SERVICE BULLETIN NUMBER 148 issue 1.1

TITLE	Rohacell shrinkage.
CLASSIFICATION	P&M Aviation have classified this service bulletin as essential.
COMPLIANCE	Inspection at Permit revalidation or within next 25 hours, whichever is less.
APPLICABILITY	All Flight Design CT2K, CTSW manufactured up to serial no. 8435 (Flight Design D-08-06-07) inclusive (March 2008). Wings, stabilator,control surfaces, undercarriage fairings.

BM72 Issue 1 Flight Design CTSW

BM65 Issue 6 Flight Design CT2K

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REVISION HISTORY

Issue	Date	Changes
1	9/4/18	Initial issue

1. INTRODUCTION

General:

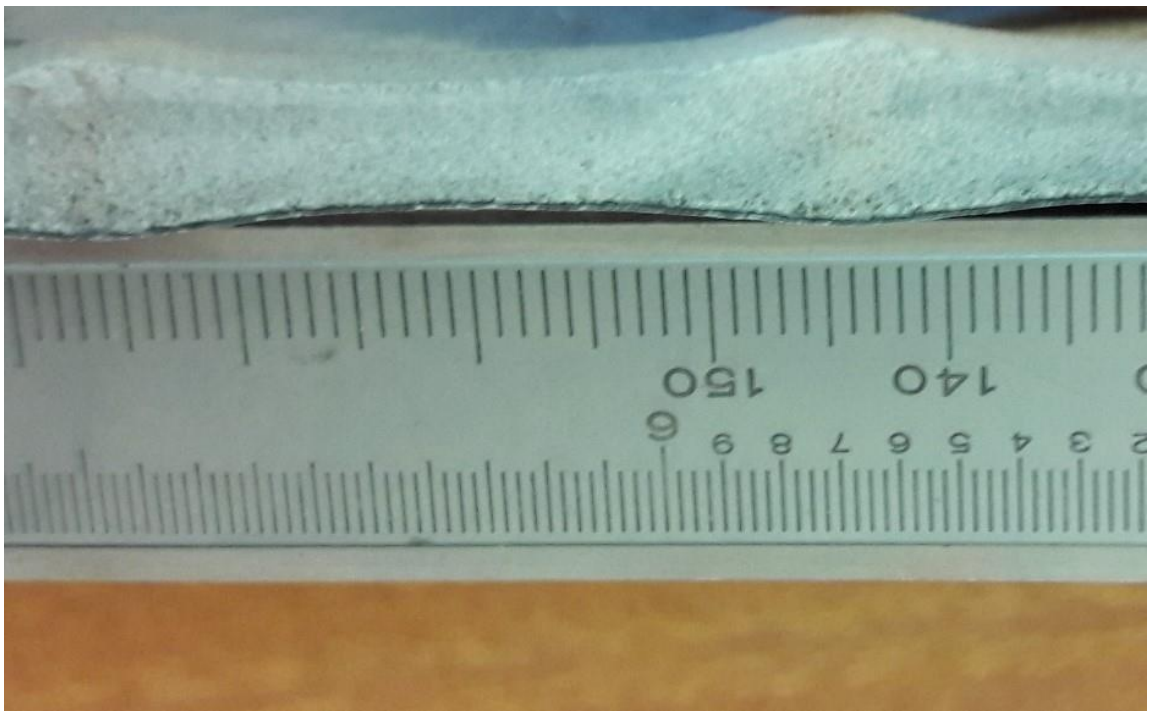
The affected CT2K and CTSW aircraft were manufactured with Rohacell polymethacrylimide (PMI) foam as a sandwich core in all areas except the fuselage and fin, which due to the compound curves has always used Airex PVC foam. Rohacell was used everywhere else because when dry it has excellent mechanical properties at minimum weight.

Aircraft manufactured after March 2008 were built with Airex foam for the wings and stabiliser, this SB does not apply.

