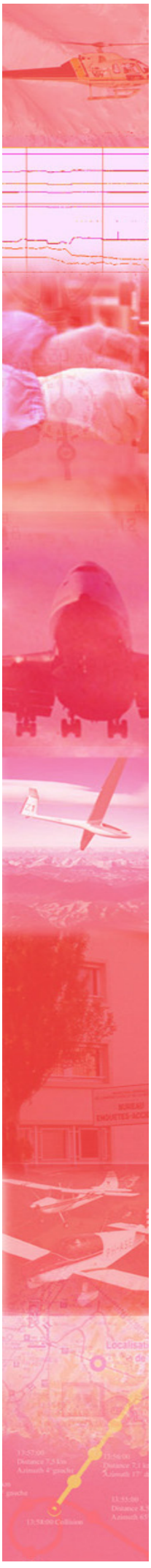
MINISTERE DE L'EQUIPEMENT, DES TRANSPORTS, DU LOGEMENT, DU TOURISME ET DE LA MER – BUREAU D'ENQUETES ET D'ANALYSES POUR LA SECURITE DE L'AVIATION CIVILE



BEA

Accident
on 22 March 2001
at Orléans Saint Denis de l'Hôtel aerodrome (45)
to the Piper PA-31-350
registered PH-ABD
operated by Tulip Air

REPORT

ph-d010322a

F O R E W O R D

This report presents the technical conclusions reached by the BEA.

In accordance with Annex 13 of the Convention on International Civil Aviation, with EC directive 94/56 and with Law No. 99-243 of 29 March 1999, the analysis of the accident and the conclusions and safety recommendations contained in this report are intended neither to apportion blame, nor to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents or incidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

SPECIAL FOREWORD TO ENGLISH EDITION

This report has been translated and published by the BEA to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in French should be considered as the work of reference.

Table of contents

Glossary

DGAC	French Civil Aviation Authority (Direction Générale de l'Aviation Civile)
FAR	Federal Aviation Regulations
FO	First Officer
ft	Feet
JAR	Joint Airworthiness Requirements
kt	Knots
lbs	Pounds
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
UTC	Universal Time Coordinated

SYNOPSIS

Date and time
22 March 2001 at 17 h 35 [1]

Site of accident
Orléans Saint Denis de l'Hôtel Aerodrome (45)

Type of flight
Passage charter flight TLP 2 B
Orléans Saint Denis de l'Hôtel - Paris Le Bourget

Aircraft
Piper PA-31-350 "Chieftain", registered PH-ABD, certified as single pilot.

Owner
Tulip Air B.V. (Holland)

Operator
Tulip Air B.V. (Holland)

Persons on board
2 Flight Crew, 8 passengers

Summary

The crew forgot to remove the flight control locking device before takeoff. At the end of the takeoff run, they could not rotate the aircraft. An attempt to abort the takeoff was undertaken but the aircraft overran the end of the runway after a slight track deviation to the left. It came to a stop on muddy ground in a field about one hundred and eighty-three metres from the end of the runway. The nose gear was broken, the propellers and the aircraft nose were damaged.

Consequences

	Persons			Equipment	Third Parties
	Killed	Injured	Uninjured		
Crew	-	-	2	Slight	None
Passengers			8	Damage	

[1] Except where otherwise noted, the times shown in this report are expressed in Universal Time Coordinated (UTC). One hour should be added to obtain the legal time applicable in metropolitan France on the day of the accident.

1 – FACTUAL INFORMATION

1.1 History of Flight

On 22 March 2001 at about 17 h 35, the PA 31-350 “Chieftain” registered PH-ABD, call sign Tulip 2B, began its takeoff from runway 23 at Orléans Saint Denis de l’Hôtel for and IFR departure to Paris Le Bourget. The flight was passenger charter flight TLP 2B.

The pilot flying, who was the co-pilot seated in the left seat, was unable to perform the rotation. He aborted the takeoff but braking failed to stop the aircraft before the end of the runway. The runway surface was wet. Marks were left by the tyres from one hundred metres before the end of the runway.

The aircraft ran across grass soaked with water. The nose gear broke and the aircraft came to a stop about one hundred and eighty metres after the end of the runway (photo of site and aircraft in appendix 1). The crew had forgotten to remove the flight control locking device.

1.2 Personnel Information

1.2.1 Captain

Male, aged 40

- Professional Pilot’s Licence 1993, CPL licence and IR valid until 1st June 2001
- Class 1 medical certificate issued 19 October 2000 valid until 1st June 2001
- Line check on 11 November 2000 valid until 1st June 2001
- Base check on 18 May 2000 valid until 1st June 2001

Experience:

- 1,110 flying hours of which 688 on type
- in the previous 90: 21 hours of which 15 on type
- in the previous 30: 18 hours of which 15 on type
- in the previous 24 hours: 2 hours on type

The Captain had not been to Orléans Saint Denis de l’Hôtel during the previous twelve months. The rest period before his departure from Rotterdam was 15 hours 30 minutes. He performed the outward flight, which lasted two hours (5 h 30 / 7 h 30) between Rotterdam and Saint Denis de l’Hôtel, as pilot flying.

He was pilot not flying, seated on the right, during the accident flight.

1.2.2 First Officer

Male, aged 25

- Professional Pilot's Licence and IR in March 2000. CPL and IR valid until 21 March 2002
- Class 1 medical certificate issued 30 October 2000 valid until 30 October 2001
- Type rating on 20 April 2000
- Base check on 20 April 2000 valid until 20 April 2001

Experience:
- 327 flying hours, of which 50 on type
- in the previous 90 days: 8 hours all on type
- in the previous 30 days: 4 hours all on type

The First Officer had not been to Orléans Saint Denis de l'Hôtel during the previous twelve months. His rest period before departure from Rotterdam had lasted 24 hours.

He was pilot flying, in the left seat, at the time of the accident.

1.3 Aircraft Information

Airframe

- Manufacturer: Piper Aircraft Corporation, USA
- Type: PA-31-350 Chieftain
- Serial number: 31-7305048
- Date of manufacture: 1973
- Date of entry into service: 20 February 1991
- Registration Certificate issued by the Netherlands on 9 April 1991
- Airworthiness certificate valid until 13 August 2001
- Total flying time: 9,820 hours

Engines

- Number of engines: 2
- Manufacturer: Lycoming, USA
- Type: TIO-540-J2BD

Left engine

- Serial number: RL – 5300 – 61 A
- Total flying time: 426 hours
- Number of cycles: 308

Right engine

- Serial number: L – 1210 – 68 A

- Total flying time: 325 hours
- Number of cycles: 240

1.4 Meteorological Conditions

The Meteorological conditions recorded by the AFIS agent at the aerodrome a few minutes after the accident were as follows:

- wind 240° / 8 kt
- visibility 5 km
- scattered cloud
- temperature 10 °C
- QNH 1007 hPa
- recent light showers

The observation made at 17 h 00 at the Orléans-Bricy aerodrome about thirty kilometres northwest was as follows:

- wind 210° / 5 kt
- visibility over 10 km
- rain
- occasional clouds at 2,800 feet
- scattered at 6,000 feet
- broken at 11,000 feet
- temperature 14 °C
- QNH 1007 hPa

1.5 Aerodrome Information

Orléans Saint Denis de l'Hôtel aerodrome (VAC chart in appendix 2) is open to public air transport. It has an aerodrome flight information service (AFIS) that is in service during scheduled hours and by arrangement outside of those hours. It has a tarmac runway 1,000 m long and 30 m wide oriented 235°/055° whose altitude is 396 feet and which has a slight slope towards 23. IFR activity is possible at the aerodrome.

