



A division of  
LANITZ-PRENA  
FOLIEN FACTORY GmbH

Material Airworthiness Limitation Test Equipment  
(MALTE Tester)  
User Manual

# Material Airworthiness Limitation Test Equipment (MALTE Tester) User Manual

Doc. N°

ADxC-51-DDP-901 Edition 1.0



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## Amendments

Issue	Date	Revised pages	Description
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## List of Effective Pages

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# 01 Introduction

## 01-00 General

In the initial certification of the ORATEX® system a low permissible life time was defined which by engineering judgement was considered conservatively safe. Meanwhile several efforts were undertaken to substantiate a higher usable life time. This included both aging and cyclic loading. The ORATEX® cover and coating systems durability has been proven in cycle tests, simulating the loads and stress of >28.000 flight hours for ORATEX® 600 and >31.000 flight hours for ORATEX® 6000. UV-deterioration test likewise showed no undue influence. However, to avoid renewing the whole aircraft cover after the generically defined time periods, it needs to be confirmed that material characteristics of the installed ORATEX® system have not changed by other aging and in-service effects that might not be grasped by these tests. On condition that the test results are successful, the aircraft can be operated further on.

This document describes the MALTE Tester and how the ORATEX® “on condition” test is performed.

## 01-10 Coverage

This manual covers Material Airworthiness Limitation Test Equipment, MALTE Tester, item N° ADxC-51-DDP-901, Lanitz-Prena Item N° 08485.

## 01-20 Related Publications

- ORATEX Application Manual and Airplane Maintenance Manual Supplement, Doc. N° ADxC-51-001-AMM Edition 8.0 or later

## 01-30      Addresses

Firm	Address
LANITZ-PRENA FOLIEN FACTORY GmbH	Am Ritterschlösschen 20 D-04179 Leipzig www.ORATEX.eu

In case of change of ownership of the airplane, design deficiency or occurrence in relation with this STC, please contact:

Firm	Address
Aircraft Design Certification GmbH (ADC)	Reichensteinstrasse 48 D-69151 Neckargemünd E-mail: <a href="mailto:stc@aircraftdc.de">stc@aircraftdc.de</a>

LANITZ-PRENA FOLIEN FACTORY GmbH developed the System and is the according STC Holder. The company has discharged the obligations with respect to Part 21 requirements to ADC EASA DOA.21.J.411.

## 02 How to Use the Manual

### 02-10 Notes

Notes and safety notes in this handbook are marked by the words **NOTE, NOTICE, CAUTION, WARNING or DANGER** in the left margin column. The text of the note or safety note is printed in bold. See the following definitions:

 **DANGER**

indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

 **WARNING**

indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

 **CAUTION**

indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

**NOTICE**

is used to address practices not related to physical injury.

**NOTE**

represents a remarkable hint.

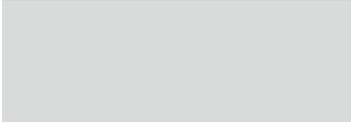
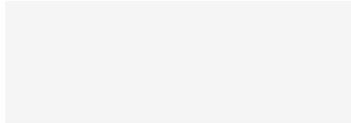
## 02-20 Terminology and Abbreviations

Term	Meaning
DDP	Declaration of Design & Performance
MALTE	Material Airworthiness Limitation Test Equipment
STC	Supplemental Type Certificate

## 02-30 Standard Elements

### Graphical Elements

The following graphical elements are generally used within this manual:

	20% black	structure (general)
	100% black	underlying surface structure
	5% black	fabric
	70% black	fabric layer

### Text Elements

The following text elements are generally used within this manual:

Normal text

- Itemization
- ▶ Instructions
- ▶ Instructions within a safety note

### Head Lines

*Head Lines* (when referenced)

## 02-40      **Safety**

- ▶ This manual only describes the application of the MALTE Tester. For applicability and examination regulation refer to ADxC-51-001-AMM Edition 8.0 or later, and to the regulations applicable to your aircraft.
- ▶ Do not modify the MALTE Tester nor change the test arrangement described in this manual.
- ▶ Do not begin any work before completely having read and understood the contents of this manual.
- ▶ Observe and follow the instructions of the products data and safety sheets of sealing and vacuum device used.

