TECHNICAL GUIDE – DYMO TAPE

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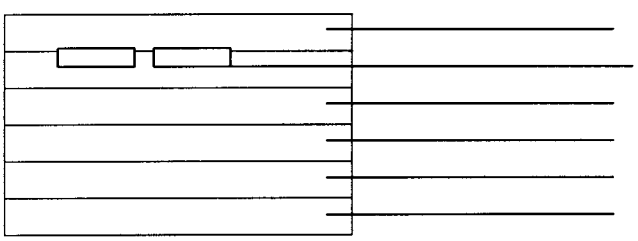
APPENDIX

1. Structure of Tape

4000 Clear Tape

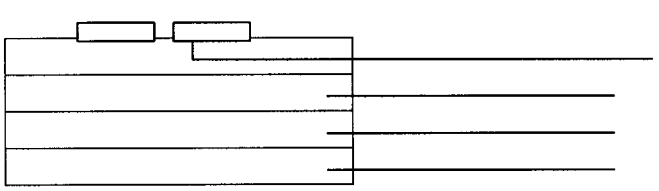
Label thickness without paper backing: 110 microns
Total thickness: 170 microns



Protective Film (polyester 50
Print
Adhesive
Carrier Film (polyester 12u)
Adhesive
Double coated siliconized pa

1000/5000/6000 Clear Tape

Label thickness without paper backing: 75 microns
Total thickness: 135 microns



Print
Polyester 50u (carrier film)
Adhesive
Liner (single coated siliconis

2. Adhesive Strength

2.1 Adhesion to different materials

Test 1: Labels applied to room temperature to each surface for 15 minutes before the force required to remove them is measured.

Surface	6000 Coloured/White	6000 Clear	4000 Coloured/White	4000 Clear
P.P	21g	20g	55g	109g
ABS	356g	824g (3)	467g	723g
Polycarbonate	300g (1)	989g (3)	549g	871g
PVC	384g	763g (3)	579g	746g
Polyester Film	511g	922g	524g	655g
Acrylic	625g	910g (3)	689g	808g (3)
Glass	726g	1,024g (3)	924g	1,044g
Foam	0g	12g	0g	11g
Wood	520g	888g (3)	750g	800g (3)
Stainless Steel	658g	953g	792g	779g

Test 2: Labels applied at room temperature. Samples are then aged for 24 hours at a temperature of 60 °C.

Surface	6000 Coloured/White	6000 Clear	4000 Coloured/White	4000 Clear
P.P	211g	485g	403g	438g
ABS	541g (1)	1,006g (3)	634g (1)	778g (3)
Polycarbonate	139g (1)	288g (3)	184g (1)	308g (3)
PVC	847g (2)	1,038g (3)	1,013g (1)	1,040g
Polyester Film	611g (2)	989g (3)	751g	876g (3)
Acrylic	249g (1)	606g (1)	592g (1)	637g (1)
Glass	1,117g (3)	1,153g	1,100g	1,100g
Foam	0g	27g	16g	26g
Wood	905g	1,048g (3)	1,030g (4)	1,046g (4)
Stainless Steel	1,261g (3)	1,492g (3)	v. high	1,447g (3)

Test 3: Labels applied at room temperature. Samples are then aged for 24 hours at normal laboratory conditions (23 °C, 50% humidity)

Surface	6000 Coloured/White	6000 Clear	4000 Coloured/White	4000 Clear
P.P	233g	593g	193g	215g
ABS	636g	853g	732g	809g
Polycarbonate	732g (1)	1,072g (3)	812g	1,057g (3)
PVC	691g (1)	910g	783g	829g (3)
Polyester Film	556g (3)	998g (3)	650g	807g
Acrylic	767g (1)	1,084g (3)	786g	1,031g (3)
Glass	837g	1,156g	926g	988g
Foam	0g	66g	0g	45g
Wood	632g (1)	935g (3)	713g	826g (3)
Stainless Steel	1,173g (3)	1,123g (3)	v. high (4)	1,071g (3)

Key :

1. Some print remains on the surface after the label is removed
2. Some ink and adhesive remain on the surface after the label is removed
3. Some adhesive remains on the surface after the label is removed
4. Lamination layer comes away from the label after the label is removed from the surface

2.2 Adhesion to rough surfaces

Degree of Roughness of Surface	6000 Coloured /White	6000 Transparent	4000 Coloured/White	4000 Transparent
# 320	776g	1,066g	977g	882g
# 280	658g	953g	792g	779g
# 240	716g	1,007g	883g	906g
# 150	667g	1,071g	823g	909g
# 80	674g	983g	787g	875g

2.3 Adhesion to rough surfaces

Test method

Sample 1: Apply 5cm of 122mm wide tape horizontally along the bar

Sample 2: Apply 4cm of 12mm wide tape around the circumference of the bar. The ends of the label must not overleap.