The declared distances offered at the two QFU's are as follows:

- take off distance available (TODA) 1,000 m
- acceleration-stop distance available (ASDA) 1,000 m
- landing distance available (LDA) 1,000 m

This information is included on the Jeppesen chart that the crew was using.

1.6 Information on Organizations and Management

Tulip Air B.V. is in possession of an Air Transport Certificate issued on

1st March 2001 by the Dutch Ministry of Transport (RLD) for the operation of two Beech 200's, two Cessna F406's and three Piper PA 31-350's for transport of passengers, freight and medical evacuations. This certificate was valid at the time of the accident.

The aircraft was certified for single pilot operation but the airline operated its PA 31-350's with two pilots. The Operations Manual does not include any procedures relating to cockpit resource management (CRM) for this type of aircraft.

Note: the JAR OPS only specifies structured training in CRM when the presence of two pilots results from a regulatory requirement.

1.7 Additional Information

1.7.1 Weight and Balance

The Captain had established the weight and balance estimate (appendix 3) on the basis of the weight allowances for passengers without hand baggage (90 kg/198 lbs) and a crew with baggage 85 kg/172,25 lbs). These allowances are in accordance with criteria prescribed in JAR OPS 1.

The aircraft empty weight is 4,747 lbs. The zero fuel weight calculated by the crew was 4,747 lbs + (8 x 198 lbs) + (2 x 172,25 lbs), thus 6,676 lbs for 7,000 lbs maximum. The weight estimate indicated 381 lbs of fuel in the inner tanks for a maximum of 636 lbs. The ramp weight was thus 7,057 lbs for a maximum of 7,398 lbs. The fuel for start-up and taxiing was estimated at 30 lbs, which gave takeoff weight of 7,027 lbs for a maximum of 7,368 lbs. The consumption for the stage was estimated at 131 lbs, which brought the estimated landing weight to 6,896 lbs for a maximum of 7,000 lbs.

The aircraft occupants and their baggage were weighed following the accident. This brought to light a true weight of 1,984 lbs (900 kg) for the occupants, 55 lbs (27 kg) more than the weight allowance, but above all the omission of 262 lbs (119 kg) of baggage. Thus all of the weights were reduced by 317 lbs (146 kg). In addition, the Equipment List (appendix 4) shows a quantity of 171 litres of fuel unconsumed on arrival at Saint Denis de l'Hôtel and a top-up of 79.9 litres, an on-board total of 250,9 litres (180 kg/398 lbs), a weight slightly above that calculated for the weight estimate.

Nevertheless, the aircraft remained within the limits of the various structural weights, except for the maximum landing weight that would have been exceeded by 230 lbs (104 kg).

The balance sheet established by the crew shows a CG at the rear limit of the envelope for the three principal weights: zero fuel weight, takeoff weight and estimated landing weight. The position of the baggage in the various compartments and of the passengers in the cabin not having been established in the course of the investigation, it is not possible to calculate the CG in relation to the true weights.

Note: on consulting the Flight Report for the flight preceding the accident, an onboard fuel quantity of 466 litres (335 kg / 739 lbs) on departure from Rotterdam is noted. Taking into account the true weight of the occupants without baggage (1984 lbs), the aircraft's empty weight (4747 lbs), and of the fuel at takeoff (709 lbs), the true weight at takeoff was 7440 lbs for a maximum weight of 7,368 lbs. After the trip fuel of 276 litres (199 kg / 438 lbs), the true weight on landing is 7,002 lbs for a maximum weight fixed at 7,000 lbs.

1.7.2 Performance

With reference to the JAR-OPS, the operation of PH-ABD comes under performance class B (sub-section H).

The takeoff performance calculation sheet extracted from the airline Operations Manual (appendix 5) shows that the necessary run distance for takeoff is 480 m and the distance necessary for takeoff of 900 m for the selected weight of 7,027 lb. These values change, respectively, to 520 m and 950 m for the recalculated weight of 7,361 lbws.

Paragraph OPS 1.530 (a) stipulates that the operator must ensure that the takeoff weight does not exceed the maximum takeoff weight specified in the Flight Manual, taking into account the pressure-altitude and the temperature at the takeoff aerodrome.

Paragraph OPS 1.545 stipulates that the operator must ensure that the landing weight does not exceed the specified maximum landing weight, taking into account the altitude and the forecast ambient temperature at the estimated arrival time at the destination aerodrome and at all other diversion aerodromes.

The aircraft Flight Manual (extract in appendix 7) approved by the RLD, mentions a takeoff procedure for short runways that includes setting the flaps at 15°. This results, specifically, in a rotation speed of about 80 kt instead of the 90 kt in clean configuration and an acceleration-stop distance of around three hundred metres. On the accident aircraft, the flaps were found set at 0°.

1.7.3 Flight Control Locking Device

The aircraft is equipped with a flight control locking device for use on the ground installed so as to avoid the flight control surfaces flapping. The system is based on locking the left side control wheel. It consists of a nail-shaped latch pin topped with a rectangular light alloy metal plate that can bear the inscription "Controls Lock" on a red background. The latch pin is inserted into holes drilled into the shoulder to the right of the wheel housing on one side and into the wheel shaft on the other.
Note: the following photos, designed to illustrate the lock, are not of the accident aircraft. The crew took the latch pin away with them.

The wheel is thus maintained in a horizontal position, the ailerons remain in a more or less neutral position and the elevator is deflected down. No use of instruments or vital controls is affected by the presence of the locking device. The wheels on the accident aircraft were equipped with clips designed to hold the takeoff or landing charts. The presence of such a card tends to hide the metal plate. According to the crew's statements, no charts were in this position during

the takeoff.

The list of actions and checks associated with preparation on PH-ABD (appendix 6) specifies:

- removing the locking device from the controls upon entering the cockpit,
- checking the freedom of movement of the flight control surfaces during the full or short pre-flight external check.

No other action or check is recommended in order to check freedom of movement of the flight controls from the cockpit before takeoff.

