FIRA

Maxwell Road, Stevenage,
Hertfordshire SG1 2EW, England.

Telephone +44 (0) 1438 777700
Facsimile +44 (0) 1438 777800

e-mail: info@fira.co.uk
website: www.fira.co.uk

Technibond Ltd
Millboard Road
Bourne End
Bucks
SL8 5XD

Our Ref: 0635/RFT/RB
Date: 12.4.00.

For the attention of Mr Summers

SAMPLE (S) FOR TEST:

Three adhesive tapes

1) Technibond HSHT (0.8 mm thick)
2) Technibond HS71 (1.0 mm thick)
3) Technibond HDP (1.0 mm thick)

TEST REQUIREMENTS

Mirror bonding tests.

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Registered Office:
Chiltern House, Stocking Lane,
Hughenden Valley, High Wycombe,
Buckinghamshire HP14 4ND, UK.

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INTRODUCTION

Tests have been carried out on behalf of Technibond Ltd on three double-sided, pressure sensitive adhesive tapes to evaluate their suitability for bonding mirrors to melamine faced chipboard (MFC) panels for furniture application. The three adhesive tapes were:-

A) Technibond HSHT (0.8 mm thick)
B) Technibond HS71 (1.0 mm thick)
C) Technibond HDP (1.0 mm thick)

EXPERIMENTAL PROCEDURES AND RESULTS

When used to mount mirrors onto a vertical surface, the adhesive tapes will be subjected to:

1) A constant shear stress due to the weight of the mirror, and

2) An additional strain (and therefore stress) resulting from relative movement between mirror and supporting panel, due, for example, to changes in environmental conditions after bonding. This will also be a shear stress if the panel remains flat, but tensile or cleavage stresses will develop if the panel distorts.

Any fixing systems must be sufficiently strong to support the mirror indefinitely, and also be flexible enough to accommodate movement in the supporting panel over the range of environmental conditions expected during storage and service.

The tests described below were carried out to investigate the strength, creep and high temperature characteristics of the adhesive tape when used to bond mirrors to MFC panels – this type of panel is used extensively for the manufacture of cabinet furniture.

TESTPIECE PREPARATION

All tests were carried out on standard shear testpieces (Fig. 1) prepared using the submitted tapes, MFC panels and mirrors. The nominal area of bond for each testpiece was 625 sq.mm (1 sq.in).

1. **Shear Strength Test**

The test bonds were tested to failure in shear on an Instron Tensile Testing machine, using a crosshead speed of 10 mm/min. Plots of force against crosshead movement were recorded for the testpieces, and from these the force required to cause failure was determined for each testpiece. The force/movement plots also yielded information on how much the tape could distort before failing.

This test was carried out:

a) After conditioning the test joints for 7 days at ambient temperature.
b) After 7 days at 85% rh, 25°C.
c) After exposure to 50°C for 7 days and then cooling to ambient temperature.

The latter is considered to be an accelerated ageing treatment for the adhesive tape, simulating long term exposure to normal service conditions.

Individual and mean shear strength results are shown in Table 1.

Table 1

CONDITIONING		FAILING FORCE (Newtons)		
		HSHT	HS71	HDP
20°C	1	425	250	230
	2	426	249	211
	3	420	251	228
	4	407	259	219
	Mean	420	252	222
85% rh	1	377	240	202
	2	418	235	202
	3	410	250	208
	4	370	245	225
	Mean	394	243	209
Aged	1	427	248	220
	2	426	250	220
	3	430	244	226
	4	432	246	213
	Mean	429	247	220

1 Newton = 0.1 kg = 0.22 lb.

All testpieces failed within the foam carrier of the adhesive tapes. It was therefore the cohesive strength of the adhesive tapes that limited the ultimate shear strength of the bonds, not the adhesion the adhesive tapes developed to the MFC panels and mirrors.

The ultimate shear strengths of the bonds made with the HS71 and HDP tapes (approximately 4 kg/sq cm or 50 lb/sq/mm) were lower than that of HSHT bonds (approximately 7 kg/sq cm or 90 lb)/sq in. Nevertheless all three tapes produced bonds having good shear strengths which were not affected by either exposure to high relative humidity or the acceleration ageing treatment. All three tapes exhibited a shear displacement of between 4 and 5 mm before failing.

