SECTION 2

LIMITATIONS

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2.1 - GENERAL

"TBM 850" is the trade name of the TBM 700 "N version" airplane (TBM 700 type), which is certified in the Normal Category.

This airplane must be flown in compliance with the limits specified by placards or markings and with those given in this Section and throughout the Pilot's Operating Handbook.

This Section of the airplane Pilot's Operating Handbook presents the various operating limitations, the significance of such limitations, instrument markings, color coding, and basic placards necessary for the safe operation of the airplane, its powerplant and installed equipment.

The limitations included in this Section have been approved by the Federal Aviation Administration in accordance with 14 CFR Section 21.29.

The limitations for optional systems are given in Section 9, "Supplements" of the Pilot's Operating Handbook.

TBM 700 airplane is certified under EASA.A.010 and FAA N° A60EU Type Certificates.

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2.2 - AIRSPEED LIMITATIONS

Airspeed limitations and their operational significance are shown in Figure 2.2.1.

	SPEED	KCAS	KIAS	REMARKS
V_{MO}	Maximum operating speed	270	266	Do not intentionally exceed this speed in normal flight category
V_A	Maneuvering speed	160	158	Do not make abrupt or full control movements above this speed
V_{FE}	Maximum flaps extended speed : landing configuration takeoff configuration	 120 180	 122 178	Do not exceed these speeds depending on flaps position
V_{LO}	Maximum landing gear operating speed : extension retraction	 180 130	 178 128	Do not extend or retract landing gear above this speed
V_{LE}	Maximum landing gear extended speed	180	178	Do not exceed this speed with landing gear extended
	Maximum inertial separator operating speed	203	200	No limitation when inertial separator is in fixed position

Figure 2.2.1 - AIRSPEED LIMITATIONS

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2.3 - POWERPLANT LIMITATIONS

ENGINE

Number of engines : 1

Engine manufacturer : PRATT & WHITNEY CANADA

Engine model number : PT6A - 66D

Maximum power :

Flaps set to UP, TO or LDG position	Flaps set to 850 position
- 100 % at Np = 2000 RPM - 110 % at Np = 1800 RPM	- 121.4 % at Np = 2000 RPM

Ng limitation :

104.1 %

Np limitation :

2000 RPM

ITT limitations :

- Take off : 850°C
- Maximum climb/cruise : 840°C
- During start : 870°C for 20 seconds max.
  1000°C for 5 seconds max.

CAUTION

WHEN NORMALLY OPERATING, REFER TO CHAPTER 5.8 "ENGINE OPERATION" TABLES

OIL

CAUTION

DO NOT MIX DIFFERENT BRANDS OR TYPES OF OIL

Maximum oil temperature : 104 °C

Oil pressure :
Minimum : 60 psi
Maximum : 135 psi

Oil capacity :
System total capacity : 12.7 Quarts (12 Litres) (Oil cooler included)
Usable capacity : 6 Quarts (5.7 Litres)

Oil grade (Specification) :

Nominal viscosity	US specification (US)	French specification (FR)	English specification (UK)	NATO code
Type 5cSt	MIL-L-23699C Amdt 1	MIL-L-23699C Amdt 1	DERD 2499 Issue 1	O.156

Figure 2.3.1 - ENGINE OIL RECOMMENDED TYPE
(Reference : Service Bulletin P & W C. No. 14001)

FUEL

Fuel pressure :
Minimum : 10 psi
Maximum : 50 psi

Fuel limitations :
2 tanks : 145.3 us gal (550 Litres) each
Total fuel : 290.6 us gal (1100 Litres)
Usable fuel : 281.6 us gal (1066 Litres)
Unusable fuel : 9 us gal (34 Litres)
Maximum fuel imbalance : 15 us gal (57 Litres)

NOTE :
Usable fuel can be safely used during all normal airplane maneuvers.

CAUTION

THE FUEL USED MUST CONTAIN AN ANTI-ICE ADDITIVE, IN ACCORDANCE WITH SPECIFICATION MIL-I-27686D OR E OR MIL-I85470A. ADDITIVE CONCENTRATIONS (EGME OR DIEGME) SHALL BE COMPRISED BETWEEN A MINIMUM OF 0.06 % AND A MAXIMUM OF 0.15 % BY VOLUME. REFER TO SECTION 8 "HANDLING, SERVICING AND MAINTENANCE" FOR ADDITIONAL INFORMATION.