Moisture, alkaline solutions and Rohacell:

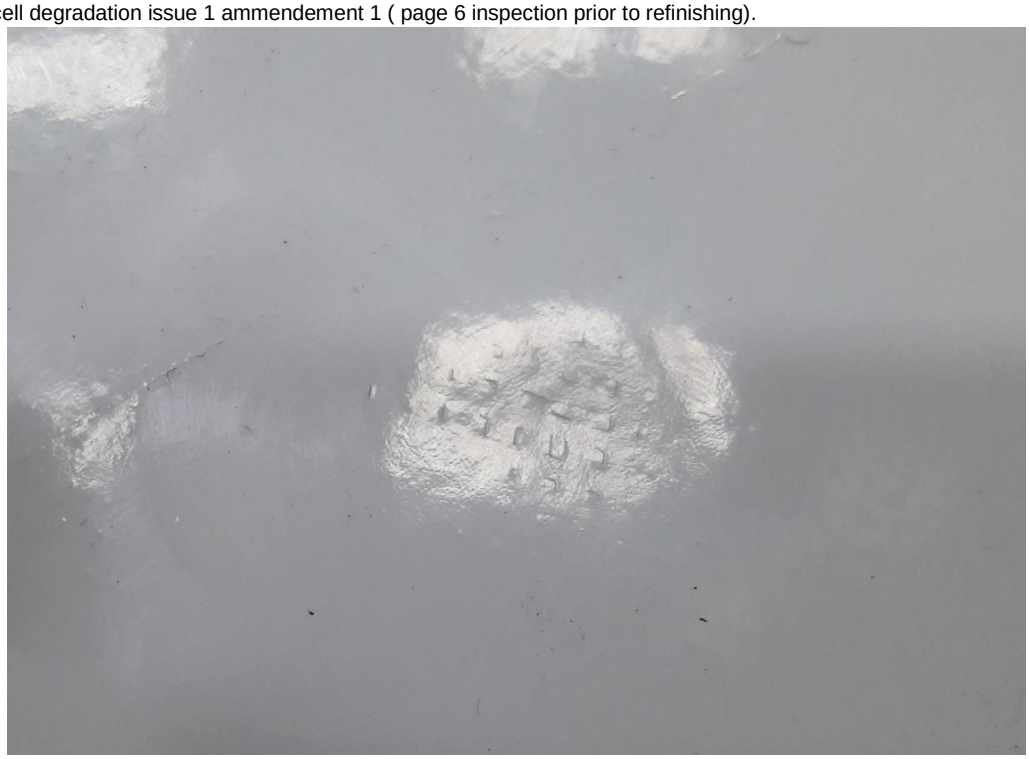
Despite being a closed cell construction, the presence of excess moisture causes Rohacell foam to shrink and at high concentrations, to become flexible. The foam is especially subject to degradation by alkaline solutions, a PH greater than 8 (e.g. washing up liquid) will damage it. The problem is often worse on the most lightly loaded structure e.g. stabilator, control surfaces, door, ventral fin because of the very thin skins. The process can take years to become evident. *Therefore it is vital to keep the aircraft as dry as possible and use correct washing materials.*

In general, the foam shrinks and the thin skin remains attached to the foam. A coin tap test will reveal if the skin is attached (high pitched ring) or delaminated (dull tap). Drying saturated foam will not eradicate the shrink marks, but will reduce it's weight and restore stiffness.



Severely damaged scrapped 8mm thick CT2K floor panel, 1mm deep shrinkage each side in 30mm. Was outside in the open for several years.

SB 148 Rohacell degradation issue 1 ammendement 1 (page 6 inspection prior to refinishing).



Shrunken area starting from porosity on a wing top surface, note fibre weave pattern.

Dimpled wing skin top surface, 0.3mm deep over 40mm, possible to refinish.

SB 148 Rohacell degradation issue 1 ammendement 1 (page 6 inspection prior to refinishing).

Shrinkage on the root of an aileron

Shrinkage can best be seen by an opaque straight edge, depth can be measured by feeler gauge. This is on the root area of the aileron shown above.

SB 148 Rohacell degradation issue 1 ammendement 1 (page 6 inspection prior to refinishing).