The Flight Manual itself recommends two extra checks on freedom of movement of the flight controls: before start-up and before takeoff.

1.7.4 Testimony

At around 90 kt, the PF could not rotate the aircraft. The crew initially thought the elevator trim was incorrectly set. When the PF noticed the presence of the flight control locking device, he tried in vain to remove it. At the same time, he reduced thrust and braked, without being able to stop the aircraft before the end of the runway.

The crew did not mention any particular rush associated with the preparation of the departure nor any malfunction in aircraft systems. The PF was apparently disturbed in carrying out actions and checks underway when the passengers arrived on board the aircraft.

1.7.5 Internal Analysis of the Event by the Operator

The PA 31-350's in Tulip Air's fleet are not all equipped with a flight control locking device system. For those aircraft that are not so equipped, the safety harnesses are used.

The FO performed the pre-flight actions and checks alone. The Captain took care of the passengers and informed them of the safety procedures. When he entered the cockpit, the pre-flight checks were complete. The FO was disturbed by a passenger during preparation of the cabin, perhaps at the time of the check on freedom of movement of the flight controls. Furthermore, he thought that the "flight control lock: remove" checklist item was not applicable as the safety harnesses were undone.

According to the Captain, the level of tension on board was a little higher than usual for several reasons:

- route clearance was received during taxiing,
- taxiing was short,
- the clearance message included a point unknown to the crew,
- the runway was considered "critical".

Following the internal analysis of the event, the operator planned the following measures:

- check performance in relation to aerodrome characteristics before accepting a flight,
- check the conversion programme for training for takeoff and landing on a short field,
- make procedures identical for all of the PA 31's in the fleet,
- check that there were no "not applicable" items on the check list,
- as far as possible, perform the check list as a crew,
- draw flight crews' attention to the possible worsening in crew resource management during phases of flight with high workload.

2 – ANALYSIS

The preparation of the flight, which seems to have taken place in an unrushed way, shows an incorrect assessment of the weight embarked. The use of weight allowances, even if they led to only a slight variation from the true values, seemed ill adapted to the situation. However, the main difference resulted from the omission of the total weight of the baggage, an omission that the investigation was not able to qualify as intentional or unintentional.

The result was a takeoff weight, which was very close to the maximum; maximum landing weight would have been exceeded. On the previous flight, even taking into account the absence of baggage, the weight limitations were also exceeded. These operating conditions could not have been unknown to the crew and should have led them to pay great attention to the balance, to fuel management and to performance.

It was not possible to determine precisely the balance parameters. Nevertheless the calculations made by the crew pushed the indices to the rear limit of the envelope. This all leads to the conclusion that this configuration was essentially identical to the weight conditions measured on weighing. This balance towards the rear would in any event have contributed to the aircraft lifting off.

Although the takeoff distance available was within the JAR-OPS performance requirements for class B aircraft, the margin was only fifty metres, which led the crew to consider that runway as "critical". However, they did not use the 15° flap setting recommended by the Flight Manual for takeoffs on "short fields".

The flight control locking device was not removed by the crew. This indicates that the list of actions and checks was not followed rigorously. Furthermore, the investigation showed that this list was incomplete in relation to the aircraft's Flight Manual. This anomaly probably went unnoticed by the oversight authorities. In any event, checking for freedom of movement of the flight controls is an integral part of the rules of the art before takeoff.

The PNF did not notice the failure to remove the flight control locking device. Basic notions such as callout procedures or guides and cross checks were not

employed. This accident confirms that an unstructured crew, which has not been trained in CRM and which has no clear indications as to task sharing, does not perform adequately to carry out a public transport flight. What is more, flight conditions were normal and there was no emergency.

3 – CONCLUSIONS

3.1 Findings

- The crew possessed the requisite licenses and qualifications to undertake the flight.
- The aircraft's weight was slightly below the maximum structural weight for takeoff.
- The crew did not use the flap deflection on takeoff adapted for short fields which would have given them an extra safety margin.
- The list of actions and checks available to the crew did not entirely reproduce the normal procedures listed in the Flight Manual.
- The flight control locking device remained in place, and neither of the pilots noticed it.
- The pilots did not act as a team; the regulations do not specify that they should receive appropriate training.

3.2 Probable Cause

The accident was caused by the crew's failure to perform pre-flight actions and checks relating to unblocking and free movement of the flight controls and flight control surfaces. This failure was able to develop to the point of being the cause of the accident as a result of the absence of precise CRM procedures.

4 – SAFETY RECOMMENDATIONS

4.1 - The investigation showed that the Operations Manual was incomplete compared to the aircraft's Flight Manual. Consequently, the BEA recommends:

- **that the RLD ensure that Tulip Airs procedures in relation to the use of its aircraft are in accordance with the Flight Manual.**

4.2 - The application of procedures intended for single pilot operation in a context with two pilots and the absence of resource management by the crew created the conditions for a basic safety step to be forgotten. Consequently, the BEA recommends:

- **that the JAA extend the obligation to undertake CRM training when the presence of two pilots on board a single pilot aircraft results from a choice by the operator.**

List of appendices

APPENDIX 1
Picture of Site and Aircraft

APPENDIX 2
VAC map of Orléans Saint-Denis de l'Hôtel aerodrome

APPENDIX 3
Weight and balance estimate established by the crew

APPENDIX 4
Materials list

APPENDIX 5
Takeoff performance grill

APPENDIX 6
Airline's list of actions and checks

APPENDIX 7
Extract from the actions and checks as featured in the approved Flight Manual