THE USE OF AVIATION GASOLINE (AVGAS) MUST BE RESTRICTED TO EMERGENCY PURPOSES ONLY. AVGAS SHALL NOT BE USED FOR MORE THAN 150 CUMULATIVE HOURS DURING ANY PERIOD BETWEEN ENGINE OVERHAUL PERIODS

NOTE :
Use of AVGAS to be recorded in engine module logbook.

US Specification (US)	French Specification (FR)	English Specification (UK)	NATO Code
ASTM-D1655 JET A ASTM-D1655 JET A1 ASTM-D1655 JET B	AIR 3405C Grade F35	DERD 2494 Issue 9	F35 without additive
MIL-T-5624L Amdt1 Grade JP-4	AIR 3407B	DERD 2454 Issue 4 Amdt 1	F40 with additive
MIL-T-5624L Amdt1 Grade JP-5	AIR 3404C Grade F44	DERD 2452 Issue 2 Amdt 1	F44 with additive when utilization
MIL-T-83133A Amdt1 Grade JP-8	AIR 3405C Grade F34	DERD 2453 Issue 4 Amdt 1	F34 with additive S748
	AIR 3404C Grade F43	DERD 2498 Issue 7	F43 without additive

Figure 2.3.2 - RECOMMENDED FUEL TYPES
(Reference : Service Bulletin P & W C. No. 14004)

PROPELLER

Number of propellers : 1

Propeller manufacturer : HARTZELL

Propeller model number : HC-E4N-3 / E9083S (K)

Propeller diameter :
Minimum : 90 inches (2.286 m)
Maximum : 91 inches (2.311 m)

Propeller blade setting at 30 inches station :
Low pitch : 21°
Feathering : 86°
Maximum reverse : - 11°

2.4 - STARTER OPERATION LIMITS

Starter operation sequence is limited as follows :

if Ng ≤ 30 % ..... 30 seconds

if Ng > 30 % ..... 60 seconds

Should several sequences be necessary, respect following spacing :

1st sequence

wait ..... 1 minute

2nd sequence

wait ..... 5 minutes

3rd sequence

wait ..... 30 minutes

4th sequence

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2.5 - WEIGHT AND C.G. LIMITS

WEIGHT LIMITS

Maximum ramp weight : 7430 lbs (3370 kg)
Maximum takeoff weight : 7394 lbs (3354 kg)
Maximum landing weight : 7024 lbs (3186 kg)
Maximum zero fuel weight (MZFW) : 6032 lbs (2736 kg)
Maximum baggage weight :
- in rear part of pressurized cabin : 220 lbs (100kg)
- in non pressurized aft compartment : 77 lbs (35 kg)

C.G. LIMITS - see Figure 6.4.2

Center of gravity range with landing gear down and flaps up, attitude 0° :

Forward limits :

181.3 inches (4.604 m) aft of datum at 4409 lbs (2000 kg) or less (14 % of m.a.c)
183.6 inches (4.664 m) aft of datum at 6250 lbs (2835 kg) (18 % of m.a.c)
185.3 inches (4.707 m) aft of datum at 6579 lbs (2984 kg) (20.85 % of m.a.c)
187 inches (4.752 m) aft of datum at all weights above 7024 lbs (3186 kg) (23.8 % of m.a.c)

Aft limits :

194.9 inches (4.951 m) aft of datum at all weights below 6250 lbs (2835 kg) (37 % of m.a.c.)
194.3 inches (4.936 m) aft of datum at 6579 lbs (2984 kg) (36 % of m.a.c.)
193.65 inches (4.921 m) aft of datum at 7394 lbs (3354 kg) (35 % of m.a.c.)

Reference datum : 118.1 inches (3 m) in front of the firewall front face.
Straight line variation between points.
Leveling point : Cabin floor rails.

NOTE :
It is the responsibility of the pilot to insure that the airplane is properly loaded. See Section 6 "Weight and Balance" for proper loading instructions.

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2.6 - OPERATION LIMITS

MANEUVER LIMITS

This airplane is certified in the normal category.
The normal category is applicable to airplanes intended for non-aerobatic operations.

Non-acrobatic operations include any maneuvers incidental to normal flying, stalls (except whip stalls), lazy eights, chandelles, and steep turns in which the angle of bank is no more than 60°.

Acrobatic maneuvers, including spins, are not approved.