2. High Temperature Test

Standard shear testpieces were supported vertically in an air circulating oven, and loaded in shear to give a nominal shear stress on the bond of either 0.07 or 0.14 kg/sq.cm. (1 or 2 lb/sq.in.). The temperature of the oven was raised in 5°C steps every ten minutes up to 100°C giving an average rate of temperature increase of 30°C/hour. The temperature at which each test bond failed was noted, and these are shown in Table 2.

Table 2

NOMINAL STRESS kg/cm^2	FAILURE TEMPERATURE (°C)		
	HSHT	HS71	HDP
0.07	95	85	100*
0.14	85	85	100

*Failure after 20 minutes at 100°C.

The results show that the bonds made with all three submitted tapes had excellent high temperature resistance.

3. Creep Test at Room Temperature (20°C)

The standard shear testpieces were loaded to various levels of nominal shear stress between 0.14 and 2.0 kg/sq.cm. (2 and 28 lb/sq.in.) to determine their resistance to long term stressing and creep at 20°C. The testpieces were examined regularly for signs of failure. Table 3 shows the times to failure of the test bonds at each nominal stress. Fig. 2 shows the results in graphical form.

Table 3

NOMINAL STRESS kg/cm^2	TIME TO FAILURE (Days)		
	HSHT	HS71	HDP
0.14	-	-	>62
0.21	-	-	>62
0.28	>69	>69	27
0.35	-	-	10
0.42	>49	-	4
0.49	43	>69	<1
0.63	33	-	-
0.77	16	>69	<1
0.98	11	>69	<1
1.26	8	36	-
1.47	5	18	-
1.96	-	5	-

The results for this test, which is considered to be the most important of the three tests for evaluating mirror bonding systems, show that whilst the bonds made with tapes HS71 and HSHT had excellent creep resistance, tape HDP bonds were poor in this respect. The creep strength (i.e. the stress below which failure will never occur) was in excess of 1.0 kg/cm^2 for Tape HS71, in the region of 0.4 kg/cm^2 for Tape HSHT and in the region of 0.25 kg/cm^2 for Tape HDP

DISCUSSION

The mirror bonds made to the MFC panels by all three submitted tapes had good ultimate shear strengths which were unaffected by exposure to high relative humidity or the accelerated ageing treatment. All test bonds failed within the foam carriers of the tapes, and so their strengths were limited by the adhesive strength of the tapes, not the adhesion they developed to the mirror or MFC panel. All three tapes were able to accommodate reasonable shear displacements (between 4 and 5 mm) before failing and had good high temperature resistance. The creep test showed that tapes HS71 and HSHT had excellent creep resistances, in the region of 1.0 and 0.4 kg/sq cm respectively, whilst the HDP bonds had a creep resistance in the region of 0.25 kg/sq cm

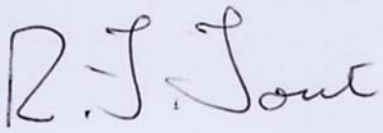
BS 7449, 1991, recommends a minimum tape coverage of 4000 sq mm/kg of mirror, giving a nominal service stress of 0.025 kg/sq cm. In addition, FIRA recommends that there should be a safety factor of at least 10, and so a satisfactory mirror bond should have a minimum creep strength of 0.25 kg/sq cm. Adhesive tapes HS71 and HSHT easily satisfy the requirement but tape HDP is borderline.

CONCLUSIONS

The good results for tapes HS71 and HSHT, especially in the important creep test, show that these tapes would be suitable for bonding mirrors to MFC panels, provided sound bonding procedures are used.

Tape HDP also performed well in the shear strength and high temperature tests, but its creep strength was close to what is considered to be the minimum requirement for satisfactory performance in service. Increasing the tape coverage to, say 5000 sq mm/kg of mirror would restore the safety factor of 10 between creep strength and nominal service stress.