Vacuum forces can cause injuries. Do not allow any part of the body to get in contact with vacuum.

### **NOTICE**

The MALTE Tester, its application, applicable fail pass criteria and according determination of airworthiness is only evaluated and applicable for the ORATEX® covering system. Its application and use for any other cover system (Cotton, Ceconite, Poly-Fibre, etc.) is not approved. Fail-pass criteria for application of the MALTE Tester on ORATEX-Wet® or additionally top coat painted ORATEX® have not (yet) been determined.

## 03 Description

### 03-10 Scope of Delivery



*Figure 1 Scope of delivery ADxC-51-DDP-901, Lanitz-Prena item No 08485*

Item	Designation
1	MALTE Tester
2	Pressure hose
-	This User Manual

## 03-20 Required additional Equipment

In Addition to the MALTE Tester, the following items are necessary.

- Cloth and cleansers to clean the fabric.
- A vacuum pump able to deliver at least 0.7 bar suction. A normal vacuum cleaner will not suffice.
- “290110000 FIXOGUM Rubber Cement Marabu” used as removable sealant.
- A stopwatch or clock to take time for the airtightness test

## 03-30 MALTE Tester

The MALTE Tester is a tool for non-destructive testing of required airworthiness parameters.

The MALTE Tester consists of a

- test head (1)
- deflection indicator (2)
- pressure indicator (3)
- shut-off valve (4)
- adjusting valve (5)



Figure 2 MALTE Tester

## 03-30-01 Test Head

The test head (No 1 in Figure 2) is a vacuum cup to be placed on the fabric.

## 03-30-02 Deflection Indicator

The deflection indicator (No 2 in Figure 2) consists of

- a metal piston with an adjusting screw on the bottom and an indicating ring on the top positioned in the centre of the test head
- an acrylic glass cylinder with a scale showing the deflection of the tested fabric from 0 thru 35 mm located on the top of the test head.

### Calibration

- ▶ Place the test head on a level even surface.
- ▶ Adjust the indicating ring position to match the 0-line by turning the adjusting screw.

## 03-30-03 Pressure Indicator

The pressure indicator (No 3 in Figure 2) is a round gauge showing the pressure inside the test head on a scale of 0 thru -1.0 bar. It is screwed to the test head.

## 03-30-04 Shut-off Valve

The shut-off valve (No 4 in Figure 2) screwed to the test head opens or closes the connection to the vacuum pump. The red handle has two positions:

Position	Function
In line with pressure tube	open
Perpendicular to the pressure tube	close

## 03-30-05 Adjusting Valve

The adjusting valve (No 5 in Figure 2) allows steplessly bypassing the pressure tube by means of the adjusting wheel and thus setting the

desired differential pressure when a vacuum device is connected. It is screwed to the shut-off valve.

Action	Function
Turning the wheel to the right	Increases differential pressure in the test head
Turning the wheel to the left	Decreases differential pressure in the test head

## 03-40 MALTE Tester Working Principle

This tool:

- enables a test of the fabric integration
- includes the ability to determine the elongation of the material for the determination of the stiffness
- provides means to measure the airtightness of the fabric
- applies sufficient tensile load onto the fabric to test for tensile strength

The fabric will be sucked into the tester depending on the stiffness of the material. The measured deflection of the fabric and the correlating pressure is a measure for the stiffness.

The airtightness can be investigated by a vacuum pressure drop test where the tester needs to hold a certain pressure for a determined amount of time.

After application of suction force, the amount of suction the fabric can endure is a criterion for sufficient tensile strength.