TEMPERATURE LIMITS

Minimum temperature at start and takeoff : - 40°C (- 40°F)

Maximum temperature at start and takeoff :
ISA + 37°C (+ 67°F) from 0 to 8000 ft pressure altitude

Maximum temperature in flight :
ISA + 37°C (+ 67°F) from 0 to 8000 ft pressure altitude
ISA + 30°C (+ 54°F) at 31000 ft pressure altitude
Linear decrease between 8000 and 31000 ft

FLIGHT LOAD FACTOR LIMITS

Flaps up

Weight below 6579 lbs (2984 kg) :

$-1.5 \leq n \leq +3.8$ g

Weight above 6579 lbs (2984 kg) :

$-1.5 \leq n \leq +3.5$ g

Flaps down

$-0 \leq n \leq +2.0$ g

CAUTION

INTENTIONAL NEGATIVE LOAD FACTORS PROHIBITED

SEVERE ICING CONDITIONS

WARNING

SEVERE ICING MAY RESULT FROM ENVIRONMENTAL CONDITIONS OUTSIDE OF THOSE FOR WHICH THE AIRCRAFT IS CERTIFICATED. FLIGHT IN FREEZING RAIN, FREEZING DRIZZLE, OR MIXED ICING CONDITIONS (SUPERCOOLED LIQUID WATER AND ICE CRYSTALS) MAY RESULT IN ICE BUILD-UP ON PROTECTED SURFACES EXCEEDING THE CAPABILITY OF THE ICE PROTECTION SYSTEM, OR MAY RESULT IN ICE FORMING AFT OF THE PROTECTED SURFACES. THIS ICE MAY NOT BE SHED USING THE ICE PROTECTION SYSTEMS, AND MAY SERIOUSLY DEGRADE THE PERFORMANCE AND CONTROLLABILITY OF THE AIRCRAFT

During flight, severe icing conditions that exceed those for which the aircraft is certificated shall be determined by the following visual cues. If one or more of these visual cues exists, immediately request priority handling from Air Traffic Control to facilitate a route or an altitude change to exit the icing conditions.

- Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.
- Accumulation of ice on the upper surface of the wing aft of the protected area.

Since the autopilot, when operating, may mask tactile cues that indicate adverse changes in handling characteristics, use of the autopilot is prohibited when any of the visual cues specified above exist, or when unusual lateral trim requirements or autopilot trim warnings are encountered while the aircraft is in icing conditions.

Refer to the list of "Equipement required depending on type of operation" in this same chapter.

In any case of icing conditions, first refer to particular procedures described in Chapter 4.5 (normal procedures) and in case of unforeseen icing conditions, refer in addition to the emergency procedure described in Chapter 3.13.

FLAP OPERATING ENVELOPE

The use of flaps is not authorized above 15 000 ft.

The use of flap control in "850" position is prohibited for takeoff and landing.

REVERSE UTILIZATION

The use of control reverse BETA (β) range is prohibited during flight.

EQUIPMENT REQUIRED DEPENDING ON TYPE OF OPERATION

The airplane is approved for day & night VFR and day & night IFR operations when appropriate equipment is installed and operating correctly.

The type certification for each use requires the following equipment. The equipment must be installed and operate perfectly according to the indicated type of use.

CAUTION

IT IS THE PILOT'S RESPONSIBILITY TO CHECK THAT THE FOLLOWING EQUIPMENT LISTS ARE IN ACCORDANCE WITH THE SPECIFIC NATIONAL OPERATION RULES OF THE AIRPLANE REGISTRATION COUNTRY DEPENDING ON THE TYPE OF OPERATION.

NOTE :
Systems and equipment mentioned hereafter do not include specific flight and radio-navigation instruments required by decree concerning operation conditions for civil airplanes in general aviation or other foreign regulations (for example FAR PART 91 and 135).

