TECHNICAL REPORT

A BM TRADA Company

Maxwell Road, Stevenage
Hertfordshire
SG1 2EW, UK

T: +44 (0) 1438 777700
F: +44 (0) 1438 777800
info@fira.co.uk
www.fira.co.uk

Wilsonart Limited

Lambton Street Industrial Estate
Shildon
County Durham
DL4 1PX

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For the attention of John H Middleton

SAMPLES FOR TEST

Solid surface worktop
Gemstone Permian – (improved surface finish process 5finish performance test).
Construction: 6 mm nominal white glass and shell solid surface type material. Surface material for particleboard based worktop.

TEST REQUIREMENTS

FIRA Gold Assessment – Solid surface specification
Finish Performance BS 6222 Part 3 & Selected EN 438 tests

FIRA International Ltd
Registered Office: Chiltern House, Stocking Lane, Hughenden Valley,
High Wycombe, Buckinghamshire, HP14 4ND, UK
Registered in England No. 3181481

FINISH PERFORMANCE TESTS (BS 6222 PART 3 1999)

Finish performance requirements for the assessment of domestic kitchen worktops*, doors and other panel elements are specified in BS 6222 Part 3 1999 Domestic Kitchen Equipment 5 Performance requirements for durability of surface finish and adhesion of surfacing and edging materials5Specification'. (*Plastics laminate used for worktops should also comply with the relevant requirements of BSEN 438).
Test procedures to assess the durability of furniture surface finishes are detailed in:
BS 396256: 1980 Methods of test for finishes for wooden furniture Part 6 Assessment of resistance to mechanical damage, BS 6222 Part 3 Annex A Resistance to impact by large ball worktops, BSEN 12720:2009 Furniture Assessment of surface resistance to cold liquids, BSEN 12721: 2009 Furniture Assessment of surface resistance to wet heat and BSEN 12722: 2009 Furniture Assessment of surface resistance to dry heat
The tests are generally applicable to all types of finishes including liquid based finishes, plastics laminate and surfacing foils such as paper, melamine and PVC bonded to wood based substrates. The finish is normally tested on the substrate on which it will be used, such that the durability of the finish/substrate combination is assessed rather than the finish in isolation.

Assessment of Resistance to Mechanical Damage (BS 3962 Part 6: 1980)

Crosscut Test
A grid pattern of knife cuts, to a depth of 0.3mm, is made into the surface finish of the sample. The test area is then brushed and examined with a x3 magnification hand lens.

Impact Test
A 19.1mm diameter steel ball weighing 28g is dropped on to the test panel from a height of two metres; the ball is caught to prevent multiple impacts. The test area examined with a x3 magnification hand lens.

Large ball impact BS 6222 kitchen worktops.
Similar to above but ball diameter 42.8 mm, weight 324g and drop height 450mm.

Scrape Test
A radiused blade is traversed 200mm over the panel surface at a speed of 20 mm/sec applying an increasing vertical force from 1.5N to 26N. The scrape line is examined with a x3 magnification hand lens to determine i) point of surface penetration of the coating and iii) point of substrate penetration. The force in Newtons is recorded and also converted into a rating.

Assessment of Surface Resistance to Wet Heat (BS EN 12721:2009)
A 100 mm diameter aluminium alloy block is heated to a specified test temperature and placed on a wetted nylon cloth in contact with the surface of the test panel. The block is allowed to cool for 20 minutes and then removed. The test area is wiped dry and left undisturbed for at least 16 hours, following which the test surface is examined.

Assessment of Surface Resistance to Dry Heat (BS EN 12722:2009)
The dry heat test is similar to the wet heat test except for the omission of the wetted cloth.

Assessment of Surface Resistance to Cold Liquids (BS EN 12720:2009)
A 25mm disc of absorbent paper is immersed in a test liquid and placed on the surface of the panel and covered with a glass dish for a period of 1 hour, except cold oil and fats which are placed on the panel uncovered for a period of 24hr. The excess liquid is then soaked up by an

absorbent material (but not rubbed clean) and left undisturbed for further 16 hours after which the test surface is full cleaned with standard 'cleaning' solution.

General
Test areas are carefully examined both in diffuse daylight and reflected light.

Flexible rating allowance
BS 6222 Part 3:1999 contains the following flexible allowance "A maximum of two results in any column may fall below the ratings shown in the table, provided that each is not more than 1 rating below the rating shown and that neither rating is less than a rating 2".