Shrinkage

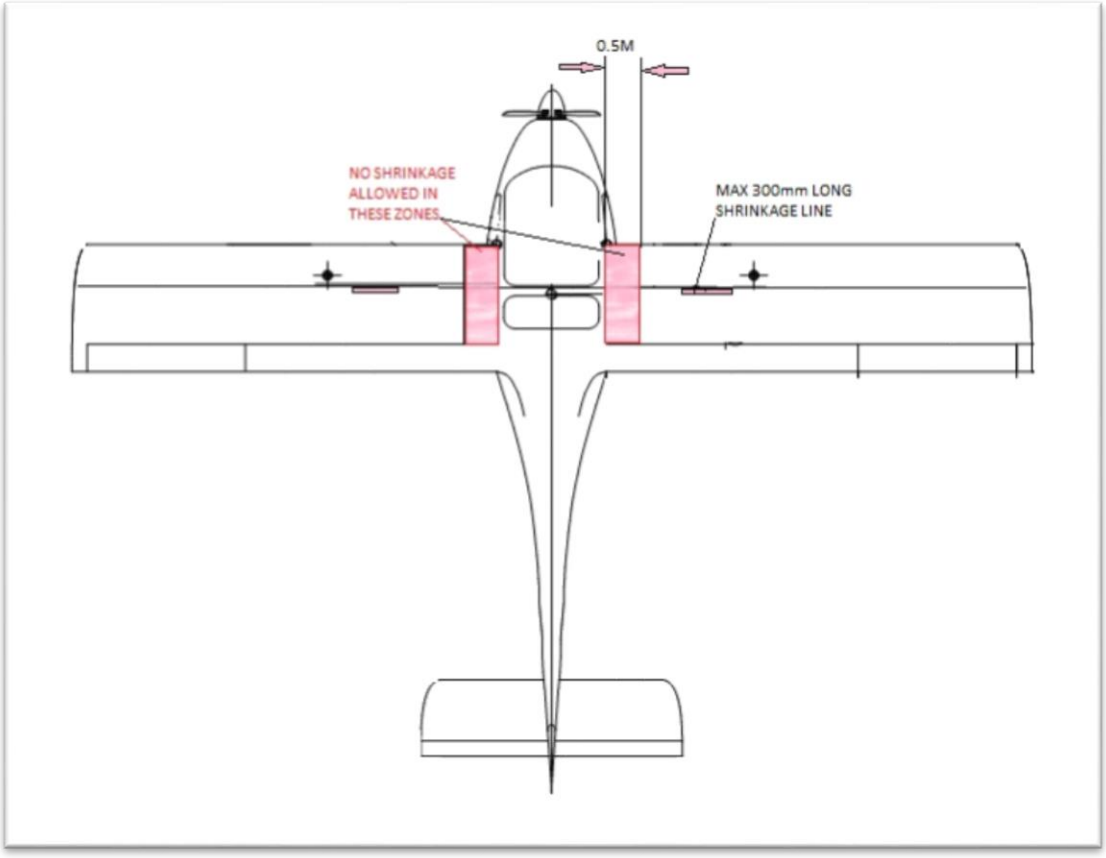
Inspection pass/fail criteria:

During manufacture, the foam panels are “needled” by holes at approximately 40mm pitch to expel air. These holes form resin rich areas which do not tend to shrink. Joints between foam panels also tend to form resin rich areas. Light witness marks from these areas (less than 0.1mm deep or protruding) are normal.

Localised shrunken areas less than 75mm diameter and 1mm deep, typically around areas of porous finish are generally a cosmetic concern only, provided they are at least 0.5m outboard of the wing roots. The aerofoil used is designed for laminar flow but is also quite tolerant of imperfections. See drawing.

Shrinkage along a continuous line greater than 300mm long is not acceptable.

In severe cases it will be plainly obvious that bending stiffness has been lost (panel bends easily under finger pressure compared to undamaged areas) or that the panel has delaminated (producing a dull note on a coin tap test) or that the dimple exceeds the maximum dimensions. In these cases a structural repair scheme will be necessary or the part be scrapped. Shrinkage on the door skins and ventral fin is considered cosmetic.



No shrinkage allowed within + 0.5m outboard of wing roots. Max linear shrinkage 300mm anywhere on structure.

Refinishing:

Before commencing work, the parts must be inspected, weighed and the extent of damage recorded. Refinishing must be carried out by P&M Aviation. Spares must also be provided by P&M Aviation.

Refinishing the panels adds weight but will restore the aerodynamic profile and slow down or stop the degradation by sealing off porous skin areas from moisture ingress.

The surface has to be abraded prior to filling. The parts should be dried out as much as possible till the weight stabilises. Abrasion should be carried out with great care, preferably manually, as it is very easy to go through the thin skin. On aramid surfaces, abrasion also causes fluffing which is difficult to eradicate.

Chemical paint strippers must NOT be used!

