	600
<u>Oil temperature indications :</u>			
Oil temperature (note 2) All conditions.	-40	-	+95
For 15 minutes.	-	-	+100
<u>Fuel temperature indications :</u>			
Normal fuel temp	+5	-	+18
Cold fuel temp. warning	+1	+3	+5
Hot fuel temp. warning	+49	+51	+53
Maximum fuel temperature	-	-	+65

- NOTES :
1. This limit should be referred to especially when engine & nacelle and airfoil anti-icing bleeds are selected .
 2. The maximum oil temperature can be exceeded during take-off when temperature of the fuel in the tanks exceeds 15°C. This discrepancy must correct itself during climb.
 3. If the limitation of 670°C is exceeded, the engine need not be stopped provided the over-temperature conditions do not prevail for more than 10 sec. and 680°C is not exceeded.
 4. The maximum operational limit for JPT is 700°C: should the JPT reach this limit, the engine needs to be stopped.
If the JPT exceeds 700°C, the following action must be taken
 - a. The engine may continue in service after investigating the reason for the hot start or after taking corrective action, if the temperature has not exceeded 740°C
 - b. If the overswing temperature has exceeded 740°C, the engine must be inspected by ground personnel according to the requirements of the engine maintenance manual.
 - c. The engine must be changed if the temperature has exceeded 780°C.
- All cases of JPT exceeding 700°C must be recorded in the T.R.

1.3.5. PRESSURE LIMITS.

Limitations (psi)	Min.	Normal	Max.
<u>Oil pressure indications :</u>			
Minimum for opening up after starting :	10	-	-
<u>Minimum before take-off :</u>			
- oil temp. 95°C	29	-	-
- oil temp. 15°C or below	34	-	-
<u>Minimum to complete flight :</u>			
- at 7900 RPM	20	-	-
- at 7000 RPM	18	-	-
- at 6000 RPM	15	-	-
- at 5000 RPM	13	-	-
- at 4500 RPM	12	-	-
Oil low pressure warning :	12	15	17
<u>Fuel pressure indications :</u>			
Before take-off :	7	down to 11	-
Fuel low pressure warning :	4	5	6

1.3.6. OIL CONSUMPTION.Oil consumption limits :

- Consumption lower than 0,5 L/hr : no special precautionary measures.
- Consumption higher than 0,5 L/hr : Ground run-up to check if important leaks exist or oil rejection from the centrifugal breather. The engine may continue in service if nothing abnormal is observed (eventually compare the operation with that of the other engine).
- Consumption higher than 0,8 L/hr : the engine has to be removed.

1.3.7. STARTING SYSTEM.

Limitations	Units	Min.	Normal	Max.
<u>No load voltage recommended limits (note) :</u>				
Ground generator	Volt	112	-	125
Gnd or airplane batteries	Volt	120	-	140
<u>Timer operation :</u>	sec.	30	32	34

NOTE: Starting is still possible with voltage up to 10V. below minimum recommended limit, but precautionary measures must be taken.



1.4. MISCELLANEOUS SYSTEM LIMITS

1.4.1. AIR CONDITIONING AND PRESSURIZATION.

a) Air Conditioning.

Limitations	Units	Min.	Normal	Max.
<u>Primary Heat Exchanger Control :</u>				
Prim. exch. valve setting	+°C	222	232	242
Turbo Fan shut-off valve setting	+°C	248	258	268
Prim. exch. overtemp. warning	+°C	-	-	282
Prim. exch. temp. indication	+°C	-	up to 232	282
<u>Duct temperature :</u>				
Duct thermo resistor setting (anticipator)	+°C	-	-	70
Duct overtemperature warning	+°C	115	120	130
Cabin duct temperature indic.	+°C	-	up to 55	130
Cockpit Duct Temperature indic.	+°C	-	up to 77	130

b) Pressurization.