FINISH PERFORMANCE TEST RATINGS

BS 3962 CROSSCUT : APPEARANCE OF TEST AREA	RATING
Cuts are smooth, no finish removed, except for small chips at the intersections of the cuts and an occasional small chip along the cut.	5
Finish removed at intersections and intermittently along the cuts.	4
Finish consistently removed along the cuts.	3
Finish removed along the cuts and completely from one or more of the squares, but from less than 50% of the squares.	2
Finish removed completely from more than 50% of the squares.	1

BS 3962 SCRAPE – FORCE AT SURFACE PENETRATION	RATING	BS 3962 SCRAPE – FORCE AT SUBSTRATE PENETRATION	RATING
Equal to or greater than 6N	5	Equal to or greater than 14N	5
Less than 6N but equal to or greater than 4.5N	4	Less than 14N but equal to or greater than 9N	4
Less than 4.5N but equal to or greater than 3N	3	Less than 9N but equal to or greater than 6N	3
Less than 3N but equal to or greater than 1.5N	2	Less than 6N but equal to or greater than 4N	2
Less than 1.5N	1	Less than 4N	1

BS 3962 IMPACT TEST : APPEARANCE OF TEST AREA	RATING
No surface cracking	5
Slight cracking e.g. one or two circular cracks around the edge of the indentation.	4
Moderate or severe cracking confined to the area of the indentation	3
Cracking extending outside the area of the indentation and/or slight flaking of the finish	2
More than 25% of finish removed from the area of indentation	1

BSEN 12720 COLD LIQUIDS : APPEARANCE OF TEST AREA / BSEN 12721&12722 WET AND DRY HEAT : APPEARANCE OF TEST AREA	RATING
No change 5Test area indistinguishable from adjacent surrounding area	5
Minor change: Test area distinguishable from adjacent surrounding area, only when the light source is mirrored on the test surface and is reflected towards the observer's eye, e.g. discolouration, change in gloss and colour. No change in the surface structure, e.g. swelling, fibre raising, cracking, blistering	4
Moderate change 5Test area distinguishable from adjacent surrounding area, visible in several viewing directions, e.g. discolouration, change in gloss and colour. No change in the surface structure, e.g. swelling, fibre raising, cracking, blistering	3
Significant change: Test area clearly distinguishable from adjacent surrounding area, visible in all viewing directions e.g. discolouration, change in gloss and colour. And /or structure of the surface slightly changed, e.g. swelling, fibre raising, cracking, blistering	2
Strong change : The structure of the surface being distinctly changed 5and / or discolouration, change in gloss and colour, and / or the surface material being totally or partially removed, (Liquid attack test) and / or the filter paper adhering to the surface (Wet heat test) and/or the polyamide fibre cloth adhering to the surface	1

RESTORATION

‘Resurfaceable ‘solid surface’ worktop materials are unlikely to fully meet the finish performance requirements of BS6222 Part 3 and EN 428 after test and standard cleaning with a mild detergent.

Typically some marking occurs in high temperature tests and with strong solvents such as acetone. In view of this situation FIRA has made a provision within the finish performance assessment for additional restoration of solid surface materials for these more demanding tests. This restoration process is typically carried out using a mild abrasive, according to the manufacturer recommendations, but not generally exceeding the use of a fine 320 grit sandpaper or ‘red scotchbrite’ wet/dry type abrasive pad. This process should restore the surface to a similar lustre to that as originally supplied.

The above is given as a general guideline but FIRA will act as final arbitrator in such assessments and this process is subject to review.

GEMSTONE PERMIAN

TECHNICAL REPORT

RESULTS: FINISH PERFORMANCE : SOLID SURFACE DOMESTIC KITCHEN WORKTOPS : FINISH PERFORMANCE BS 6222 PART 3

TEST	FIRA REQUIREMENT (BS 6222)	SAMPLE: GEMSTONE PERMIAN SOLID SURFACE WORKTOP			
BS 6222 PART 3		RATING After Initial BS6222 Cleaning		RATING After abrasive clean	
Scrape: Surface penetration	5	5	16.9N mar line		
Scrape: Substrate penetration	5	5	>26N		
Wet Heat 55°C	5	5	No change		
Wet Heat 70°C	4	5	No change		
Wet Heat 85°C	4	5	No change		
Dry Heat 120°C	5	5	No change		
Dry Heat 140°C	4	4	Minor change slight texture change 5barely detectable		
Dry Heat 160°C	3	4	Minor change slight texture change 5barely detectable		
Acetone	5	4*	Minor change slight texture change just evident.		
Ethanol 96%	5	5	No change		
Ethanol 48%	5	5	No change		
Tea	5	5	No change		
Coffee	5	5	No change		
Disinfectant: Phenol	5	5	No change		
Disinfectant: Chloro	5	5	No change		
Paraffin Oil	5	5	No change		
Blackcurrant Juice	5	4 (2*?)	No colour staining but some slight change visible when mirrored into the light.		
Ammonia Solution	5	5	No change		
Acetic Acid	5	4 / 2*	No colour change but some erosion of shell particles and some slight change visible when mirrored into the light.		
Olive Oil	5	5	No change		
Cold Oils (24hr)	5	5	No change		
Cold Fats (24hr)	5	5	No change		

TECHNICAL REPORT

SUMMARY/COMMENTS

Generally the Gemstone Permian solid surface worktop , (with improved surface finish process), performed well in test with no significant marking or staining evident in most of the test areas 5indicating an improvement on previously submitted samples (FIRA report reference TMGAF47662).

