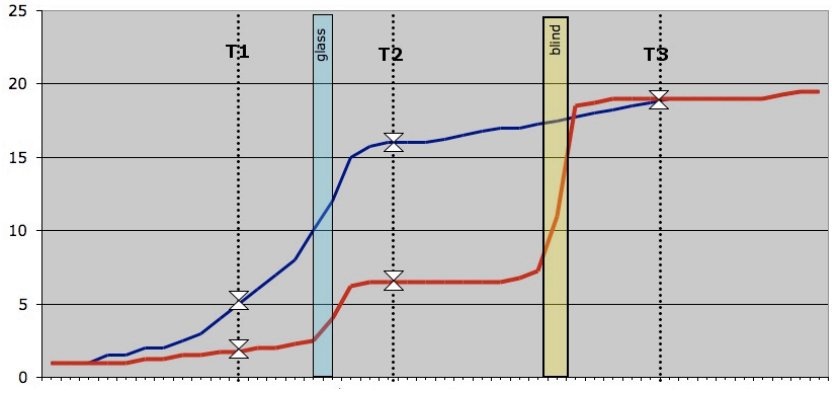
the thermal blind co.



testing - the thermal blinds in action

report of tests undertaken in December 2010

Katy Duke BSc BArch, The Thermal Blind Company

info@thermalblind.co.uk 07791 550568

Thermal Roman Blinds in Action by The Thermal Blind Company

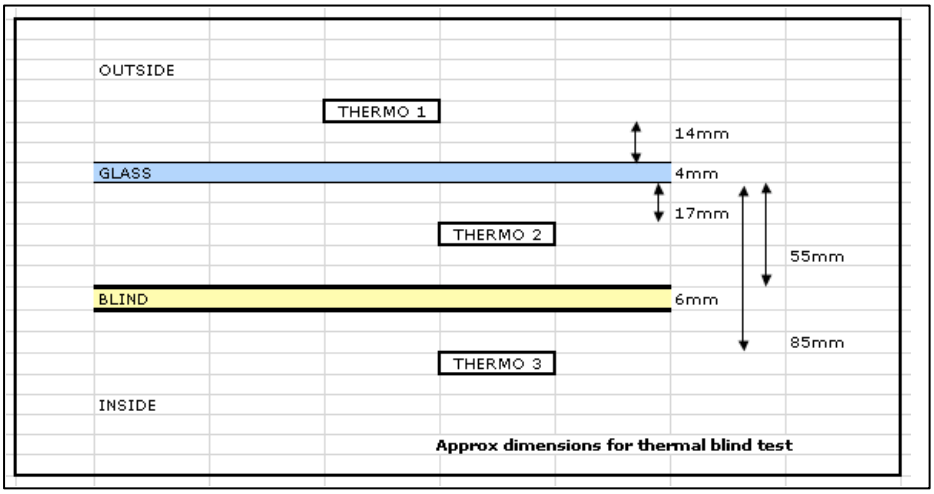
Testing the performance of the prototype blind - revision 3 (company info added)

Performance tests were undertaken on a thermal roman blind fitted to a typical Victorian sash window with its lower leaf fixed, upper leaf sliding, ∴ some air infiltration, standard clear float glass c. 4mm thick.

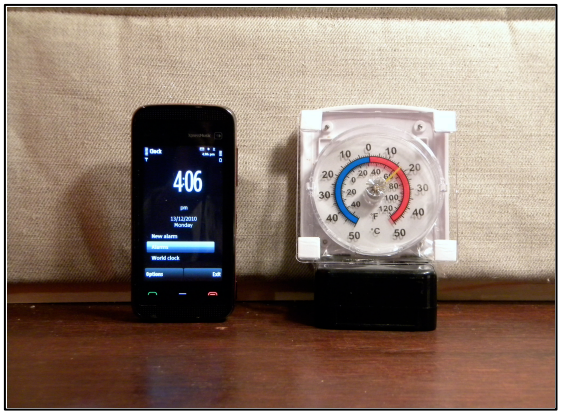
Roman Blind – hand-stitched traditional roman blind with five layers;
1. Inner fabric – linen cotton mix fabric. (NB. Now using 100% polyester for blinds)
2. 12mic Aluminised Mylar MET813 (space blanket), HiFi Industrial Film
3. 7mm C100 Thinsulate, 'Clo' value of circa 1.1, by 3M.
4. 12mic Aluminised Mylar MET813
5. Cotton sateen lining fabric (with wooden slats, traditional rings & thread pull cords). NB. Now using proprietary chain-pull system to avoid trailing cords).

