

# AquaLac Hardness Development

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**Background:** Upon replacement of the R109150000 Water Based Self-Sealer with the WX-888650 AquaLac Water Based Self-Sealer the customer ABC Millwork reported increased incidents of scratching on millwork after being stacked in vertical racks overnight.

**Objective:** Evaluate the scratch resistance of films of R109150000 and WX-888650 in the first hours after being cast onto wood.

## **Experimental approach:**

- Stain wood using a dark colored, water based spray stain where applicable so scratches in the topcoat will be as visible as possible.
- Spray and dry two coats of each clear self-sealing product according to each of the three protocols described in the table below.
- Record pencil hardness and scratch resistance at specified time intervals.

## **Scratch Test**



Scratch test apparatus. 400 grit sandpaper, 200 gram mass.

### Application Protocols Tested

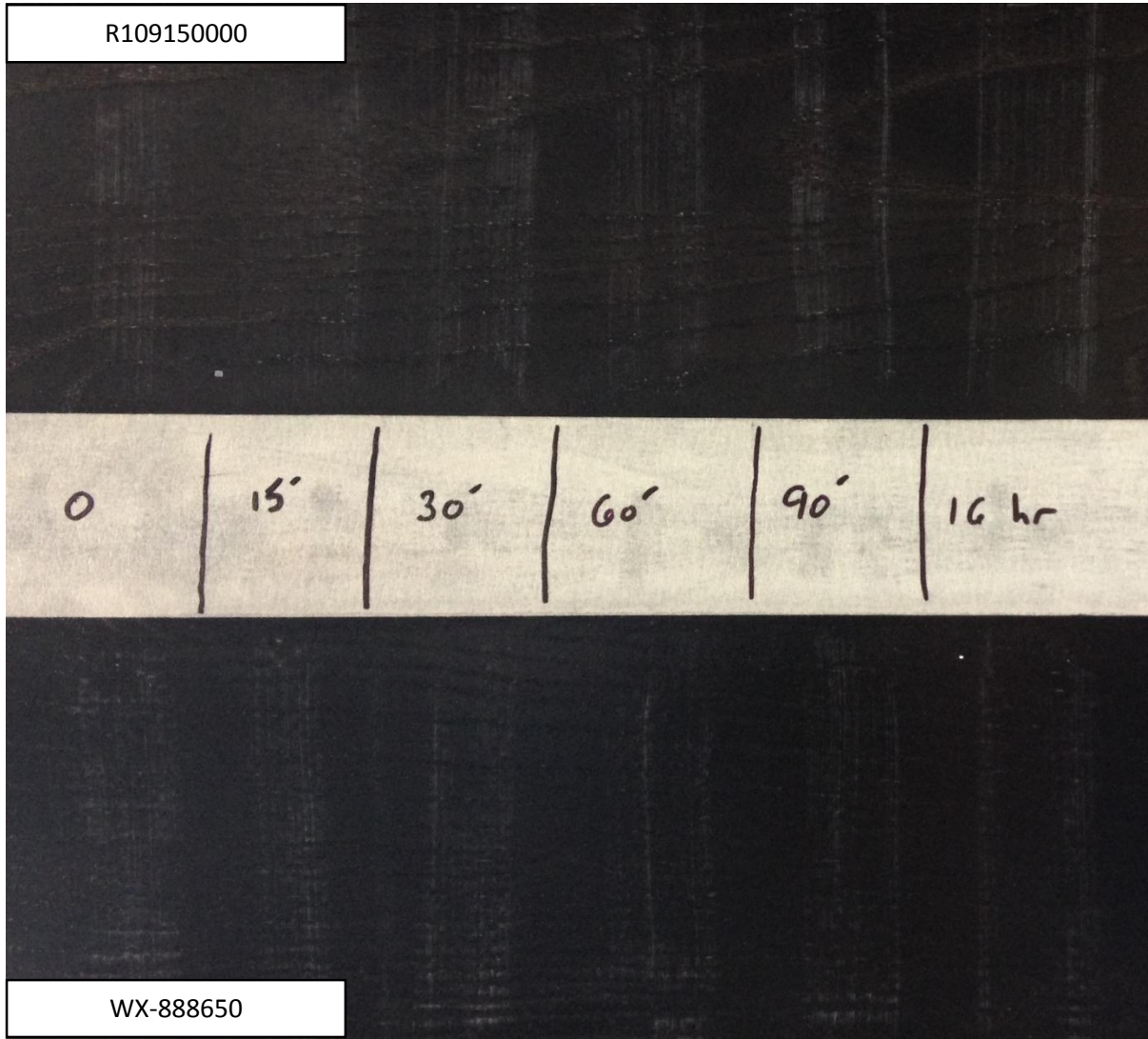
	Dry Cycle 1	Dry Cycle 2	Dry Cycle 3
<b>Substrate</b>	Oak	"Primewood"	Steel panel
<b>Spray</b>	3 – 4 mils wet	3 – 4 mils wet	3 – 4 mils wet
<b>Flash</b>	7 minutes	1.5 minutes	1.5 minutes
<b>Oven</b>	7 minutes, 130°F	2.33 minutes, 119°F	2.33 minutes, 119°F
<b>Cool</b>	7 minutes	1.5 minutes	1.5 minutes
<b>Spray</b>	3 – 4 mils wet	3 – 4 mils wet	3 – 4 mils wet
<b>Flash</b>	7 minutes	1.25 minutes	1.25 minutes
<b>Oven</b>	7 minutes	2.33 minutes, 135°F	2.33 minutes, 135°F
<b>Cool</b>	7 minutes	1.5 minutes	1.5 minutes