Day VFR

1) Pilot instruments

   - Airspeed indicator
   - Sensitive and adjustable altimeter
   - Magnetic compass with built-in compensator

2) Warning lights

   - Oil pressure
   - Low fuel pressure
   - Fuel selector OFF
   - Fuel auxiliary pump ON
   - L.H. and R.H fuel tank low level
   - Non functioning of fuel timer
   - Battery overheat
   - Battery stop
   - Main generator OFF
   - Low voltage
   - Ground power unit connected
   - Inertial separator
   - Starter
   - Ignition
   - Flaps
   - Landing gears and doors

3) Aural warning

   - V_{MO} warning
   - Landing gear warning
   - Stall warning

4) Engine instruments

   - Torquemeter
   - Propeller tachometer
   - Interturbine temperature indicator (ITT)
   - Gas generator tachometer (Ng)
   - Oil pressure indicator
   - Oil temperature indicator

5) Various indicators

- Fuel gauge indicators (2)
- Fuel pressure indicator
- Voltmeter
- Ammeter
- Outside air temperature

6) Installations

- Fuel mechanical pump (main)
- Fuel electrical pump (auxiliary)
- Fuel shut-off valve
- Fuel timer
- Starter generator
- Inertial separator
- Stall warning
- Electrical aileron trim
- Electrical rudder trim
- Manual elevator pitch trim
- Engine ignition
- Landing gear electro-hydraulic unit
- Landing gear emergency hydraulic pump (manual)
- Flaps
- Overspeed regulator
- Manual feathering
- Battery

7) Miscellaneous

- Seats (each occupant)
- Belts (each occupant)
- Straps (each occupant)
- Pilot's operating handbook

Night VFR

1) All equipment required for day VFR
2) Attitude display indicator
3) Instrument lighting
4) Instrument panel lighting
5) Emergency lighting
6) Vertical speed indicator
7) Navigation lights (4)
8) Anticollision lights (2)
9) Landing light

IFR

1) All equipment required for day VFR
2) All equipment required for night VFR (if flight is performed during night)
3) Taxi light (if flight is performed during night)
4) Clock
5) 2nd altimeter
6) Emergency static source
7) Pitot static tube deicing

Pressurized flight

- Cabin altimeter
- Cabin vertical speed indicator
- Cabin differential pressure indicator
- Pressurization control valve
- Safety valve
- Pressurization control
- Maximum cabin altitude and pressure warning light

Flight into icing conditions

- All equipment required for IFR flight
- Propeller deicing
- L.H. windshield deicing
- Airframe, stabilizer and elevator horn deicing
- Wing leading edge inspection light (if night flight)
- Stall warning deicing
- Inertial separator

ALTITUDE OPERATING LIMITS

Maximum altitude : 31000 ft (9449 m)
Maximum differential pressure : 6.2 psi

Operation in RVSM area

Reduced Vertical Separation Minima (RVSM) are met pending airplane compliance with SB 70-120-34.

Airworthiness Approval alone does not authorize flight into airspace for which an RVSM Operational Approval is required by an ICAO Regional Navigation Agreement.

NOTE :
Only altimeters AM250 are compliant with TBM 850 operation in RVSM area.

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2.7 - MISCELLANEOUS LIMITS

SEATING LIMITS C.G.

- 2 front seats at 178.5 in. (4.534 m)
- 2 intermediate seats at 222.7 in. (5.656 m)
- Rear bench (2 seats) at 267.1 in. (6.785 m

BAGGAGE LIMITS

- Baggage in pressurized cabin at 303 inches (7.695 m)
- Rear baggage at 329.4 inches (8.366 m)

MINIMUM CREW

- One pilot

MAXIMUM OCCUPANCY

The number of persons on board is limited by approved seating configuration installed but must not exceed six, including the pilot.

USE OF DOORS

Flight with door open or ajar is prohibited.

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2.8 - MARKINGS

AIRSPEED INDICATOR

Airspeed indicator markings and their color code significance are shown in Figure 2.8.1.

MARKING	KIAS (Value or range)	SIGNIFICANCE
White arc	65 - 122	Full Flap Operating Range Lower limit is maximum weight V_{SO} in landing configuration.
Wide	65 - 81	Transition point between wide and narrow arcs is stall speed with flaps UP
Narrow	81 - 122	Upper limit is maximum speed permissible with flaps LDG
Red line	266	Maximum speed for all operations

Figure 2.8.1 - AIRSPEED INDICATOR MARKINGS

PRESSURIZATION

MARKING	VALUE	SIGNIFICANCE
Red line	6.2 psi	Cabin ΔP limit

Figure 2.8.2 - PRESSURIZATION MARKING

ENGINE INSTRUMENTS

Engine instrument markings and their color code significance are shown in Figure 2.8.3.