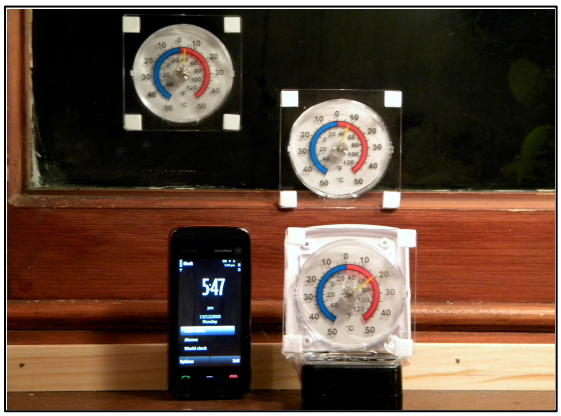
When the blind is drawn down it is secured to the timber window frame magnets at approx. 200mm c/s using N42 NdFeB + NiCuNi. Temperatures taken using simple thermometers – stick-on window type, all identical & calibrated to show same internal temp before commencement.

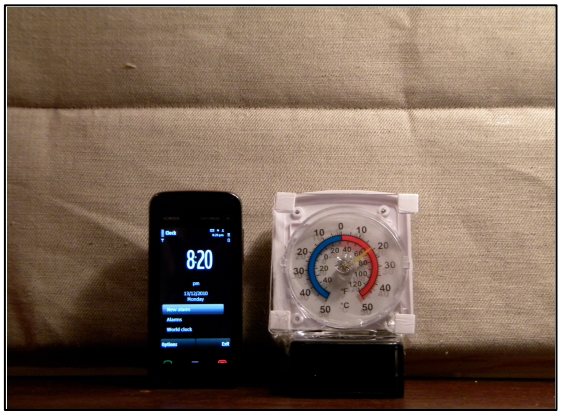
Plan of testing equipment

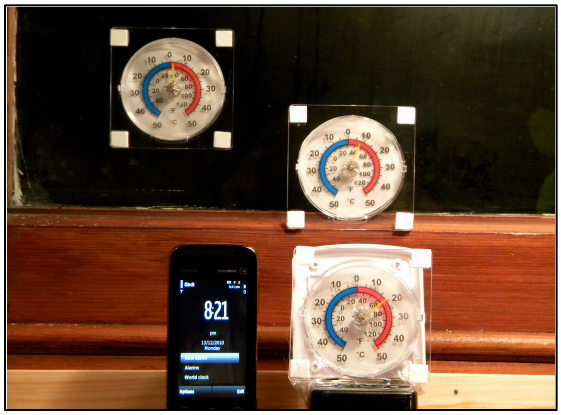


General view of test









Test photos

Showing a selection of the measured temperature readings over the 6 hour test– NB. Photos available for all bold figures in chart. The photos for the ‘blind down’ temperatures were taken by briefly raising the blind before closing it as quickly as possible.

Test data – NB **Bold** figures are the measured temperatures, regular figures are interpolated. The test commenced at 15:20 & ended at 21:15 on 13th December 2010. The external temperature was dropping & internal temperature rising (CH set at 19˚C from 16:00). For illustrative purposes the blind up/down was graphed as two figures.