<u>Cabin differential control :</u>				
Max. cabin differential	psi	7,9	8,1	8,3
Differential safety valve oper.	psi	8,35	8,55	8,75
Max. cabin diff. for landing	psi	-	-	0,3

Limitations	Units	Min.	Normal	Max.
<u>Pressurization syst. warnings :</u>				
Cabin diff. press. switch setting	psi	8,55	8,75	8,95
Cabin low press. switch setting	ft.	9.700	10.500	11.300
Cabin R/D switch setting	ft/min	9.000	10.000	11.000

1.4.2. ELECTRICAL SYSTEM.

Limitations	Units	Min.	Normal	Max.
<u>D.C. System :</u>				
<u>a. D.C. Generators :</u>				
Generator voltage (see note 1)	Volts	27	28	29
Generator current (gnd. oper.)	Amp.	-	-	180
Generator current (continuous)	Amp.	-	-	375
Generator current (max. 30 min.)	Amp.	-	-	400
Diff. between gen. currents (see note 2)	Amp.	-	-	20
Engine speed for cut-in	RPM	3000	-	-
Engine speed for full load	RPM	4000	-	-
<u>b. Batteries :</u>				
Normal battery voltage } (see note 3)	Volts	22	24	-
Standby battery voltage }	Volts	22	24	-
Emergency battery voltage	Volts	22	24	-
<u>c. Alternators :</u>				
Alternator voltage (see note 1)	Volts	110	120	130
Engine speed for cut-in	RPM	3000	-	-
Engine speed for full load	RPM	4600	-	-
Transformer-rectifier voltage (note 4).	Volts	26	28	31
Transformer-rectifier current	Amp.	-	-	250
<u>d. A.C. System :</u>				
Inverter voltage (see note 1)	Volts	108	115	120
115/26 transformer voltage	Volts	20	24	28
<u>e. Ground power:</u>				
DC Ground power voltage	Volts	27	28	29
AC ground power voltage	Volts	110	115	120

- NOTES: 1. Voltage should be read 15 min. after starting of the system.
 2. At maximum load (375A) of the generators in parallel, the maximum allowable spread is 20A (i.e. 5% load).
 For lower loads, the spread may increase linearly, (for instance) up to 35A



(i.e. 50% load) at 70A load.

3. The minimum voltage specified here corresponds to a load voltage: emergency inverter operating (for the normal battery), and main 1 booster pumps ON (for the standby battery).
4. The TR no load voltage is about 31V. In other conditions, voltage is normally $28 \pm 2V$ depending upon the load.

1.4.3. HYDRAULIC SYSTEM.

Power System	Limitations	Units	MIN.	NORMAL	MAX.
BLUE and GREEN	System pressure (see note 2)	psi	2150 $\begin{smallmatrix} +100 \\ -50 \end{smallmatrix}$	2150 to 2650	2650 $\begin{smallmatrix} +150 \\ -100 \end{smallmatrix}$
	Thermal relief valve setting	psi	3450	3600	-
	Low pressure warning	psi	1300	1400	1500
	Blue hydraulic level (see note 1)	L	(X)	16-17	17
	Blue low level warning	L	7,5	8	8,5
	Green hydraulic level (see note 1)	L	(X)	41-42,5	42,5
YELLOW	Green low level warning	L	19,5	20,5	21,5
	System pressure	psi	1700 $\begin{smallmatrix} +130 \\ -130 \end{smallmatrix}$	1700 to 2500	2500 $\begin{smallmatrix} +100 \\ -100 \end{smallmatrix}$
RED	Thermal relief valve setting	psi	3450	3600	-
	System pressure	psi	2000 $\begin{smallmatrix} +130 \\ -130 \end{smallmatrix}$	2000 to 2500	2500 $\begin{smallmatrix} +130 \\ -130 \end{smallmatrix}$
	Thermal relief valve setting	psi	3450	3600	-
	Red hydraulic level (see note 1)	L	(X)	13-14	14

NOTE 1 : The hydraulic level limitations are applicable only in the following conditions : reading levels on the individual tank gages, airplane on the ground (landing gear extended), all accumulators depressurized (several minutes before checking the levels), stairway extended.

2 : Pressure peaks of about +100 to 150 above max. limits are often observed. Such peaks are transient and due to the inertia of the indicators.