INSTRUMENT	Red Line or arc --- Minimum Limit	Yellow Line or Arc --- Caution Range	Green Arc --- Normal Operating	Red Line --- Maximum Limit
Oil temperature	- 40 °C (- 40 °F)	- 40 to 0 °C (- 40 to 32 °F) 104 to 110 °C (219.2 to 230 °F)	0 to 104 °C (32 to 219.2 °F)	110 °C (230 °F)
Oil pressure	60 psi	60 to 100 psi	100 to 135 psi	135 psi
Fuel pressure	0 to 5 psi	---	10 to 50 psi	50 psi
Generator RPM (Ng)	---	---	51 to 104 %	104 %
Propeller RPM (Np)	---	450 to 1000 RPM	1600 to 2000 RPM	2000 RPM
ITT	---	840 to 1090 °C (1544 to 1994 °F)	400 to 840 °C (752 to 1544 °F)	840 °C (1544 °F) normal limit --- 1090 °C (1994 °F) (red triangle) absolute limit
Torque (TRQ)	---	121.4 %	0 to 121.4 % (arc ½ thick from 100 to 121.4 %)	121.4 %

Figure 2.8.3 - ENGINE INSTRUMENT MARKINGS

SUCTION GAGE

MARKING	CORRESPONDING VALUE
Green	Normal operating from 4.4 to 5.2 in.Hg
Red lines	at 4.4 and 5.2 in.Hg

Figure 2.8.4 - SUCTION GAGE MARKINGS

2.9 - PLACARDS

(1) Under L.H. front side window

I4113004AAKMA18100

FLIGHT CONDITIONS : DAY AND NIGHT VFR AND IFR

TBM 850
THIS AIRPLANE MUST BE OPERATED AS A NORMAL CATEGORY AIRPLANE IN COMPLIANCE WITH THE OPERATING LIMITATIONS STATED IN THE FORM OF PLACARDS, MARKINGS AND PILOT OPERATING HANDBOOK

ICING CONDITIONS ALLOWED

INVERTED FLIGHT	PROHIBITED
ACROBATIC MANEUVERS	PROHIBITED
INTENTIONAL SPINS	PROHIBITED
MAXIMUM TAKEOFF WEIGHT	3354 kg / 7394 lbs
MAXIMUM LANDING WEIGHT	3186 kg / 7024 lbs
DESIGN LOAD FACTOR (MAXIMUM)	
FLAPS UP WEIGHT BELOW 2984 kg / 6579 lbs	$-1.5 \leq n \leq +3.8$ g
ABOVE 2984 kg / 6579 lbs	$-1.5 \leq n \leq +3.5$ g
FLAPS DOWN	$0 \leq n \leq +2$ g

MANEUVERING SPEED V_A	158 KIAS
MAXIMUM OPERATING SPEED V_{MO}	266 KIAS
FLAPS EXTENDED MAXIMUM SPEED V_{FE}	
TAKEOFF CONFIGURATION	178 KIAS
LANDING CONFIGURATION	122 KIAS
LANDING GEAR EXTENDED MAXIMUM SPEED V_{LE}	178 KIAS
LANDING GEAR OPERATING MAXIMUM SPEED V_{LO}	
UP	128 KIAS
DOWN	178 KIAS

(2) Calibration chart on compass and on windshield post

WARNING

TURN L AND R WINDSHIELD DE-ICE OFF BEFORE COMPASS READING

For	N	30	60	E	120	150
Steer						
For	S	210	240	W	300	330
Steer						

DATE : RADIO ON

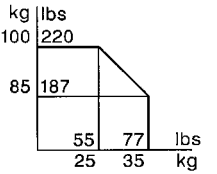
(3) On pressurized baggage compartment partition wall