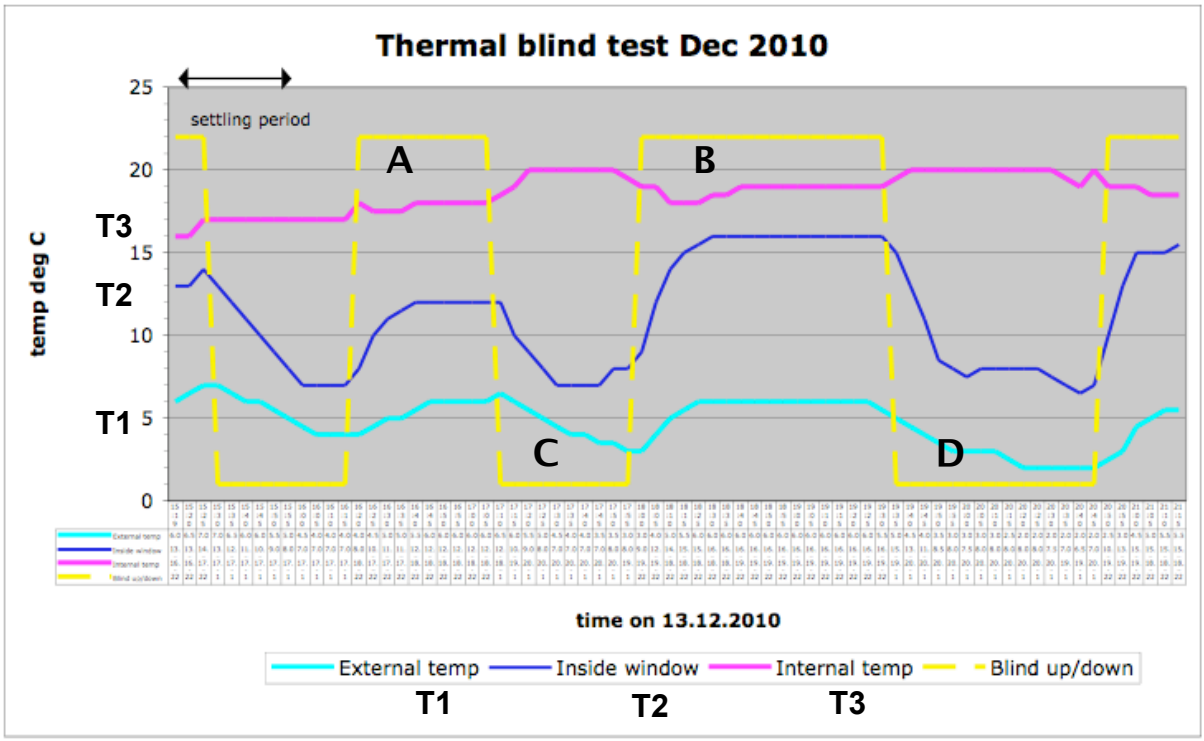
Test data, 13.12.2010

TIME	External temp	Inside window	Internal temp	Blind up/down
15:19	**6.0**	**13.0**	**16.0**	22
15:20	6.5	13.0	16.0	22
15:25	**7.0**	**14.0**	**17.0**	22
15:30	7.0	13.0	17.0	1
15:35	6.5	12.0	17.0	1
15:40	6.0	11.0	17.0	1
15:45	6.0	10.0	17.0	1
15:50	5.5	9.0	17.0	1
15:55	5.0	8.0	17.0	1
16:00	4.5	7.0	17.0	1
16:05	**4.0**	**7.0**	**17.0**	1
16:10	4.0	7.0	17.0	1
16:15	4.0	7.0	17.0	1
16:20	**4.0**	**8.0**	**18.0**	22
16:25	4.5	10.0	17.5	22
16:30	**5.0**	**11.0**	**17.5**	22
16:35	5.0	11.5	17.5	22
16:40	5.5	12.0	18.0	22
16:45	**6.0**	**12.0**	**18.0**	22
16:50	6.0	12.0	18.0	22
16:55	6.0	12.0	18.0	22
17:00	**6.0**	**12.0**	**18.0**	22
17:05	6.0	12.0	18.0	22
17:10	**6.5**	**12.0**	**18.5**	1
17:15	6.0	10.0	19.0	1
17:20	**5.5**	**9.0**	**20.0**	1
17:25	5.0	8.0	20.0	1
17:30	4.5	7.0	20.0	1
17:35	**4.0**	**7.0**	**20.0**	1
17:40	4.0	7.0	20.0	1
17:45	3.5	7.0	20.0	1
17:50	**3.5**	**8.0**	**20.0**	1
17:55	3.0	8.0	19.5	1
18:00	**3.0**	**9.0**	**19.0**	22
18:05	**4.0**	**12.0**	**19.0**	22
18:10	**5.0**	**14.0**	**18.0**	22
18:15	5.5	15.0	18.0	22
18:25	**6.0**	**15.5**	**18.0**	22
18:30	6.0	16.0	18.5	22
18:35	6.0	16.0	18.5	22
18:40	**6.0**	**16.0**	**19.0**	22
18:45	6.0	16.0	19.0	22
18:50	**6.0**	**16.0**	**19.0**	22