However it was noted in the acetic acid test (the 4% acetic acid at test simulates vinegar, which can be in the range 45 8% acetic acid) and to a lesser extent in the in the blackcurrant test that some surface change had occurred. In the case of the acetic acid test some slight surface roughening to the touch was evident over the test area. Additionally some cosmetic appearance change was evident when mirroring the surface into the light – less glossy appearance of the shell fragments. The change appeared to be confined to the shell fragments and it is suspected that the calcium carbonate comprising the shell composition has been slightly etched /eroded/ dissolved as a result of exposure to acid conditions.

Although outside formal testing a longer duration 4% acetic acid test was carried out over a 5 hour period with just a pool of liquid left on the surface. This more deeply etched the shell surface fragments with more significant roughening. Additionally applying an ink stain to this etched surface area resulted in some absorption of stain into the shell, whereas the 'as supplied' smoother untested areas were not obviously receptive to such staining.

In order to investigate this further additional ad5hoc testing was carried out on the Gemstone Permian material using a range of potentially acidic household products. The liquids were simply placed as pools on the panel with the following results noted:

Tomato Ketchup (1 hour): Some cosmetic change when mirrored into the light but no readily or significant detectable roughening of surface.
Apple Sauce (1 hour): Some cosmetic change when mirrored into the light but no readily or significant detectable roughening of surface.
Lemon Juice (1 hour): Some cosmetic change when mirrored into the light and significant detectable roughening of surface 5similar to Viakal result)
Lemon Juice (30mins): Some cosmetic change when mirrored into the light and detectable roughening of surface.
Vinegar (1 hour:) Some cosmetic change when mirrored into the light and detectable roughening of surface. Viakal) kitchen limescale remover (1 hour): Some cosmetic change when mirrored into the light and significant detectable roughening of surface.

Generally the visual appearance change was only apparent under relatively precise viewing conditions 5acute angle and mirroring into light. The surface change was not readily visible on general viewing with the surface in a horizontal position. In some respects it is considered that the surface, comprising numerous random fragments of glass and shell, tends to confuse the eye and masks any distinguishable change.

The ad5hoc tests corroborate the findings of the formal BS6222 acetic acid test in that acid based products left in contact with the surface are likely to result in some erosion of the shell material resulting in some cases in slight surface roughening and a general cosmetic appearance change 5 the latter visible when mirroring into the light

It is difficult to rate the submitted worktop material and arguably in terms of the BS 6222 Part test programme it may be considered 'borderline' but perhaps a 'fail' due to the issues concerning shell erosion under acid conditions. The additional ad5hoc tests suggest that a range of commonly used household products are likely to result in such erosion if left in contact with the surface.

In terms of performance in service use it is a complex situation as the tests carried out are one off spot tests and do not simulate day to day use over prolonged periods. The BS 6222 tests suggest generally satisfactory performance in most areas but with the one reservation concerning resistance to contact with acidic products.

*denotes failure in test

TECHNICAL REPORT

RESULTS: FINISH PERFORMANCE : SOLID SURFACE DOMESTIC KITCHEN WORKTOPS FINISH PERFORMANCE BSEN 438 SELECTED TESTS

TEST	FIRA SPEC. SOLID SURFACE WORKTOP	SAMPLE: GEMSTONE PERMIAN SOLID SURFACE WORKTOP			
		RATING After Initial BS6222 Cleaning		RATING After abrasive clean	
BS EN 438 Selected Tests					
Sodium Hydroxide5Covered 25% Covered 10 mins	4	5	No change		
Hydrogen Peroxide5Covered 30% Covered 10 mins	4	5	No change		
Shoe Polish5 Black Covered 10 mins	4	5	No change 5removes with solvent		
Cigarette Burns	3	3	Moderate brownish stain mark visible		
SUMMARY/COMMENTS : PASS					

*denotes failure in test

BSEN 438 2005: Clause 30 Resistance to Cigarette Burns
Cigarettes complying with the precise requirements specified in BSEN 438 are no longer available in the UK. FIRA currently uses Rothmans King size declared on packet as 10mg tar & 0.9mg but other brands with similar specification may be used according to availability. (Directive 2001/37/EC requires a range of measures to be taken by manufacturers of tobacco productsO.. 'setting ceilings to the yields of tar (10mg), nicotine (1mg) and carbon monoxide (10mg) for all cigarettes manufactured within the community irrespective of whether for consumption or export'. Ref www.ash.org.uk)

TESTED BY: J ERIBANKYA & V TAYLOR

APPROVED BY: V TAYLOR (SECTION HEAD: MATERIALS TECHNOLOGY)

********** END OF REPORT **********