It should be noted that a smooth MFC is a relatively easy surface for adhesive tapes to bond to, and that bonds made to other furniture surfaces (e.g. paper foils, textured surfaces) may be less durable.

Report by R F Tout 

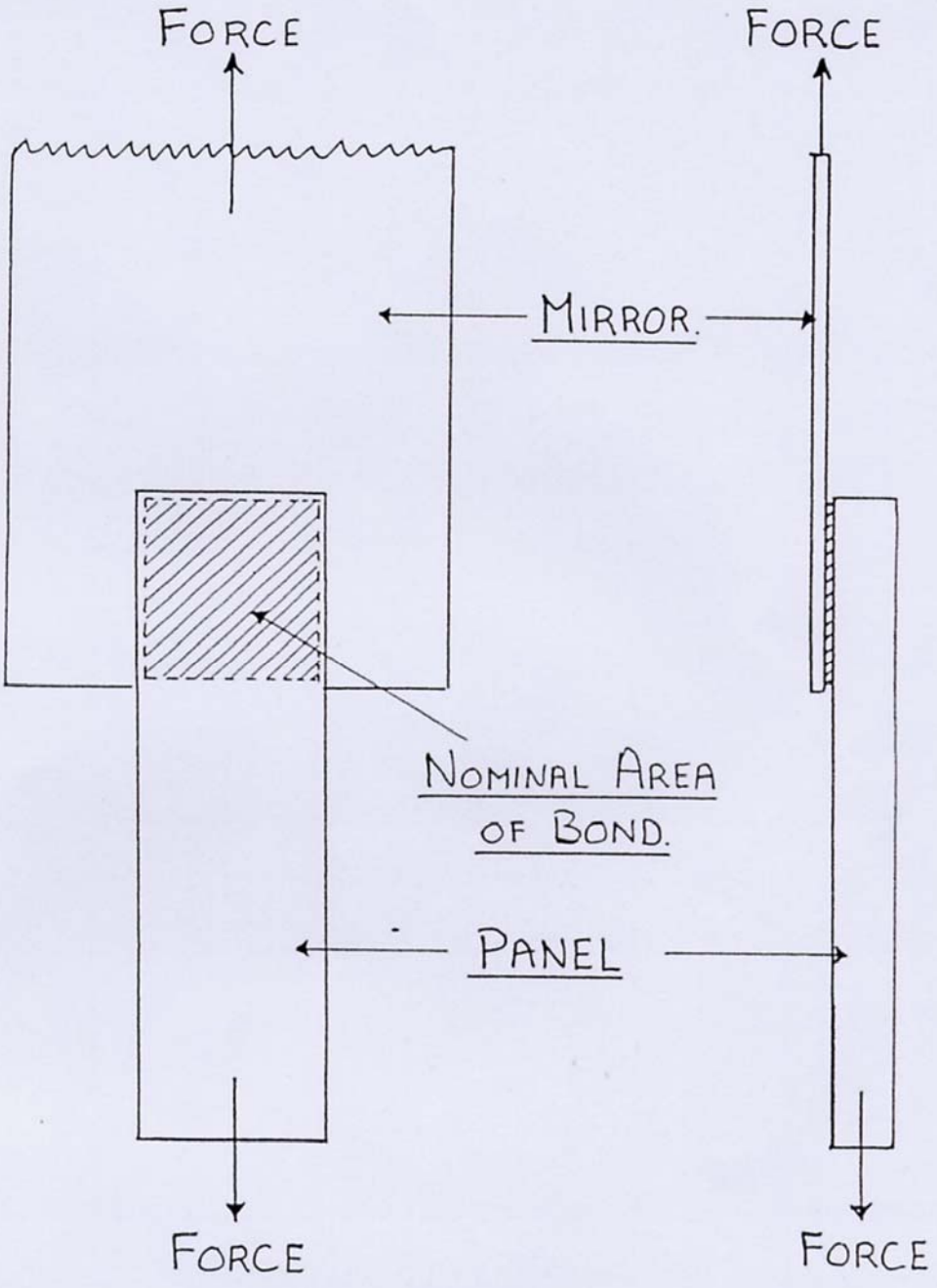


FIG. 1 SHEAR TESTPIECE.