## 04 Limitations

### 04-10 Intended Use

The Material Airworthiness Limitation Test Equipment (MALTE Tester) is approved for testing ORATEX 600 (ADxC-51-DDP-002, ADxC-51-DDP-020) and ORATEX 6000 (ADxC-51-DDP-001, ADxC-51-DDP-019), fabric against the criteria outlined in this Manual.

Any other use is not approved and not allowed.

# 05 Inspection and Maintenance

## 05-20 Scheduled Maintenance

Scheduled Inspection	as specified	100h	Annual
Check test head for general condition.			X
Inspect screwed connections and acrylic glass for leaks.			X
Check valves for proper function.			X
Check free movement of deflection indicator			X

## 20 Standard Practices

### 20-10 Testing ORATEX® Fabric

#### 20-10-01 General Considerations

The purpose of the tests is to compare the material characteristics of the installed ORATEX® System that are suspected to be affected by material aging with the material characteristics of the new product. The set of inspection criteria for this test has been derived from the main functions of airplane fabric covering. The fabric covering on an airplane has two major tasks: to form an aerodynamic shape and to distribute aerodynamic loads onto the supporting structure of the aircraft. In principle, the fabric cover needs to satisfy four major requirements:

- sufficient bonding to the structure,
- tensile stiffness to maintain the aerodynamic shape,
- airtightness,
- tensile strength to carry the resulting membrane loads.

#### NOTICE

Any fail/pass criteria or acceptable value stated in the following are for convenience, information given in ADxC-51-AMM-001 limitation chapter 04-10 is binding.

#### NOTICE

Fabric testing with the MALTE tester must be performed on single layer surfaces without additional topcoat, paint or foil stripping. In case of doubt contact ADC.

#### Bonding to Structure

For this criteria, please refer to the ORATEX® application manual ADxC-51-AMM-001 manual chapter 20-55-08.

## Tensile Stiffness

The stiffness is determined by measuring the deflection of the ORATEX<sup>®</sup> fabric when a testing pressure of 0,7 to 0,95 bar is applied with the MALTE Tester. If the deflection is within the limits stated in ORATEX<sup>®</sup> application manual ADxC-51-AMM-001 manual limitation chapter 04-10, then the material is airworthy.

## Airtightness Requirements

Depending on the flight condition, the air pressure at different positions around an air foil varies. To ensure that the differences in pressure cannot equalise, airtightness of the airfoiled surface is required. In this test the decay rate of an applied pressure is used as fail/pass criteria for the airtightness. The following requirement is derived from tests on ORATEX<sup>®</sup> fabric.

- With an initial test pressure differential of 0,7 to 0,95 bar is applied to the fabric. The pressure differential shall not drop faster than 0,1 bar per 60 seconds, when the test setup described below is used.

## Tensile Strength

Aerodynamic loads while flight cause 2-axis tensile (membrane) load on the ORATEX<sup>®</sup> fabric. The ability to withstand this load is essential for airworthiness. To show that the fabric is airworthy, this test applies a pressure to the fabric, that causes a tensile load on the material that is several times higher than any load achievable in flight:

- After application of a specified test pressure on the fabric that is higher than achievable pressure in flight operations, the resulting tensile load shall not cause any irreversible damage to the cover.

## 20-10-02 Procedures

If performed in the order below and placed on the UPPER side of lifting surfaces (UV exposure), the test head can remain on the same place for all four tests.

## Preparations

- ▶ Ensure deflection indicator calibration is done.
- ▶ Prepare ORATEX MALTE Test Reporting Form

The following steps must be performed prior to each specific test:

- ▶ Clean fabric if necessary.
- ▶ Ensure adjusting valve is open.
- ▶ Ensure shut-off valve is open.
- ▶ Connect the MALTE Tester to a conventional vacuum device.
- ▶ Apply a layer of sealing Fixogum 290110000 on the bottom face of the test head, make sure it is homogenous apply in order to ensure proper sealing for testing.