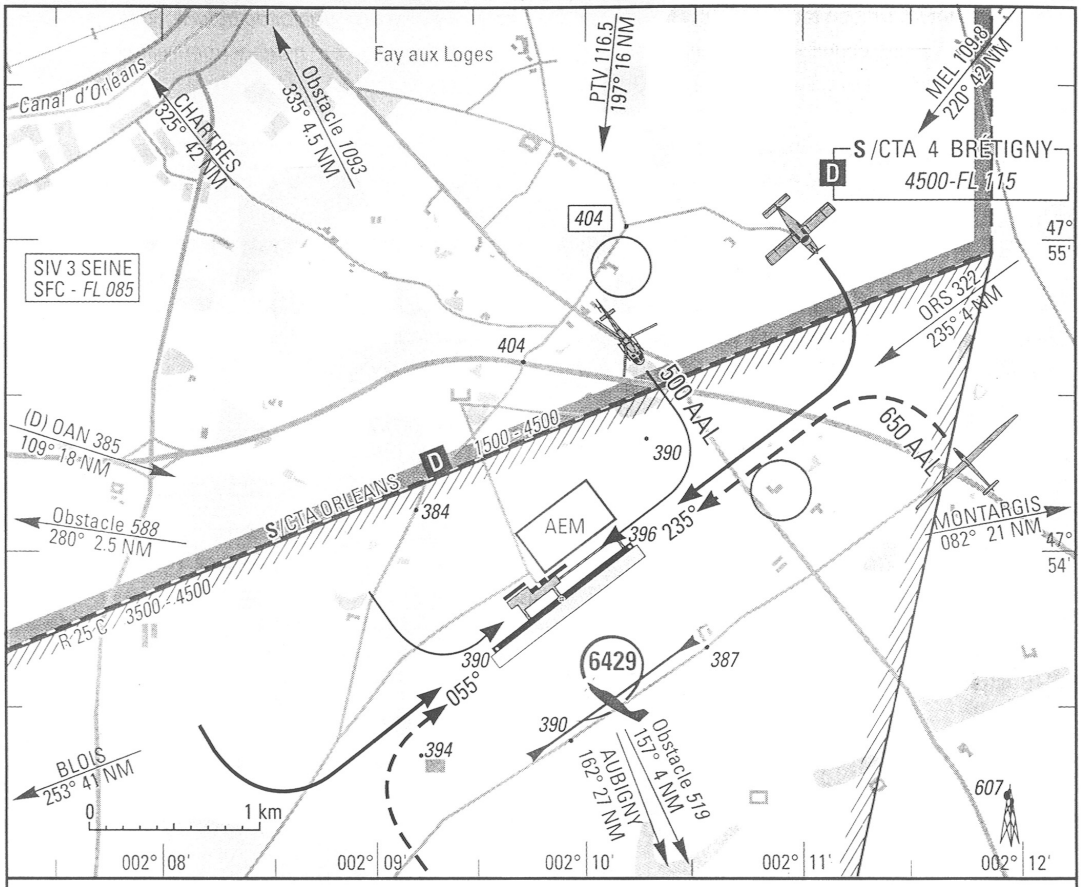
Picture of Site and Aircraft

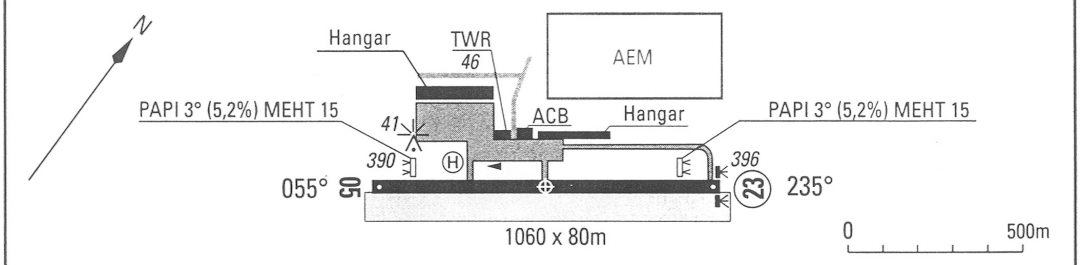
VAC map of Orléans Saint-Denis de l'Hôtel aerodrome

ATTERRISSAGE A VUE — Ouvert à la CAP — 01 ORLEANS **ST DENIS** DE L'HOTEL LFOZ
Visual landing — *Public AirTraffic* — 01 03 22

Coord. WGS-84 — LAT: 47 53 51 N
ALT en ft — LONG: 002 09 51 E
ALT AD : *396 (14 hPa)* — DEC 2 °W (00)

APP : NIL
TWR : NIL
AFIS : ST DENIS Information 122.4. En l'absence AFIS, A/A en FR seulement.





RWY	QFU	Dimensions *Dimension*	Nature *Surface*	Résistance *Strength*	TODA	ASDA	LDA
05	055	1000 x 30	Revêtue *Paved*	6/-/-	1000	1000	1000
23	235				1000	1000	1000

Aides lumineuses : RWY 05/23 : BI — ***Lighting aids :*** *RWY 05/23 : LIL*

SERVICE DE L'INFORMATION AERONAUTIQUE — AMDT 04/01 **CHG** : SIV 3 SEINE obstacles — © SIA

VAC map of Orléans Saint-Denis de l'Hôtel aerodrome

02 ORLEANS **ST DENIS** DE L'HÔTEL LFOZ

01 03 22

CONSIGNES PARTICULIÈRES / *PARTICULAR INSTRUCTIONS*

Aérodrome réservé aux ACFT avec radio Activité voltige (N° 6429) axe 055/235 sur longueur de 1000 m, 3500 AAL/1700 AAL réservé aux ACFT autorisés par le gestionnaire AFIS. Activité à annoncer à BRICY APP 122.7 et SEINE Info 118.05	*AD reserved for ACFT equipped with radio Aerobatics (NR 6429) overhead RWY extending on 055/235 orientated length of 1000 m, 3500 AAL/1700 AAL reserved for authorized ACFT. Activity to be announced at BRICY APP 122.7 and SEINE Info 118.05*
Entraînement interdit en tour de piste < 500 ft	*Aerodrome circuit prohibited below 500 ft.*
Eviter le survol des communes avoisinantes.	*Avoid the overflight of neighbouring villages.*
Aéromodélisme figuré sur la carte : 330 ft AAL MAX, HJ.	*AEM area : 330 ft AAL MAX, HJ.*
PAPI obligatoire pour une utilisation de nuit RWY 05.	*PAPI compulsory for use of RWY 05 by night.*
Piste non revêtue réservée aux planeurs et avions de servitude.	*Grass RWY reserved for gliders and service aeroplanes.*
Piste et voie de circulation non revêtues inutilisables après fortes pluies ainsi que l'hiver.	*Unpaved RWY and taxiway unserviceables after heavy rainfalls and during winter season.*
Atterrissages et décollages simultanés sur les 2 pistes accolées strictement interdits.	*Simultaneous LDG and TKOF strictly prohibited on both adjacent RWY.*
Activité IFR possible.	*Possible IFR activity.*

INFORMATIONS DIVERSES / *MISCELLANEOUS*

1 - Situation : 4 km NE de Saint Denis de L'Hôtel (45 - LOIRET).

2 - ATS : AFIS : ETE : LUN-VEN 0600-1000, 1300-1700 sauf JF
HIV : LUN-VEN 0700-1100, 1400-1700 sauf JF
Extension sur PPR pendant HOR AFIS au plus tard la veille avant 1500. (HIV + 1HR)
☎ 02 38 46 33 33 - FAX : 02 38 59 11 59.

3 - VFR de nuit : agréé.

4 - Gestionnaire : SMAEDAOL - Aérodrome des 4 vents
45550 St Denis de l'Hôtel
☎ 02 38 46 33 33 - FAX : 02 38 59 11 59.

5 - District Aéronautique : CENTRE.

6 - BDP/BIA : BRIA de rattachement : LE BOURGET (voir GEN).

7 - RSFTA : oui (LFOZXHAX).

8 - MET : VFR : voir GEN VAC
IFR : voir GEN IAC
STATION : NIL.