These different samples are subjected to different conditions for a period of 24 hours.

Conditions:

1. normal laboratory conditions (23 °C and 50% humidity)
2. 20°C
3. 60°C and 90°C humidity

Test Results

Results show the number of mm of tape that came loose from the bar and also for the 4000 tape the mm of laminate that came loose from the tape.

Conditions	**6000**	**6000**	**4000**		**4000**	
& Samples	**Coloured**	**Transparent**	**Coloured**		**Transparent**	
	White		**White**			
	Effect on	Effect on	Effect on	Effect on	Effect on	Effect on
	Label	Label	Laminate	Label	Laminate	Label
a.1.	0mm peel	0mm peel	1mm peel	0mm peel	1mm peel	0mm peel
			End of label		End of label	
a.2.	0mm peel	0mm peel	1mm peel	0mm peel	1mm peel	0mm peel
			End of label		End of label	
b.1.	0mm peel	1mm peel	2mm peel	1mm peel	1mm peel	1mm peel
		End of label	End of label	End of label	End of label	End of label
b.2.	0mm peel	0mm peel	0.5mm peel	0mm peel	0.5mm peel	0mm peel
			End of label		End of label	
c.1.	0mm peel	0mm peel	4mm peel	0mm peel	3.5mm peel	0mm peel
			End & sides		End & sides	
			Of label		Of label	
c.2.	0mm peel	0mm peel	10mm peel	0mm peel	11mm peel	0mm peel
			End & sides		End & sides	
			Of label		Of label	

2.4 Adhesion in different temperatures:

This table shows the force that is required to remove a 12mm wide tape at different temperatures from the surface to which it is adhered. This force is measured in grams per 12mm (i.e. "g force")
6000 tape was tested which has the same properties as 1000/5000 tape.

Temperature	Coloured/White	Transparent
-20 C	810g	1159g
23 C	1046g	1207g
50 C	1487g	1369g
100 C	1637g	Delamination of adhesive
150 C	Delamination of adhesive and ink	Delamination of adhesive

After 2 hours dwell time, there was 1 hour of stabilisation at room temperature.

3. Heat Resistance

3.1 Effects on the legibility of the label

Red up to	200°C	no change in colour
Above	200°C	red fades to orange
Blue up to	200°C	no change in colour
Above	200°C	blue fades
Green up to	200°C	no change in colour
Above	200°C	green colour darkens
Yellow up to	200°C	no change in colour
Above	200°C	yellow colour darkens
White up to	150°C	no change in colour
Above	150°C	white tape yellows
Clear up to	150°C	no change in colour
Above	150°C	clear tape yellows

3.2 Effects on the mass of the tape

The test results on the next page show the degree of effect that high temperatures have on the tape.

	1 % change in mass	2 % change in mass
6000 white/coloured tape	256°C	309°C
6000 transparent	252°C	304°C

4. Resistance to water and chemicals

Test 1
Printed labels are applied to a surface and immersed in solvent for a period of 15 minutes. After this time the label is removed and the panel is left to dry. When the panel is dry the sample is examined to see if any of the print is damaged. After this, a cloth dipped in the solvent is rubbed over the surface of the label applying normal force. None of the print should be damaged during the test.

Results Test 1

Water	OK
Mechanical Oil	OK
Vegetable Oil	OK
Mechanical Grease	OK
Vegetable Grease	OK
Animal Grease	OK

Weak Solvents

Benzine	OK
Butylphospat	OK
Ethylalcohol	OK
Heptaan	OK
Iso – propyalcohol	OK
Isopropyalcohol	OK
Kerosine	OK
Medical Alcohol	OK
Methanol	OK
n – Hexan	OK
Trichlortrifluorethan	OK
White Spirit	OK

Strong Solvents

Aceton	Neg
Diacetone Alcohol	Neg
Ether	Neg
Ethylacetaat Pro analyse	Neg
Ethylglycol	Neg
Isopropylacetaat	Neg
Methyl Ethyl Keton	Neg

Test 2

Printed labels are applied to a surface and immersed in solvent for a period of 2 hours. After this time the label is removed and the panel is left to dry. When the panel is dry, the sample is examined to see if any of the print is damaged.

