Ultrasonic Thickness Testing of Acrylic Aircraft Windows Using the Olympus 45MG

Introduction

Aircraft windows make air travel exciting. Seeing the world from 35,000 feet in the air is amazing. Most importantly acrylic transparencies perform the important function of providing a protective boundary between the harsh outside environment and the comfortable cabin. They keep us safe while we enjoy the view.

These windows can become scratched or worn over time. Scratches can be polished-out but there is a limit to how thin an aircraft window can be polished.

In this event you will learn how to determine how thin an aircraft window is by using a nondestructive test method (NDT) called Ultrasonic Thickness Testing using the Olympus 45MG ultrasonic thickness gage.

Outline of Ultrasonic Thickness Test Event

There will be two primary tasks conducted in this event.

1. Perform an instrument calibration.
2. Perform thickness measurements on sample acrylic aircraft window panels.

Perform Calibration:

1. Identify the 3 calibration coupons in the 45MG kit, note the thicknesses.
2. Follow the instrument calibration instructions as shown in the Calibration Procedure for the 45MG Ultrasonic Thickness Gage provided.
3. Re-calibrate if results are not as defined in the calibration procedure.
4. Record calibration readings obtained for each coupon on the Instrument Calibration Worksheet provided. Write clearly.

Perform Measurements:

1. Identify the 3 acrylic window panel samples for measuring.
2. Locate the 5 measuring areas marked on each panel.
3. Take a thickness reading at each of the 5 measurement areas per panel.
4. Record thickness measurements for each panel on the Panel Measurement Worksheet provided. Write clearly.
5. Identify and decide which panel is the thinnest.
6. Record your decision on the Panel Measurement Worksheet provided. Write clearly.

Calibration Procedure for the Olympus 45MG Ultrasonic Thickness Gage

The 45MG must be calibrated to ensure the thickness measurement accuracy for the transducer and the tested material being used. This is archived by performing the velocity and zero calibrations on two known thicknesses of a test block made from the same material as the inspected part.

INSTRUCTIONS

1. Familiarize yourself with the 45MG instrument and kit contents.
    a. 45MG Ultrasonic thickness gage
    b. Transducer probe
    c. Couplant
    d. Calibration coupons (3).

2. Locate transducer probe and attach it to the 45MG Transmit/Receive transducer connector number 1. at the top of the unit. T/R 1.

3. Power-up the 45MG by depressing the green Power Button 

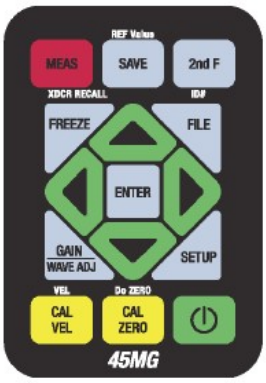

Fig. 2

3) Wait approx. 15 seconds for the unit to completely power-up. You will see the screen display as shown in Fig 3. At that point the 45MG is ready to proceed with calibration.

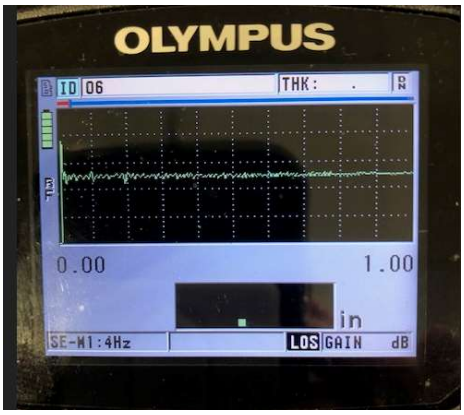

Fig. 3

4) Once powered-up, press the 2nd Function button 

5) Then press the FREEZE button 

.

6) The 45MG will then display the transducer category list as shown in Fig. 4.

Fig. 4

7) Use the arrow keys to highlight Custom Single Element and press the ENTER key 

.

8) The 45MG then displays the setup list of transducers as shown in Fig. 5.

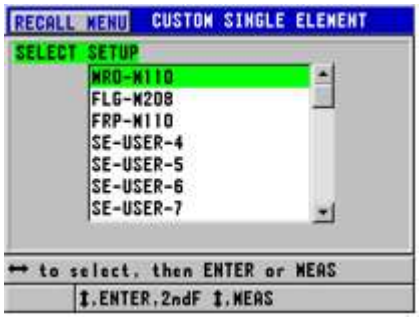

Fig. 5

9) Use the arrow keys to highlight "MRO-M110" and press the MEAS key 

.

10) Put a small drop of couplant in the circled area on the thickest calibration coupon, then COUPLE the transducer by squarely placing the pink sensor side of the transducer onto the acrylic coupon. The 45MG will display a thickness value.

10) While holding a steady reading press the CAL VER key 

11) Then press the ENTER key 

12) UN-COUPLE the transducer by lifting it off the coupon and use the [Up, Down, Left and Right] arrow keys on the 45MG to enter the know thickness of the calibration coupon.

13) Put a small drop of couplant in the circled area on the thinnest calibration coupon, then COUPLE the transducer by squarely placing the pink SENSOR side of the transducer onto the acrylic coupon.

14)Press the CAL ZERO key 

The 45MG will display a thickness value.

15) While holding a steady reading press the ENTER key 

.

16) Uncouple the transducer from the test piece and use the arrow keys [Up, Down, Left and Right] to enter the know thickness of the calibration coupon.

17) Press the red MEAS key 

to complete the calibration.

VERIFY THE CALIBRATION

1. Verify the calibration by putting a small drop of couplant in the circled area on all three of the calibration coupons.

2. Couple the transducer in the circled area and note the thickness value on the display.

3. Calibration readings should read within +/- 0.004 inches of the known thickness printed on the coupons.

4. If the thickness values are not within specification, power the 45MG off by pressing the POWER key  and repeat the calibration procedure.

DOCUMENT THE RESULTS

1. Record the 3 calibration results on the Instrument Calibration Worksheet.

Once correct calibration is achieved, and results recorded, you may proceed to the Panel Measurement Exercise. Locate the 3 panels and the Panel Measurement Worksheet. Follow the instructions.

Ultrasonic Thickness Testing of Acrylic Aircraft Windows Using the Olympus 45MG

INSTRUMENT CALIBRATION WORKSHEET

Enter team name: _____

Circle your work station: A or B

Enter your calibration readings below:

Thickest coupon calibration reading: _____

Mid-thickness coupon calibration reading: _____

Thinnest coupon calibration reading: _____

Ultrasonic Thickness Testing of Acrylic Aircraft Windows Using the Olympus 45MG

PANEL MEASUREMENT WORKSHEET

Enter your team name: _____

Circle your workstation: A or B

1. Apply a small drop of couplant to each of the five measuring areas on the panels.
2. Couple the transducer to each measurement area.
3. Obtain thickness readings for each area using the 45MG.
4. Use this table to enter the thickness measurements taken from the 3 acrylic panels.
5. Place a checkmark in the box for Thinnest panel.

Panel 1 Thickness Readings	Panel 2 Thickness Readings	Panel 3 Thickness Readings
Area 1.	Area 1.	Area 1.
Area 2.	Area 2.	Area 2.
Area 3.	Area 3.	Area 3.
Area 4.	Area 4.	Area 4.
Area 5.	Area 5.	Area 5.
Thinnest: _____	Thinnest: _____	Thinnest: _____