9 - Douanes : PPR 24HR pendant HOR AFIS - ☎ 02 38 46 33 33.

10 - AVT : Carburant : 100LL - Lubrifiant : D80 (CIV-MIL)
0700-1000, 1200-1700 HIV : + 1 HR
JET A1 : HOR AFIS et PPR 24 HR

11 - SSIS : Catégorie 2 - Niveau 2 pendant HOR AFIS. Extension au profit aéronefs de classe 2 et supérieure en transport de PAX sur PPR pendant HOR AFIS au plus tard la veille avant 1500 ☎ 02 38 46 33 33
FAX : 02 38 59 11 59.

12 - Hangars pour aéronefs de passage : oui

13 - Réparation : Val de Loire Aviation ☎ / FAX : 02 38 59 12 71.

14 - ACB : d'Orléans et du Loiret ☎ 02 38 59 18 34 - FAX : 02 38 59 11 30.

SERVICE DE L'INFORMATION AERONAUTIQUE

AMDT 04/01

Weight and balance estimate established by the crew

TULIP AIR B.V. — **BOARDBOOK / TECHLOG** — A/C REG: PH-ABD — A/C TYPE: PA31 — INV. NO: 01-1161-075 — IFR-VFR — U-C-L-V-P-T — NO: 05108

LEG	DATE	FLNO	DEPARTURES FROM	DEPARTURES BLOCK	DEPARTURES AIR	ARRIVALS TO	ARRIVALS LAND	ARRIVALS BLOCK	TOTAL HOURS AIR	TOTAL HOURS BLOCK	CREW + LOAD CAP	CREW + LOAD COP	CREW + LOAD PAX	CREW + LOAD CARGO	FUEL UPL/DEP	FUEL BURN-OFF	FUEL FOB/ARR	OIL-UPL LE	OIL-UPL RE
1 I	22/3	TLP2A	EHRD	10:00	10:10	LFOZ	12:03	12:07	1:53	2:07	EHK	TMP	8	—	68,46	295	171	9/0	8/1
2															79,9				
3																			
4																			
5																			
TOT									1:53	2:07			8	—	148,36	295		0	1

LEG	ACFT ACCEPT	DISCREPANCY	CORRECTIVE ACTION	ENG	SIGN
1		—			
2		ABORTED T/O. STANDSTIL IN THE GRAS. FULL DETAILS ON TRIP REPORT.			

ENG	ITT EGT	TORQ MAN.P	PROP RPM	N1%	FUEL FLOW	FUEL PRESS	OIL TEMP	OIL PRESS	AC.V AC.A	DC.V DC.A	F.LEV C.LEV	DIFF PRESS	O2 N2	W.DE ICE	PROP DE-ICE	PROP DE-ICE	IAS	PRESS SUCT	IOAT	COWL FLAP	CYL TEMP	WEIGHT
LE	1600	31	2700	—	70	38	165	75	+	+	FOGO	—	—	+	+	+	150	4,75	-3	CLSD	410	7100
RE	1575	30	2700	—	69	37	170	80	+	—	—	—	—	+	+	+	152	—	—	CLSD	400	—

	TIME BEFORE INSPECTION HOURS (AIR)	AIRFRAME HOURS (AIR)	AIRFRAME LANDINGS	LEFT ENGINE HOURS (AIR)	LEFT ENGINE CYCLES	RIGHT ENGINE HOURS (AIR)	RIGHT ENGINE CYCLES
BR. FORWARD	18.43	9818.25	9822	426.10	308	325.15	240
TOTAL	1.53	1.53	1	1.53	1	1.53	1
NEW	16.50	9820.18	9823	428.03	309	327.08	241

COMPONENT CHANGES

PART NUMBER	S/N IN	S/N OUT

CERTIFICATE OF RELEASE TO SERVICE

NAME: LIC. NO:

COMPANY: AUT. NO:

A/C HOURS: W/O NO:

DATE: SIGN:

Certifies that the work above, except as otherwise specified, was carried out in accordance with JAR-145 and in respect to that work the aircraft is considered ready for release to service.

TYPE OF INSP. PERF:

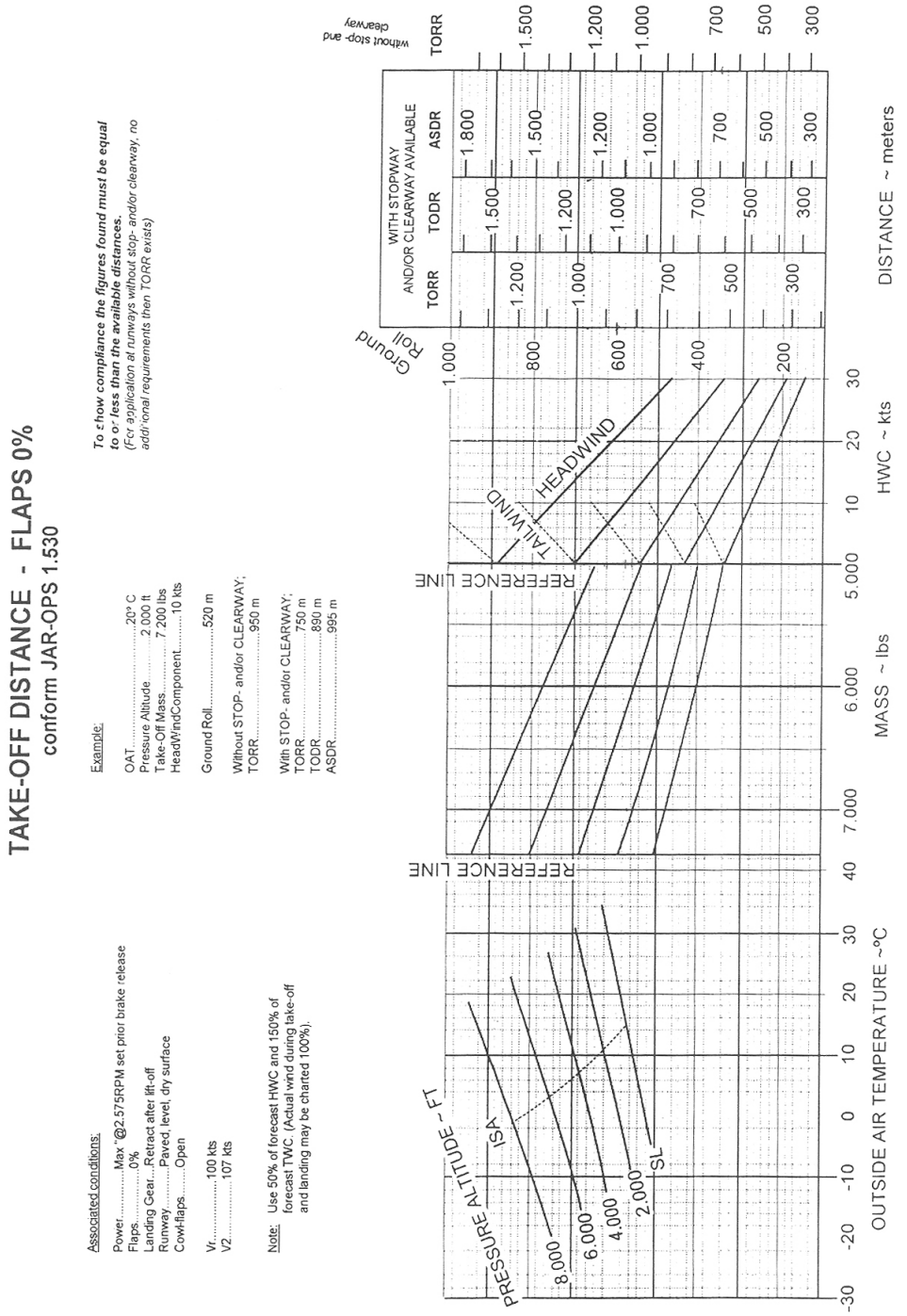
TYPE OF NEXT INSP:

PREFLIGHT INSP. A / T

CAPTAINS SIGNATURE

Takeoff performance grill

4.2.1 NORMAL TAKE-OFF



Airline's list of actions and checks

TULIP AIR **PH-ABD** NORMAL CHECKLIST 04 February 2000

ENTERING COCKPIT

Control locks	REMOVE
Parking brake	RESET
Papers	ON BOARD
Fuel selectors	ON

PRE-FLIGHT

		External
Walk around	COMPLETED	
Clocks	SET	
Alternate static source	CLOSED	
Parking brake	SET	
Gear handle	DOWN NEUTRAL	
Controls	FREE & CORRECT	
Trims	FREE & SET	
Power levers	FREE & IDLE	
Propeller levers	FREE & FULL FINE	
Mixture levers	FREE & CUT-OFF	
Alternate air	IN	
Heater	OFF	
Avionics	OFF	
Electrical switches	OFF	*AS REQ.*
Alternator circuit breakers	ON	
Fire wall shutoff	OPEN	
Fuel selectors	OUTBOARD	
Master switch	ON	*OFF*
External power	*NA*	*ON*
Interior lighting	SET	
Circuit breakers	IN	
Digiflow	SET	
Gear lights	4 CHECKED	
Annunciator lights	CHECKED / TESTED	
Cabin signs	FSB & NO SMOKING	
Chocks & covers	REMOVED	
Doors & lockers	CLOSED	

SHORT TURN-AROUND PRE-FLIGHT

Doors & lockers	CLOSED
Alternate static source	CLOSED
Trims	SET
Controls	FREE
Fire wall shutoff	OPEN
Fuel selectors	OUTBOARD
Alternate air	IN
Avionics	OFF
Master switch	ON
Circuit breakers	IN
Digiflow	SET
Cabin signs	FSB & NO SMOKING

CLEARED TO START ENGINES

Exterior lights	AS REQUIRED
Magnetos	ON (4 x)
Avionics	ALL OFF
Engine NO.2	START
Hydraulic pump NO.2	CHECKED
Engine NO.1	START

AFTER STARTING

External power	*NA*	*DISCONNECT*
Battery	*NA*	*ON*
Avionics	ON	
Storm scope	ON	
Cowl flaps	CLOSED	
Heater inlet	OPEN	
Fuel quantity (outboard)	CHECKED	
Annunciator lights	CHECKED	
Pneumatics	CHECKED	
Navigation set-up	COMPLETED	
Taxi & departure briefing	COMPLETED	

TAXI

Brakes	CHECKED
Flaps	(*TESTED) & SET
Fuel X-feed	(*TESTED) & OFF
Fuel selectors	INBOARD
Fuel quantity (inboard)	CHECKED
Flight & engine instruments	CHECKED
Take-off briefing	PERFORMED

Airline's list of actions and checks

TULIP AIR **PH-ABD** NORMAL CHECKLIST 04 February 2000

BEFORE TAKE-OFF

Engine instruments	CHECKED
* Feather check	COMPLETED
Amps	CHECKED
DC Voltage	SUFFICIENT
Magnetos	CHECKED
* Surface de-ice	CHECKED
* Prop anti-ice	CHECKED
De-ice boots	DEFLATED
Idling	NO CUT
All annunciators	CONFIRM
Route clearance	OBTAINED

LINE UP

Transponder	SET
Strobe lights	ON
Ice protection	AS REQUIRED
Runway heading	CHECK
Take-off clearance	OBTAINED
Landing / taxi lights	ON / OFF
Emergency pumps	ON

CLIMB

Gear	UP (4 LIGHTS OFF)
Flaps	UP
Climb power	SET
Emergency pumps	OFF
Landing / taxi lights	OFF
Cowlings	NO OIL SPILL
Engine instruments	MONITOR

CRUISE

Cruise power	SET
Fuel selectors	AS REQUIRED
Fuel quantity	MONITOR
Engine instruments	MONITOR
Altimeters	SET
Cabin signs	AS NECESSARY

DESCENT

Cowl flaps	CLOSED
Cabin signs	AS REQUIRED

** Items may be omitted SCD*

APPROACH

Approach briefing	COMPLETED
Altimeter	QNH SET
Flight instruments	X-CHECKED
Navigation set-up	COMPLETED
Markers	SET
Cabin signs	FSB & NO SMOKING
Fuel selectors	INBOARD
Autopilot	OFF

FINAL

Gear	DOWN & LOCKED
Landing light	ON
Windshield heat	OFF
Flaps	SET
Propeller levers	SET (2200/2400)
Mixtures	FULL RICH
Emergency pumps	ON
Brakes	CHECKED

AFTER LANDING

Emergency pumps	OFF
Ice protection	ALL OFF
Transponder	STANDBY
Flaps	UP
Exterior lights	AS REQUIRED
Heater	COOL

PARKING

		External
Parking brake	SET	
Digiflow	NOTED	
Stormscope	OFF	
All lights	OFF (EXCEPT BEACON)	
Avionics	OFF	*OFF*
Amps	CHECKED	
Magneto grounding	CHECKED	
EGT	STABILISED	
Mixture engine NO.2	CUT-OFF	
Hydraulic pump NO.1	CHECKED	
Mixture engine NO.1	CUT-OFF	
Boost pumps	OFF	
Magnetos	4 x OFF	
Beacon light	OFF	
Master switch	OFF	
External power	*NA*	*CONNECT*
Position lights	*NA*	*ON*