*Figure 3 Application of Fixogum*

**⚠ CAUTION**

Vacuum forces can cause injuries.

- ▶ Do not touch nor get closed to openings of suction lines.

All three tests can be executed in one time following this procedure. The tests must be repeated at least on 3 different unsupported fields per wing side, on at least 2 locations on fuselage upper surface, on at least 1 unsupported field per stabilizer side and on each control surface top side, both sides for rudder.

- ▶ Prepare sufficient copies of the reporting form (chapter 20-10-02)
- ▶ Place the MALTE tester to an area of ORATEX®, where the cover is not in contact with the structure on the UPPER side of lifting surfaces (UV

exposure). The test head must be placed in the center of a fabric field between ribs.



*Figure 4 Positioning of test head*

- ▶ Switch on the vacuum device and set the differential pressure to 0,7 to 0,95 bar using the adjusting valve.
- ▶ Read the deflection of the fabric on the deflection indicator. Note the deflection and pressure in the report form.



*Figure 5 Reading of the deflection*

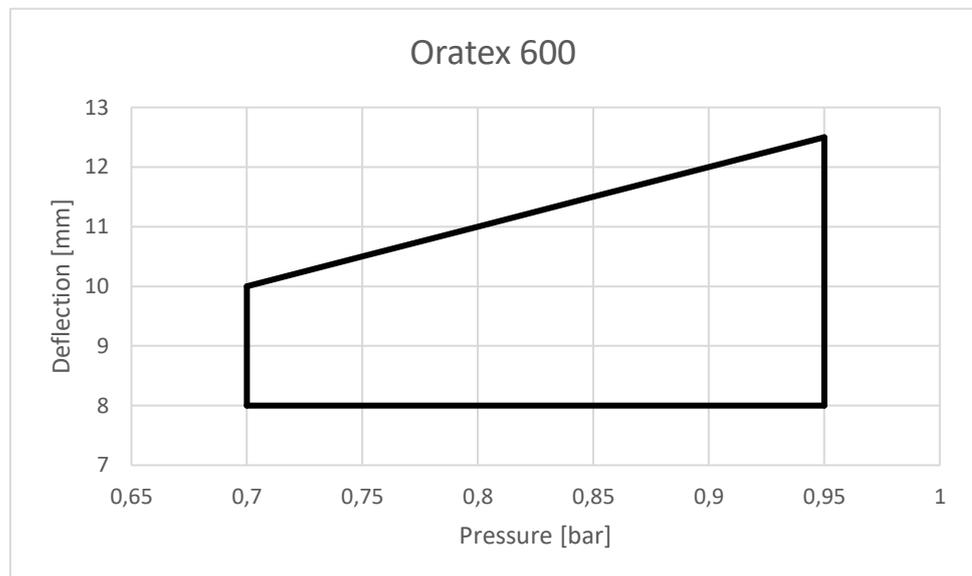
- ▶ Close the tester's shut-off valve and start the timer.
- ▶ Open the adjusting valve.