I4112003AAABMA8200

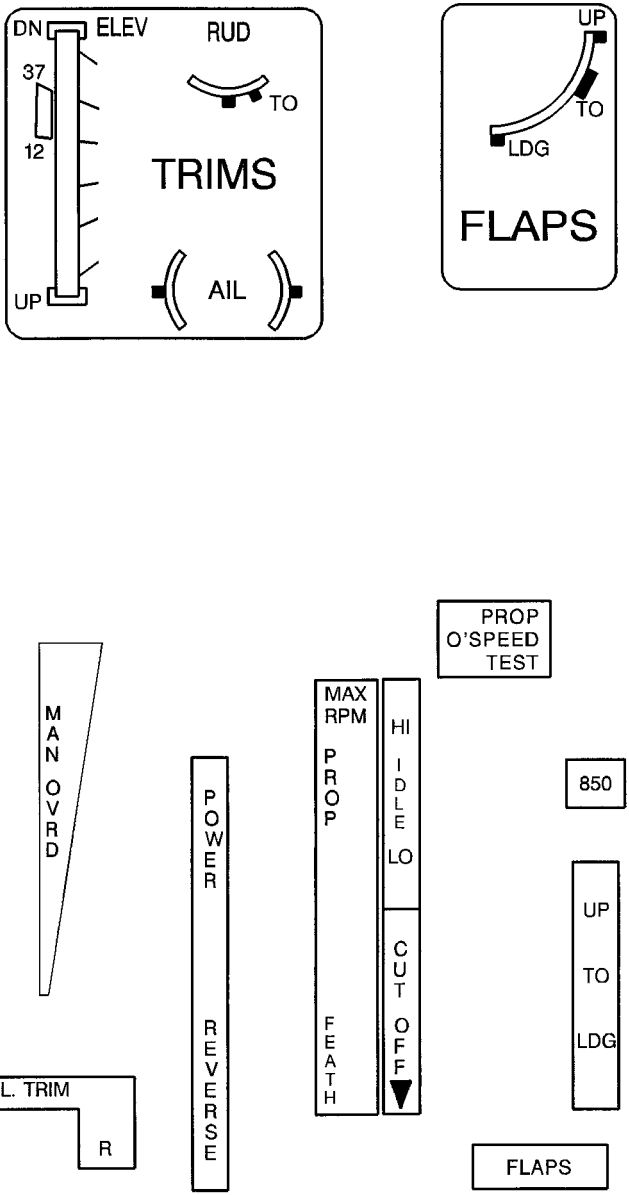
100 kg - (220 lbs) MAXIMUM

IT IS THE PILOT'S RESPONSIBILITY TO CHECK THAT ALL THE BAGGAGES ARE PROPERLY SECURED.
FOR LOADING INSTRUCTIONS SEE "WEIGHT AND BALANCE DATA" IN PILOT'S OPERATING HANDBOOK AND GRAPH OPPOSITE.

CABIN COMPARTMENT



(4) Under radio rack, in front of pedestal

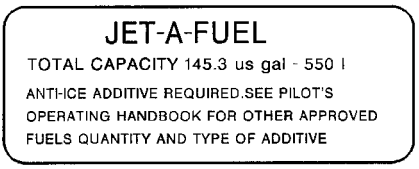


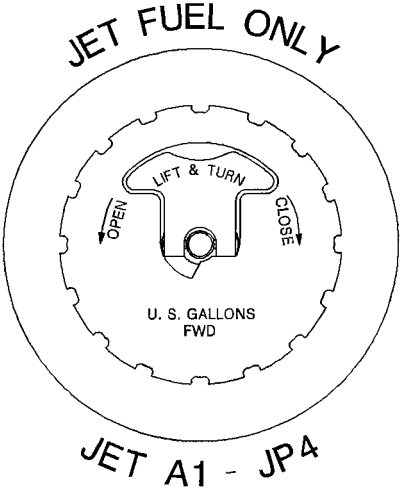
(5) On fuel selector

I4113006AAALMA8100

(6) Near fuel tank caps

I4112004AAAAMA8000





(7) On internal face of L.H. engine cowling

Oil system capacity 12 l 12.7 qt

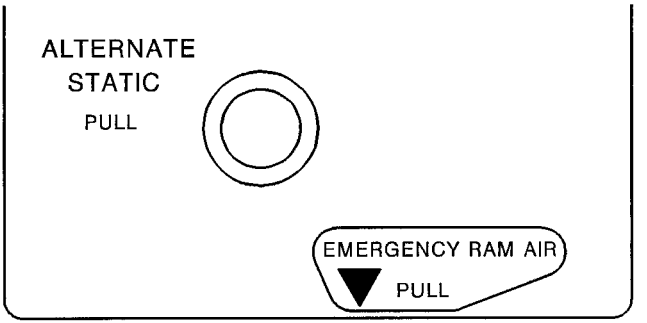
(8) On landing gear emergency control access door