Results Test 2

	6000 Coloured/White	**6000 Transparent**	**4000 Coloured/White**	**4000 Transparent**
Toluene	Swelling of adhesive.	Swelling of adhesive. Print is fading	Swelling of adhesive. Adhesion of laminate is low	Swelling of adhesive. Adhesion of laminate is low
Hexane	No change	No change	Adhesion of laminate is low	Adhesion of laminate is low
Methanol	No change	No change	Puffing of laminate	No change
Ethylac	Swelling of adhesive. Colour is fading	Swelling of adhesive. Colour is fading	Swelling of adhesive. Adhesion of laminate is low	Swelling of adhesive. Adhesion of laminate is low
Acetone	Swelling of adhesive. Colour is fading Adhesion decreases	Swelling of adhesive. Print is fading	Swelling of adhesive. Colour is fading Adhesion of laminate is low	Swelling of adhesive. Adhesion of laminate is low
Tri	Swelling of adhesive. Colour is fading Adhesion decreases	Swelling of adhesive.	Swelling of adhesive. Colour is fading Adhesion of laminate is low	Swelling of adhesive. Adhesion of laminate is low
IPA	Swelling of adhesive.	Swelling of adhesive.	Swelling of adhesive.	Swelling of adhesive.
Water	No change	No change	No change	No change
NaOH	Puffing of adhesive Adhesion decreases	Puffing of adhesive Adhesion decreases	Adhesion decreases	Puffing of adhesive Adhesion decreases
HCl	No change	No change	Adhesion decreases	No change

Test 3
Printed label is rubbed with solvent. It is assumed that if more than 20 passages are required to completely remove the print this is very good and 20 is taken as the maximum.

Results Test 3

6000 tape:

Solvent	Rubs required to remove print
Hexane	> 20
Methanol	> 20
Isopropylalcohol	> 20
Deionised water	> 20
HCl	> 20
Trichloroethane	12
Toluene	6
Ethylacetate	5
Acetone	4

4000 tape:

With all solvents tested no print disappears.

5. Resistance to Abrasion

Durability Tests

a) Test with rubber eraser
Gold and Silver: Print removal begins after 5 passages of the rubber eraser

b) Test with metal pin (weight 500g, diameter 5mm)
Gold and Silver: Print remains undamaged after 165 cycles

c) Test with Scotch adhesive tape
Gold and Silver: Print remains undamaged up to 130 passages

6. Insulating properties

Definitions:

Electrical Strength: The maximum voltage which an insulator will resist under particular test conditions.

Breakdown Voltage: The voltage at which an insulator will fail under particular test conditions.

According to ASTM and IEC regulations 8 KV is and acceptable Electrical Breakdown Voltage for an insulating material. Our tape showed following performance levels during testing.

		Electrical Strength	Breakdown Voltage
1000/5000/6000	Coloured	7,800 volts	13,600 volts
	White	9,600 volts	15,600 volts
	Clear	7,800 volts	13,600 volts
4000	Coloured	8,800 volts	13,200 volts
	White	8,800 volts	12,900 volts
	Clear	7,500 volts	11,300 volts

Discolouration = UV Resistance:

Test carried out to prove there is no visible change in colour of the tape after1 year's exposure to direct sunlight and of course, the legibility remains excellent.

The tape was placed in an Accelerated Exposure Machine CPS. There was no visible change in the colour of the label or the legibility of the text after a prolonged exposure. This exposure corresponds to a Woolscale of 7-8.

Removal of Labels:

The tape has been developed as a permanent labelling system, which means it will stick on to most surface and materials. This also means that, on removal from particular surfaces such as PVC or stainless steel, some traces of the adhesive may remain. If this occurs, the adhesive can be removed in most cases by rubbing with the correct solvent, such as Toluene for stainless steel, or Methanol for other surfaces.

8. Health and Safety Aspects:

8.1 In relation to contact with human skin

Tests were carried out by Sellotape as to Dymo tape's reaction on human skin. 10 different people were asked to apply a piece of Dymo tape to their skin:

1. for a period of 24 hours
2. for a period of 7 days

In all cases no skin irritation was found. Despite these results, people with very sensitive skin could suffer some effects and it is therefore not recommended to fix the tape to skin.

St Niklaas is investigating OECD (Organisation for Economic Co-operation and Development) safety regulations mentioned in the Brother tape guide.

8.2 In relation to food and food preparation

Dymo tape is not considered suitable for direct contact with food stuffs according to FDA standards (USA Food and Drug Association) because of the chemicals contained in the adhesive.
Regulations concerning indirect contact with food (i.e. on food wrappers, preparation utensils etc.) are still being investigated.

9. Content of the Tape:

Both our material suppliers (Nitto and Sellotape) have conducted analysis of the composition of the tape and found that there are no hazardous products contained in any of our tape materials.

- no elements are contained that could be hazardous to health
- no elements are contained that could constitute a hazard during transportation of the product
- in the case of fire, ordinary fire extinguishing equipment may be used such as water, foam or powder.

10. Removal of Labels:

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