1.4.4. FUEL SYSTEM.

Limitations	Units	Min.	Normal	Max.
<u>Fuel supply and tanks:</u>				
Main tank low level warning	kg	150	200	250

Limitations	Units	Min.	Normal	Max.
<u>Pressure refueling :</u>				
Pressure delivery	kg/cm ²	-	-	3,5
	psi	-	-	50
Main tank flow delivery	L/hr.	-	-	60.000
	L/min	-	-	1.000
Aux. tank flow delivery	L/hr.	-	-	20.000
	L/min	-	-	330

UNBALANCE BETWEEN WING TANKS.

a. Main tanks (aux. tanks being balanced) :

The airplane is still laterally controllable with 4000 kg. difference between main tanks, but VNO must be reduced by 50 kts.

b. Auxiliary tanks (main tanks being balanced) :

With 1 auxiliary tank emptied : VNO must be reduced by 35 kts.

With both auxiliary tanks emptied : VNO must be reduced by 45 kts.

NOTE: These informations are not officially certified. They are given here only for information. Any use of the airplane in the conditions described in items a. and b. must be subjected to approval of the Chief Pilot or the Assistant Chief Pilot of the sector, or in their absence, of the Chief of the Flight Division or the Vice President or the Assistant Vice President Operations or the Chief of the Technical & Training Division.

1.4.5. ICE AND DRAIN PROTECTION.

Limitations	Units	Min.	Normal	Max.
<u>Servodyne heating :</u>				
Servodyne temp. regulation	+ °C	20 ± 5	-	45 ⁺¹⁰ -5
<u>Servodyne compmt. temp. indication :</u>				
- elevator	+ °C	15	-	55
- aileron	+ °C	0 (X)	-	55
Brake chute compart. temp. indic.	+ °C	0	-	70
Overheat warning	+ °C	60	70	75
(X) At the end of a long descent with low RPM and extended speedbrakes a minimum temperature of -5°C can be allowed. It is however reminded that one is advised against such an operation.				
<u>Airfoil anti-icing :</u>				
Leading edge temp. regulation	+ °C	30	35	42
Leading edge temp. temperature	+ °C	-	-	65
Overheat warning	+ °C	73	80	87

"FULL" operation 1 engine flight	RPM	-	-	7900
2 engine flight	RPM	-	-	6800



1.4.6. LANDING GEAR.

Limitations	Units	Min.	Normal	Max.
<u>Brakes :</u>				
Brake supply pressure (normal)	psi	2050	2100 - 2800	-
Brake supply pressure (emerg.)	psi	1850	1900 - 2600	-
Max. brake pressure (normal)	psi	1106	1140	1174
Max. brake pressure (emergency)	psi	1717	1770	1823
<u>Landing gear :</u>				
Steering angle to either side	degr.	-	-	48 ⁺⁰ -1
Retraction time :				
2 eng. driven pumps	sec.	-	10 - 14	-
Extension time :				
2 eng. driven pumps	sec.	-	10 - 14	-
1 eng. driven pumps	sec.	-	-	-
Red pump	sec.	-	14 - 20	-

NOTE : Conditions of replacement of tires after an aborted take-off.

After an aborted take-off, it is necessary to compute and to check the absorbed energy factor = take-off weight (kg) X max. airspeed (kts). If the factor exceeds the max. limit of 6.000.000 the tires of the main landing gear have to be replaced before the next flight.

The check systematically applies to all training flights.

1.4.7. OXYGEN SYSTEM.

Pressure limitations (psi)		Max. oper. time (min.) (100% O2)
<u>Crew fixed bottle :</u>		(3 masks used)
(107 cu.ft.)	Normal : 1800 Min. : 1200 (*)	approx.: 245 159
(114 cu.ft.)	Normal : 1800 Min.: 1200 (*)	261 169

(*) The desired minimum for departure from Brussels is 1400 psi.

Pressure limitations (psi)		Max. oper. time (min.) (100% O ₂)
<u>Crew portable bottle :</u>		(1 mask used)
(10,6 cu.ft.)	Max.: 1800 Min.: 1400	40 30
<u>Passenger portable bottle :</u>		(1 mask used)
(10,6 cu.ft.)	Max.: 1800 Min.: 1400	100 75