Extract from the actions and checks as featured
in the approved Flight Manual

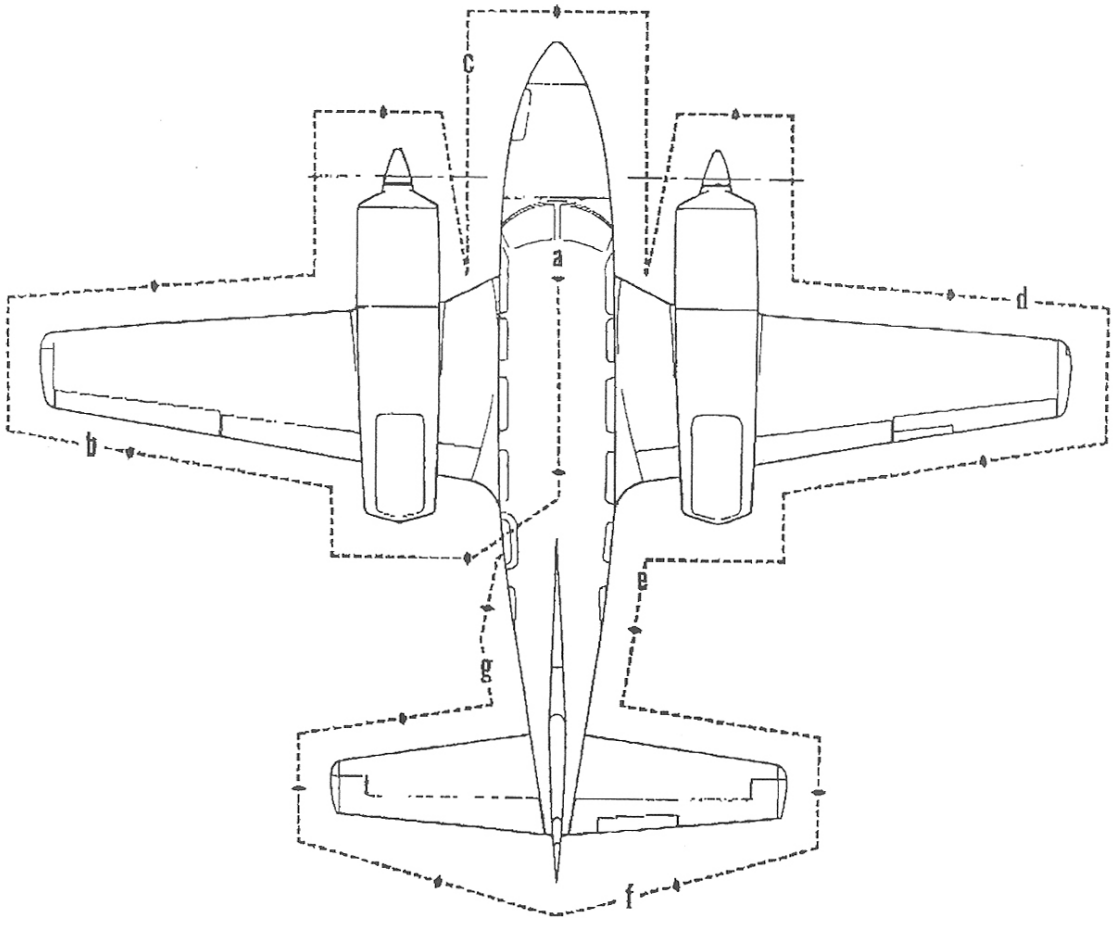
SECTION II

PROCEDURES

A. NORMAL OPERATING PROCEDURES

1. PREFLIGHT
   a. Airplane status - check
   b. Weight and c.g. - compute
   c. Performance - compute

2. WALK-AROUND INSPECTION



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Extract from the actions and checks as featured in the approved Flight Manual

a. Cockpit

(1) Controls - unlocked
(2) Magneto switches - off
(3) All switches - off
(4) Master switch - on
(5) Fuel quantity - sufficient
(6) Trim - neutral
(7) Cowl flaps - open
(8) Master switch - off
(9) Mixture - idle cut off
(10) Airplane papers - checked
(11) Escape hatch - secure
(12) Fire extinguishers - inspect if installed
(13) Oxygen pressure - checked and off, masks in place
(14) Gear handle - down

b. Left Wing

(1) Wing root fillet - check
(2) Flap - condition and rigging
(3) Nacelle locker door latched and proper loading
(4) Aileron - lock removed, condition, rig, attachment, freedom
(5) Static wicks - in place, condition
(6) Wing tip - condition checked, counterbalance checked
(7) Leading edge - condition checked
(8) Fuel tank caps - sufficient fuel, secure
(9) Top and bottom of wing - no tears or fuel stains, no ice
(10) Fuel tank vents - clear
(11) Tie down rope - removed
(12) Outboard fuel drain - check for water, sediment and proper fuel
(13) Landing gear - condition, strut inflation, micro switches, tires, brakes, gear door
(14) Cowl flaps - open
(15) Chocks - as desired
(16) Nacelle - check for condition and security of panels
(17) Oil - checked
(18) Propeller - check condition of blades and spinner
(19) Engine cowl and baffles - inspect
(20) Wing root fillet - check
(21) Inboard fuel drain - check for water, sediment and proper fuel
(22) Filter drain - drain and check for water, sediment and proper fuel
(23) Crossfeed line drain - drain and check for water, sediment and proper fuel.

c. Nose Section

(1) General condition
(2) Baggage compartment - baggage secure, door locked
(3) Battery vents - clear
(4) Nose gear - tire, doors, struts - checked
(5) External power receptacle - as required
(6) Pitot tube - cover removed, holes clear
(7) Nose gear - condition, strut inflation, micro switch, tires, light
(8) Inspection plates - secure
(9) Windshield - secure and clean
(10) Heater inlets and outlets - clear

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Extract from the actions and checks as featured
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d. **Right Wing**
(1) Inboard fuel tank, sump, crossfeed - drain and check for water, sediment, and proper fuel
(2) Filter drain - drain and check for water, sediment and proper fuel
(3) Wing root fillet - condition
(4) Escape hatch - secure
(5) Oil - checked
(6) Engine cowl and baffles
(7) Propeller - check condition of blades and spinner
(8) Nacelle - check for condition and security of panels
(9) Landing gear - condition, strut inflation, micro switches, tires, brakes, gear door
(10) Checks - as desired
(11) Outboard fuel drain - drain and check for water, sediment and proper fuel
(12) Tie down - removed
(13) Fuel tank vents clear
(14) Top and bottom of wing - no tears, fuel stains, ice
(15) Fuel tank caps - sufficient fuel, secure
(16) Leading edge - checked, stall warning free
(17) Wing tip condition - checked
(18) Static wicks - in place
(19) Aileron and tab - lock removed, condition, rig, attachment, freedom
(20) Flap - condition, rigging
(21) Wing root fillet - check
(22) Nacelle locker door latched and proper loading

e Fuselage - (Right Side)
(1) General condition - check
(2) Antennas - in place and secure
(3) Static vent and openings - clear

f. Empennage
(1) Vertical fin, rudder and fairing - condition checked
(2) Right air scoop - clear
(3) Horizontal surfaces - condition checked
(4) Elevator free and condition
(5) Rudder free and condition
(6) Trim tabs - neutral, good condition
(7) Tie down - removed
(8) Left air scoop - clear

g. Fuselage (Left Side)
(1) General condition - check
(2) Static air vent - clear
(3) Main cabin door attachment - check
(4) Cargo door latched (if installed)
(5) Pilot door attachment (if installed) - check