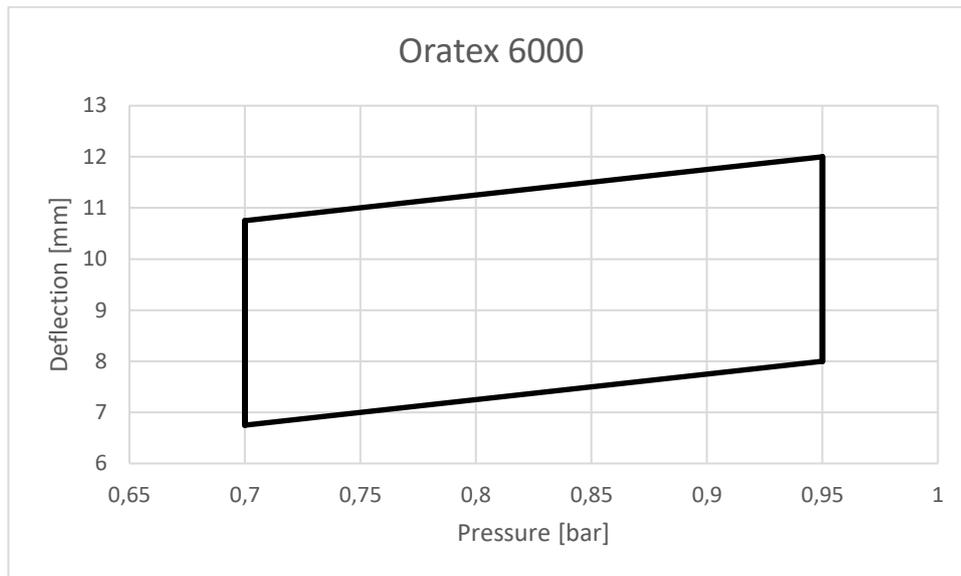
- ▶ Read the pressure indicator on the tester, note time and pressure on the test report form. After at least 120 seconds, read pressure again and note pressure and time on the test report form.
- ▶ Relieve the vacuum with the shut-off valve and remove the MALTE Tester.
- ▶ Inspect the fabric for visible or irreversible damage, note the observation on the report form. (cf. Tensile Strength damage process)
- ▶ Clean fabric from sealing residuals.

### Tensile Stiffness Test

- ▶ Readings must be within the following limits.

	ORATEX 600		ORATEX 6000	
Pressure	0,7 bar	0,95 bar	0,7 bar	0,95 bar
Minimal deflection	8 mm	10 mm	6,75 mm	8,5 mm
Maximal deflection	10 mm	12 mm	10,75 mm	12 mm





- ▶ If readings exceed limits, contact ADC.

### Airtightness Test

- ▶ Read the pressure indicator on the tester, note time and pressure on the test report form. After at least 120 seconds, read pressure again and note pressure and time on the test report form. Decay must not be faster than 0,1 bar per 60 seconds.
- ▶ If decay is faster, contact ADC.

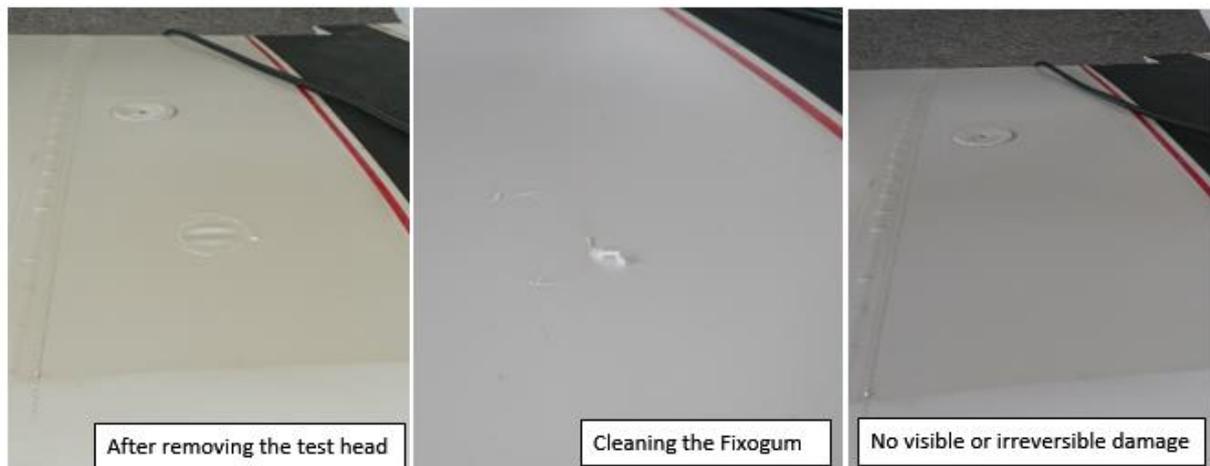
#### NOTE

If exceeded decay due to insufficient sealing is suspected, repetition of tests are permissible

### Tensile Strength Test

- ▶ Inspect the fabric for visible damage, thick the observation on the report form.