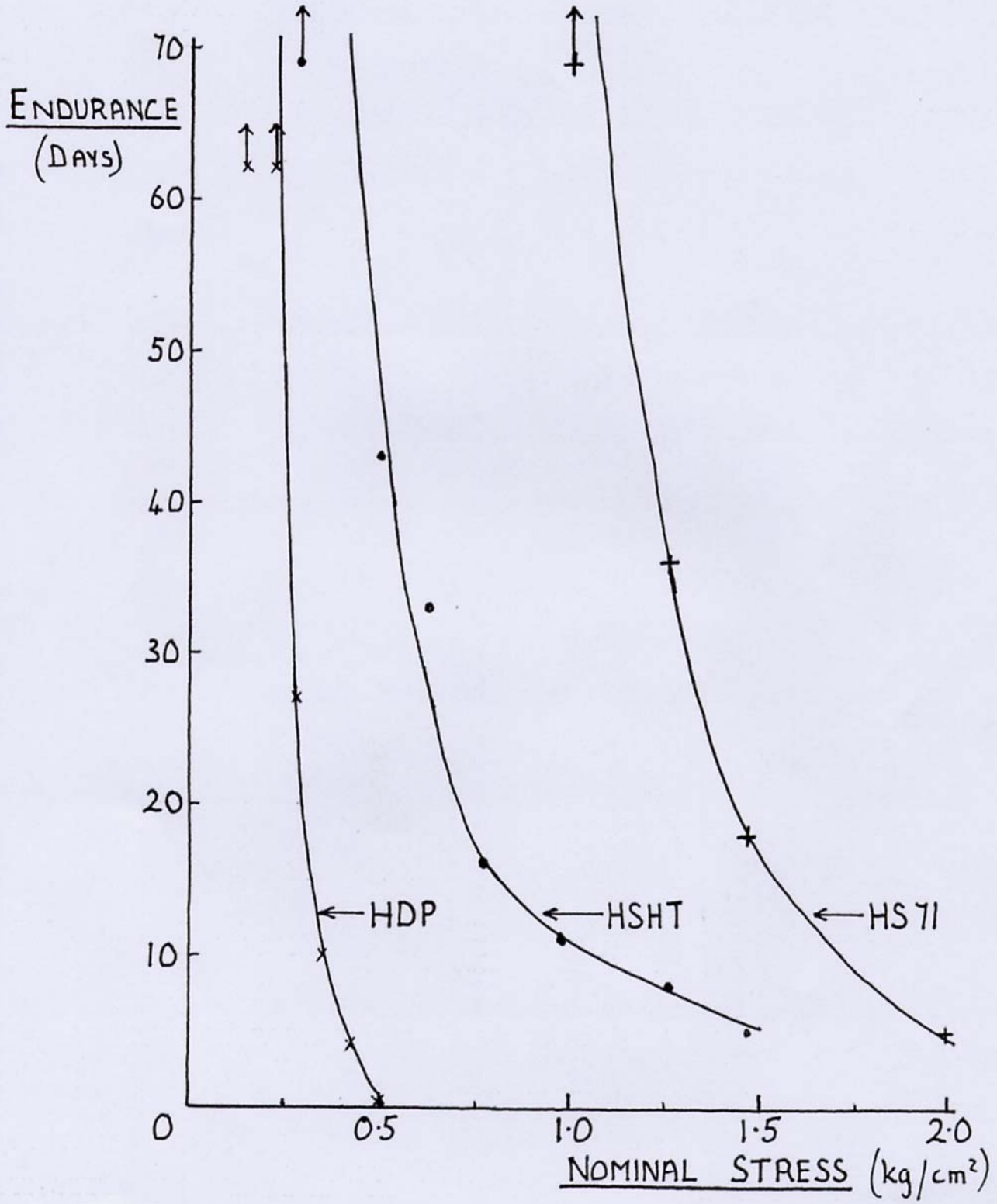


FIG. 2. CREEP RESULTS.

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