3. BEFORE STARTING ENGINES
a. Walk-around inspection - complete
b. Baggage - secure
c. Cabin door - secure, safety chain secure
d. Maps and charts - checked

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e. Passenger briefing - complete
f. Pilot's seats, seat belts, and shoulder harnesses - adjusted and secure
g. Parking brake - secure
h. Altimeter - set to field elevation
i. Controls - free and proper response
j. Fuel valves - on inboard tanks
k. Crossfeed - off
l. Firewall fuel shutoff valves - on
m. Alternate air valves - off
n. Circuit breakers - check
o. Electrical switches - off. Except: Alternator circuit breaker switches - on
p. Radio switches - off
q. Transceiver - set to tower or ground control freq.
r. Alternate static source - normal
s. Master switch - on
t. Fuel quantity - check 4 tanks
u. Trim - set for take off
v. Cowl flaps - open
w. Auxiliary power unit - connect if available (Master Switch must be off)
x. Gear lights - green
y. Baggage and main door ajar light - out
z. Seat belt and no smoking sign - on (if installed)
aa. Pilot's door latched and theft lock unlocked (if installed)
ab. Fuel boost pump lights* - off (press-to-test) (check pressure)
ac. Fuel flow warning lights** - off (press-to-test, depress for 3 sec.)

4. STARTING PROCEDURES
   a. Starting Engines (When APU is used it is preferable to start right engine first.)
      (1) Throttles - closed
      (2) Mixtures - idle cut-off
      (3) Master switch - on (emerg. pump off)* (emerg. pump on)***
      (4) Throttle - open 1/2 inch
      (5) Mixture - full rich for 5 sec. then return to idle cut-off (then emerg. pump off)***
      (6) Prop control - forward
      (7) Magneto switch - on
      (8) Props - clear
      (9) Starter - engage
      (10) Mixture - advance slowly toward rich position as engine fires
      (11) Throttle - retard if necessary during start to limit engine speed to 1000 rpm or less
      (12) Oil and fuel pressure - check
      (13) Hydraulic pump - check

*Serial nos. 31-7405479 and up and serial nos. 31-50001 thru 31-7405478 when Piper Kit No. 760 873 is installed.
**Serial nos. 31-7552017 and up.
***Serial nos. 31-5001 thru 31-7405478 when Piper Kit No. 760 873 is not installed.

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NOTE

On airplanes equipped with fuel boost pumps it may be necessary to use emergency fuel pumps for additional prime during cold weather starts.

b. Flooded Start
   (1) Mag. switches - on
   (2) Throttle - open
   (3) Mixture - idle cut off
   (4) Starter - engage
   (When engine fires, advance mixture and retard throttle to 1000 rpm.)

c. Hot Start
   (1) Mag. switches - on
   (2) Throttles - open 1/2 inch
   (3) Mixture - idle cut off
   (4) Emergency fuel pump - on (do not prime engine)
   (5) Starter - engage
   (6) When engine fires, advance mixture. Allow emergency fuel pump to run for approximately (3) minutes to purge fuel lines to engine.
   (7) Emergency fuel pump - off

5. BEFORE TAXI
   a. APU - removed
   b. Chocks - removed
   c. Radios - tune and check
   d. Lights (nav., cockpit, beacon, cabin) - as required and checked
   e. Gyros - set
   f. Taxi instructions - contact ground control
   g. Altimeter and clock - set
   h. AutoPilot check - see supplements section
   i. Parking brake - off

6. WHILE TAXIING
   a. Braking - check
   b. Flight instruments - check
   c. Fuel valves - check all positions

7. ENGINE RUN-UP
   a. Parking brake - on
   b. Mixtures - rich
   c. Prop controls - forward
   d. Cowl flaps - open
   e. Engine instruments - checked
   f. Crossfeed - Check crossfeed on, selector for left or right engine to "off." After 30 seconds both fuel selectors to "inboard" and crossfeed "off."
   g. Throttles - 1500 rpm
   h. Alternators - check at 1500 rpm, output - check, inop. lights out - check
   i. Instrument pressure - check, approximately 4.3" Hg. at 1500 rpm
   (See "Pneumatic System," Page 3-20)

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j. Check feathering thru not more than 500 rpm drop
   (1) With properly charged propeller, the drop from 1500 rpm to 1100 rpm drop should occur in 1.0 to 1.5 sec.
   (2) A significant difference in feather check times between propellers or a reduced rate of rpm decreases as prop speed approaches 1100 rpm indicates low dome pressure and is sufficient reason to abort flight.
k. Throttle - 2300 rpm
l. Mag. check - 175 rpm drop-off max., 50 rpm max. difference between mags.
m. Exercise props - for 300 rpm drop
n. Throttles - idle position - 600-650 rpm
o. Throttles - 1000 rpm
p. Friction - set
q. Directional gyro - reset

8. BEFORE TAKE-OFF
   a. Seat belt/no smoking sign - on (if installed)
   b. Crossfeed - off
   c. Fuel valves - on "inboard" tanks
   d. Emergency fuel pumps - on, pressure up
   e. Air conditioner - off (if installed)
   f. Mixtures - rich (forward)
   g. Prop controls - low pitch (forward)
   h. Engine instruments - normal
   i. Flaps - set 0° for normal takeoff, set 15° for short field takeoff
   j. AutoPilot - checked and off
   k. Trim tabs - set for takeoff
   l. Controls - free
   m. Deicer boots - off (if installed)
   n. Passenger briefing - complete
   o. Pitot heat - as required
   p. Transponder - on stand by (if installed)

9. TAKEOFF

NORMAL
   a. Fuel flow warning lights* - off
   b. Throttles - full forward
   c. Manifold pressure (43" normal-static sea level, std. temp.) - checked
   d. Prop speed - 2575 RPM
   e. Rotate - 101 MPH (88 Kts)
   f. Gear - up
   g. Accelerate to - barrier speed 113 MPH (98 Kts)

SHORT FIELD
   a. Fuel flow warning lights* - off
   b. Brakes - hold
   c. Throttles - full forward
   d. Manifold pressure (43" normal - static sea level, std. temp.) - checked
   e. Prop speed - 2575 RPM
   f. Brakes - release
   g. Rotate - 90 MPH (78 Kts.)
   h. Accelerate to barrier speed, 107 MPH (93 Kts.)

*Serial nos. 31-7552017 and up.

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