**Results; Pencil Hardness:** Where reliable data was able to be generated the pencil hardness of films less than 90 minutes old differed by one or less than one unit. This should be considered to be equivalent. After 16 hours on oak the WX-888650 was a B hardness while R109150000 remained at 4B. This effect was not observed with Protocol 3 on steel, a difference which may be due to relatively poorer adhesion to the steel substrate compared with the wood. WX-888650 is based on a self-crosslinking technology so a hardness increase over time is not unexpected. Indeed, historical data indicates that after 7 days a hardness of B and 3B are achieved for WX-888650 and R109150000, respectively. Application Protocol 2 did not yield reliable data as the wood substrate yielded significantly to even the softest pencils.

<b>Pencil Hardness (ASTM D3363)</b>						
	Protocol 1		Protocol 2		Protocol 3	
Substrate:	Oak		"Primewood"		Steel	
Dry Time	WX-888650	R109150000	WX-888650	R109150000	WX-888650	R109150000
<b>0 minute</b>	3B	4B	Wood is too soft to obtain a reliable result.		6B	6B
<b>15 minute</b>	3B	4B			6B	6B
<b>30 minute</b>	3B	4B			6B	6B
<b>60 minute</b>	NT	NT			6B	6B
<b>90 minute</b>	3B	4B			6B	5B/6B
<b>16 hours</b>	B	4B			4B / 5B	
<b>7 days (historical data)</b>	B	3B	NT	NT	NT	NT
	<b>Softer</b>				<b>Harder</b>	

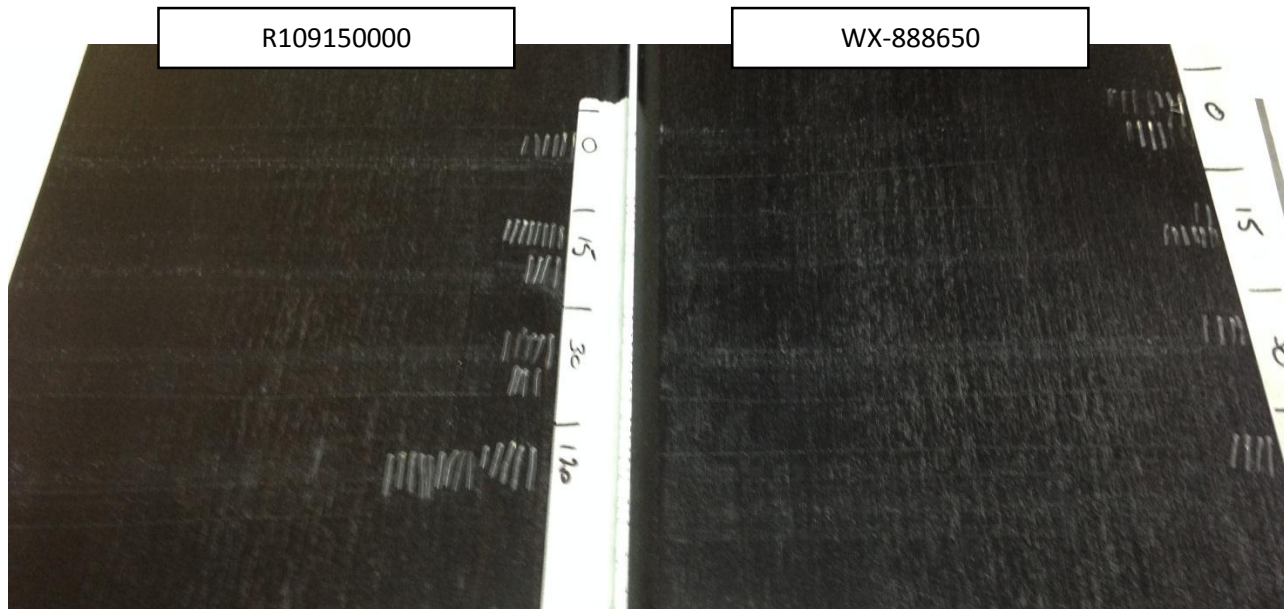
The pencil hardness of films less than 90 minutes old differed by one or less than one unit.

**Scratch Test:** A standard scratch test was performed using samples from Application Protocol 1 at 0, 15, 30, 90 minutes and 16 hours after the coating was applied. No difference in scratch resistance was observed.



The degree of scratch resistance of the R109150000 (top) and WX-888650 (bottom) was equivalent.

A standard scratch test was performed on Application Protocol 3 at 0, 15, 30, 120 minutes after the coating was applied. The WX-888650 was observed to be slightly less scratched than the R1091050000, but some allowance should be made for standard error and thus no significant difference in scratch resistance can be inferred.



**No significant difference in scratch resistance was observed.**

**General Observations:** It was noted that the WX-888650 product felt “softer” or “more rubbery” compared with the R109150000 in approximately the first 30 minutes of coating existence. This tactile effect was not found to translate into a measurable or demonstrable difference in scratch resistance between the two coatings. This effect was found to diminish with additional drying time and was not present when tested after 16 hours or thereafter.

**Conclusions:** As tested in this experiment, the degree of scratch resistance of these two coatings was equivalent. The pencil hardness of these two coatings was equivalent in the first 90 minutes of existence. WX-888680 was observed to increase in hardness to B after 16 hours, likely due to a self-crosslinking effect.