18:55	6.0	16.0	19.0	22
19:00	6.0	16.0	19.0	22
19:05	6.0	16.0	19.0	22
19:10	6.0	16.0	19.0	22
19:15	6.0	16.0	19.0	22
19:20	6.0	16.0	19.0	22
19:25	6.0	16.0	19.0	22
19:30	**5.5**	**16.0**	**19.0**	22
19:35	5.0	15.0	19.5	1
19:40	4.5	13.0	20.0	1
19:45	4.0	11.0	20.0	1
19:50	3.5	8.5	20.0	1
19:55	3.0	8.0	20.0	1
20:00	**3.0**	**7.5**	**20.0**	1
20:05	3.0	8.0	20.0	1
20:10	3.0	8.0	20.0	1
20:15	2.5	8.0	20.0	1
20:20	**2.0**	**8.0**	**20.0**	1
20:25	2.0	8.0	20.0	1
20:30	2.0	7.5	20.0	1
20:35	2.0	7.0	19.5	1
20:40	**2.0**	**6.5**	**19.0**	1
20:45	**2.0**	**7.0**	**20.0**	1
20:50	2.5	10.0	19.0	22
20:55	**3.0**	**13.0**	**19.0**	22
21:00	**4.5**	**15.0**	**19.0**	22
21:05	**5.0**	**15.0**	**18.5**	22
21:10	5.5	15.0	18.5	22
21:15	**6.5**	**15.5**	**18.5**	22

BOLD figures are measured temperatures

Graphed data

Shows the test results graphed for temperature against time for the three thermometer positions, plus the blind positions over time (yellow).



Note
Measurement commenced with an ambient external temperature of approx. 4˚C, dropping to 2˚C. Internal temperature starts at 17˚C, rising to 20˚C (CH on at c 4pm).

Results show;

A. Steady state temperatures reached during **first 'up' period** of blind (ie. no blind in place) as the following readings;