LDG GEAR EMERGENCY UNDER HATCH

(9) On rear passenger's table casing

TABLE MUST BE STOWED DURING TAKEOFF AND LANDING

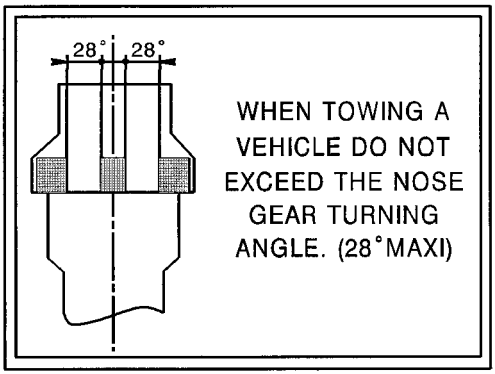
(10) Under R.H. control wheel



I4113006AAAKMA8000

(11) On nose gear door

I4112001AACMA8000



(12) On nose gear leg

NOSE LANDING GEAR
TIRE PRESSURE : 6,5 bar
94 psi

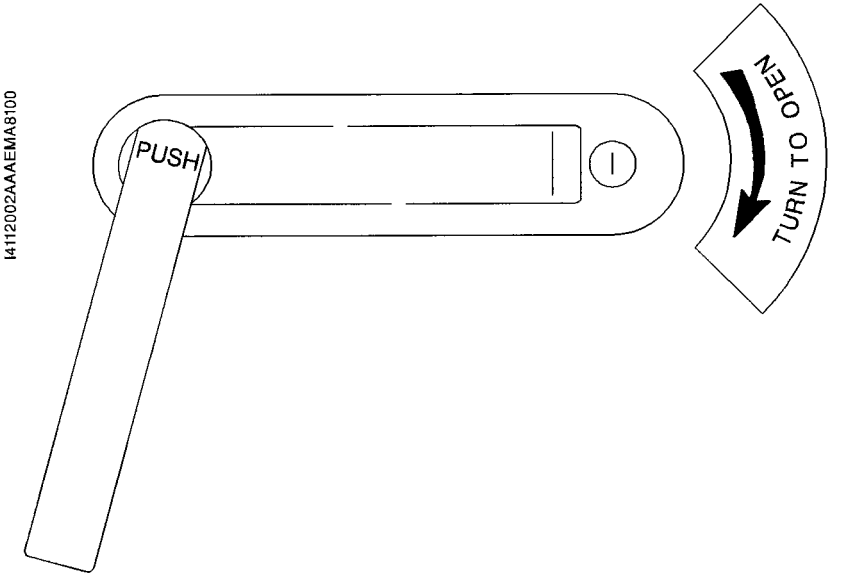
(13) On main gear leg

MAIN LANDING GEAR
TIRE PRESSURE : 8,96 bar
130 psi

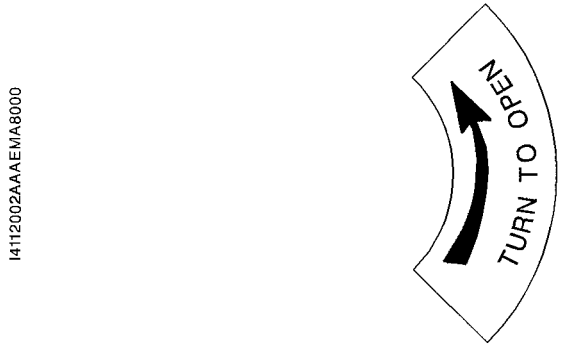
(14) On engine cowling, in front of compartment door

EXTERNAL POWER
28 VOLTS D.C. NOMINAL
800 AMPS
STARTING CAPACITY MIN
DO NOT EXCEED 1400 AMPS

(15) On "pilot" door - External side (if installed)

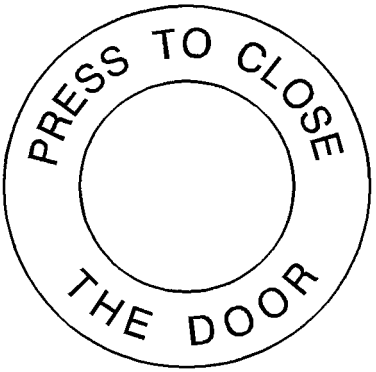


(16) On access door - External side



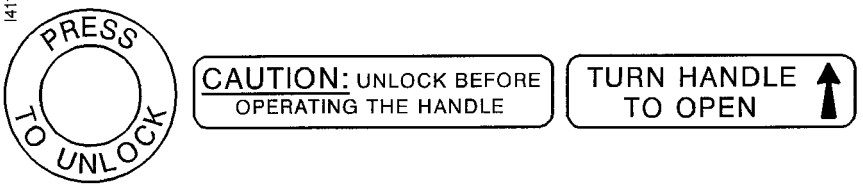
(17) On outer fuselage skin aft of access door and in the cabin forward of access door