Prepared surfaces must be dried, degreased and free of dust. Shrinkage zones must be filled with a low density epoxy/microballoon filler and sanded to profile. Finally a 2 pack acrylic primer/surfacer should be applied and flatted off, followed by the top coat. The correct original colour is RAL 9016 white, top surfaces must be predominantly white to keep the surface temperature as low as possible in the sun.

After refinishing, the aircraft should be weighed and the CG determined. Tolerances on the mass and balance of the control surfaces must also be respected including the complete stabilator.

MASS AND STATIC MOMENT INCLUDING MASS BALANCE	**CT2K**	**CTSW**	**NOTES NB +VE MOMENT = TRAILING EDGE HEAVY**
FLAP MASS	3.5-4.3kg	3.5-4.3kg	
FLAP MOMENT	120-160Ncm	120-160Ncm	
AILERON MASS	2.3-2.8kg	2.3-2.8kg	
AILERON MOMENT	35-75Ncm	35-75Ncm	
STABILATOR AND TAB MASS	10-12.4kg	5.2-8.9kg	
STABILATOR AND TAB MOMENT	0-150Ncm	0-(-610) Ncm	NB Recommended to balance the stabilator, tab and mass balance together.
RUDDER MASS	1.7-2.2kg	1.75-2.05kg	
RUDDER MOMENT	30-70Ncm	80-135Ncm	
ELEVATOR TAB ONLY MASS	0.56-0.70kg	1.05-1.3kg	
ELEVATOR TAB ONLY MOMENT	10-18Ncm	25-35Ncm	

2. ACTION

Within the next 25 hours, inspect the surfaces as described above.

If there is shrinkage but within the acceptable limits, the aircraft must be re-inspected at least at each permit revalidation.

If outside the acceptable inspection criteria, the part must be replaced or consult P&M Aviation for a repair scheme.

Refinishing will seal off the porous areas, slowing or eliminating further deterioration. Components should preferably be weighed before and after refinishing. A new weight and balance report must be carried out on completion of the work. Refinishing control surfaces will require their weight and static moment to be checked before and after repair, so they remain within established limits for prevention of flutter. Because of the mass and balance constraints it may be more practical to replace control surfaces rather than refinish.

3. CONTINUED AIRWORTHINESS

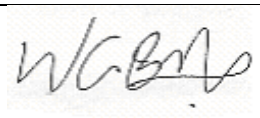
Continue to monitor the surfaces at least at each Permit revalidation for continuing degradation.

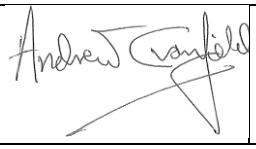
Aircraft built with Rohacell should be kept as dry as possible. Washing should be done with Ph neutral solutions (Ph < 8), e.g. Autoglym shampoo or by dry-washing e.g. Sky-SE1 Drywash.

4. DOCUMENTATION

The aircraft logbook must be signed to show it has been inspected according to SB 148. A copy of this SB should be kept with the aircraft operator's handbook.

ISSUED BY W.G.Brooks DATE

Approved		Date 10/04/18

Checked		Date 10/04/18

Some frequently asked questions (FAQ).

How does moisture get in?

The skins of the CT aircraft are very thin, typically 0.1 – 0.2mm and the paint finish is also thin. The carbon and aramid fabrics also have gaps in the weave. It is typical to see a shrunken area with pinholes in the finish at the centre. Changes in temperature draws the moisture in, allowing the foam to shrink.

The edges of the sandwich panels may also have voids which enables moisture to track along a line, which can be a serious defect if it happens along the edge of a spar, for example.

What is the purpose of the sandwich core?

The sandwich core:

a) Supports the thin faceplates against buckling and wrinkling in compression and shear.
b) Separates the faceplates, so giving high strength and stiffness for the panel at low weight.
c) Carries shear loads between the faceplates.

Why use sandwich construction?

Sandwich panel construction is popular because it enables a smooth aerodynamic surface with the possibility of low drag laminar flow. It also reduces the number of ribs and stiffeners required to stabilise the structure against buckling. Although the sandwich panels are more complex to produce, the low parts count reduces overall cost of manufacture.

Why use Rohacell?

Rohacell foam has very good specific stiffness and strength properties. Weight control is vital to keep the aircraft within the microlight category and to provide high performance. Airex and other PVC foams are heavier and less stiff but have better impact properties.