External rising 4˚C to 6˚C
Between blind & glass c. 12˚C
Internal 18˚C

B. Steady state for **second 'up' period** of blind at approx;

External steady 6˚C
Between blind & glass c 16˚C
Internal 19˚C

C. Results show steady state reached during **second 'down' period** of blind as following;

External dropping 6˚C to 3˚C
Between blind & glass c 7˚C
Internal 20˚C

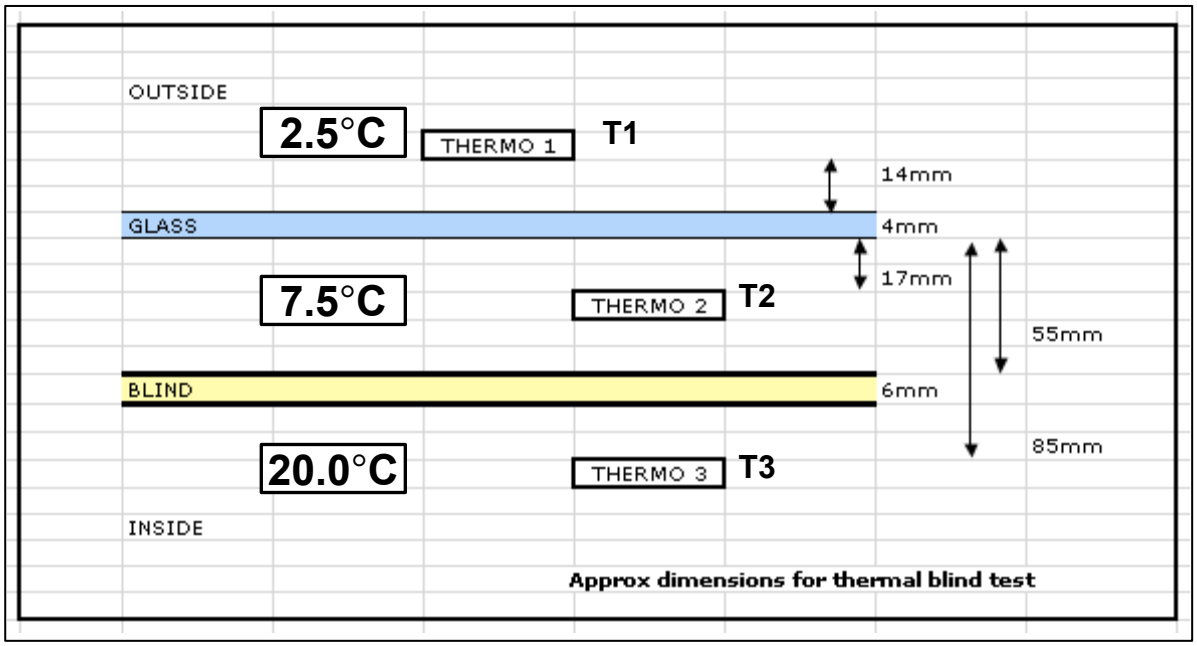
D. Steady state for **third 'down' period of blind;**