The test is pass if there is no visible or irreversible damage of the fabric after the test.



*Figure 6 Evolution of Tensile Strength test*

- ▶ If visible damage to the fabric is detected, mark fabric field for later repair as per ORATEX Application Manual ADxC-51-AMM-001. Contact ADC.

### After Testing

Immediately after pressure/tester removal wrinkles and dents are always visible. They do disappear over time with the time needed being dependent on temperature. The time to (visually) disappear should not exceed 60 seconds at normal hangar temperatures (15–20°C).

- ▶ If the time is exceeded then first perform a re-tensioning by application of heat equal to the “second pass” as described in ORATEX Application Manual Chapter 20-55-05 with an iron temperature set to 120 °C.
- ▶ Then repeat the test at the same location.

If the wrinkles/dents still take too much time to disappear the test is failed.

- ▶ Mark affected fabric field for later repair as per ORATEX Application Manual. Contact ADC.
- ▶ If the 60 seconds are exceeded, perform a re-tensioning of the entire fabric cover prior release to service. Follow the “second pass”

procedure as described in ORATEX Application Manual Chapter 20-55-05 with an iron temperature set to 120 °C.

- ▶ If the test has been passed, the test report form(s) may become part of the continuing airworthiness documentation of the aircraft.
- ▶ If the test failed, contact ADC with the test report form.

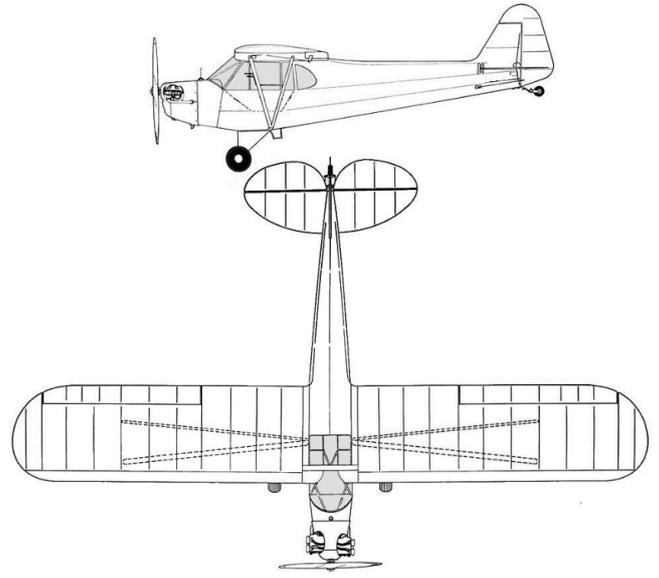
**NOTE**

Sending the filled form to ADC in any case (mail to [STC@aircraftdc.de](mailto:STC@aircraftdc.de)) is appreciated and helps for fleet data gathering.

## 20-10-03 MALTE Test Report Form

This Test Report Form should be used for continuing airworthiness documentation and contacting ADC in case of failed test.

Test Data (page .....of.....)	
Date	
Performed by	
Contact	
Aircraft Data	
Type	
Registration	
Serial Number	
ORATEX installation date	
Flight time since installation	
Landings since installation	



Mark all damages and the each test head location

Test Protocol						
Test N°	0 (example)					
Deflection Test						
Pressure	0,8 bar					
Deflection	11 mm					
Within Limits	Yes					
Pressure Decay						
Time	10:35:00					
Pressure	0,8 bar					
Time	10:37:30					
Pressure	0,65 bar					
Decay Rate	0,06 bar/min					
Within Limits	Yes					
Damage Inspection						
Visible damage	No					
Irreversible damage	No					
Conclusion						
Test Passed	Yes					