I4112002AADMA8000



(18) On access door - Internal side

I4112002AADMA8201



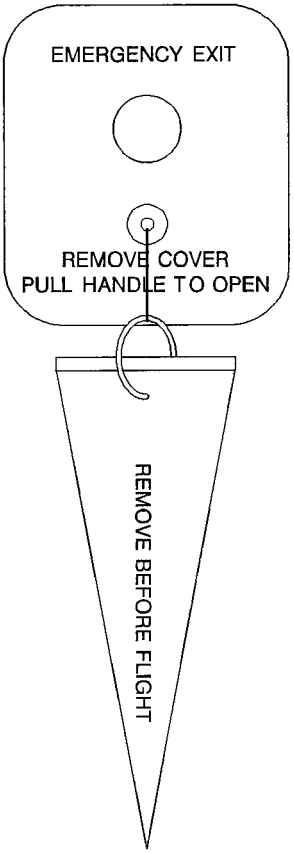
(19) On "pilot" door - Internal side (if installed)

I4112002AAADMA8101

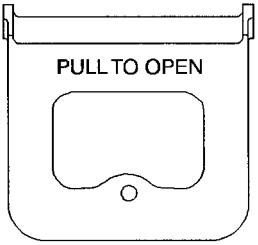
(20) On emergency exit handle

M4521000AAALMAFM00

Marking on cover



Marking on handle



(21) On last step of stairs

STAIRS MAX LOAD : ONE PERSON

(22) On R.H. access door jamb

**DO NOT USE
HAND RAIL
TO RETRACT
OR STOW
STAIRS**

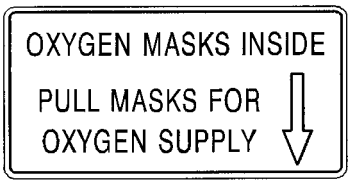
(23) On R.H. side at front seat level and on the first rear passengers masks container (R.H. side on the ceiling)

I4113400AAABMA8000

WARNING
GREASY SUBSTANCES ARE CAPABLE
OF SPONTANEOUS COMBUSTION
ON CONTACT WITH OXYGEN
DO NOT SMOKE WHILE OXYGEN IS IN USE

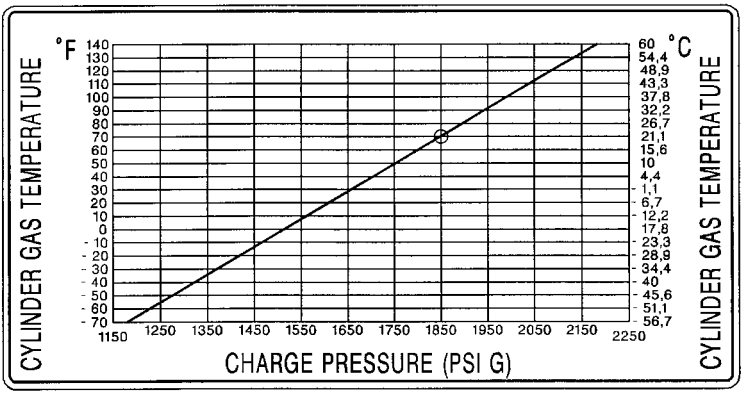
(24) On rear passengers masks containers (on R.H. side on the ceiling)

I4113400AAABMA8101



(25) On internal face of the oxygen cylinder service door

I4112400AAAAMA8000

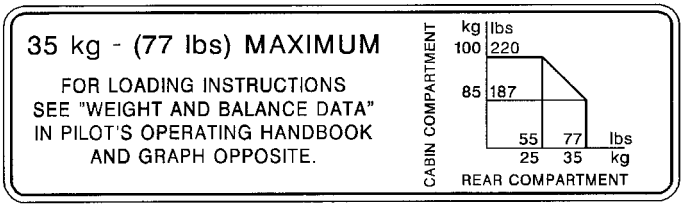


(26) On the oxygen service door

I4112400AAAAMA8100

(27) On internal face of the door of the rear baggage compartment (non pressurized)

I4112003AAABMA8100



(28) On emergency locator transmitter inspection door

I4112200AAAMA8000

INTENTIONALLY LEFT BLANK