External dropping 5˚C to 2˚C
Between blind & glass c 7˚C
Internal 20˚C

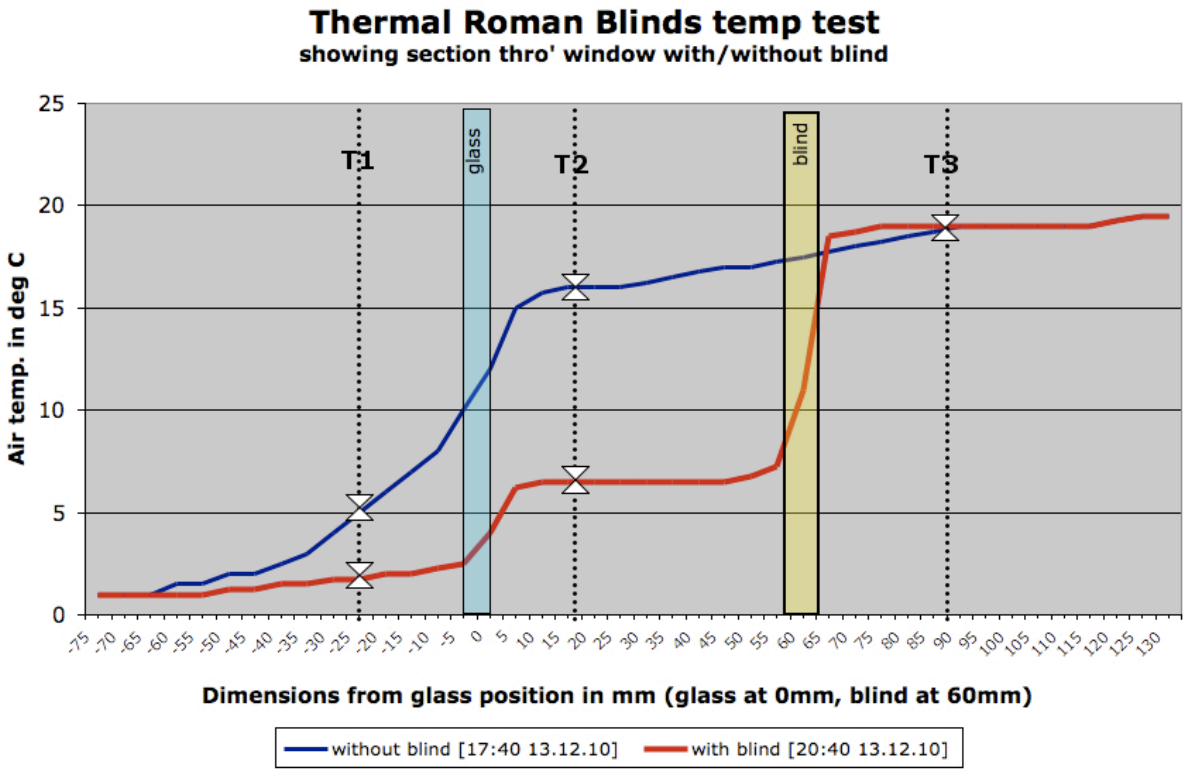
Results show

1. With no blind in place the external temperature at 14mm from outside surface of the glass rises significantly from ambient (by about **3˚C**).
2. With no blind in place temperatures just inside the glass (17mm) are generally between 6 - 10˚C warmer than ambient external temperatures, but NB 2˚C internal temp difference between two periods. Average temp. inside the glass was **8.0˚C**.
3. With no blind in place temperatures just inside the glass (17mm) are generally between 3 - 6˚C cooler than ambient internal. Note that first 'up' period is relatively short. Mean is **4.0˚C** cooler than ambient internal temperature.
4. With the blind in place temperatures just inside the glass (17mm) are generally between 3 - 5˚C warmer than ambient external temperature. Average. 4˚C warmer than external.
5. With the blind in place temperatures just inside the glass (17mm) are generally around **12.5˚C** cooler than ambient internal temperature (20˚C). This gives an indication of the performance of the blind & from this an assumed U-Value can be calculated.

Steady state temperatures for third 'down' period



Plan of window showing thermometer positions



Section through window showing temperature profiles

Conclusions

The blinds prevent a significant heat loss through the window glass & improve the comfort levels (and downdraft) close to the window, internally. From this a guide U-Value of the blinds can be ascertained. Ultimately the approximate heating cost savings and payback period for the blinds can be estimated.

A rudimentary calculation for an estimate of the u-value of the blind and window together is;

U = 4.8 (av. u-value of single-glazed window) x (T, blind down - T, air)/(T, blind up - T, air)

U-value (blind & window) = **1.8 to 2.0** W/m^2K (depending on internal temp at 16˚C [close to glass] or 19˚C [room temp.])

NB. The average U-value of a typical double glazed window is 3.1W/m^2/K for 6mm gap or 2.8 for 12mm gap (SAP 2005)

The National Physics Lab test will confirm the U-Value of the blinds.

Appendix A – technical data & links

Blind fabrics

1. Inner fabric – 100% polyester or 85% poly/15% cotton mix, H&S Fabrics / Prestigious Textiles.
2. 12mic Aluminised Mylar MET813 (space blanket), HiFi Industrial Film
3. 7mm C100 Thinsulate, manufacturer 3M, 'Clo' value of circa 1.1
4. 12micron Aluminised Mylar MET813
5. Cotton sateen lining fabric

The Thermal Blind Company - www.thermalbind.co.uk

Mylar - http://en.wikipedia.org/wiki/BoPET
Thinsulate - http://en.wikipedia.org/wiki/Thinsulate

Dr Paul Baker reports for Historic Scotland on window treatments;
http://bit.ly/PBrefone http://bit.ly/PBreftwo (downloads)

English Heritage report http://www.climatechangeandyourhome.org.uk/live/research_generic.aspx - short link http://bit.ly/EHwindowrep

National Physics Lab testing rig - http://bit.ly/NPLhotbox

ECD Architects Retrofit for the Future projects http://bit.ly/ECDAretro

Map showing Retrofit project locations & descriptions http://goo.gl/maps/wIvz

Katy Duke. February 2011.