

Improve Coating Quality & Reduce Rejects with In-line Rack and Fixture Stripping

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Kolene® Corporation



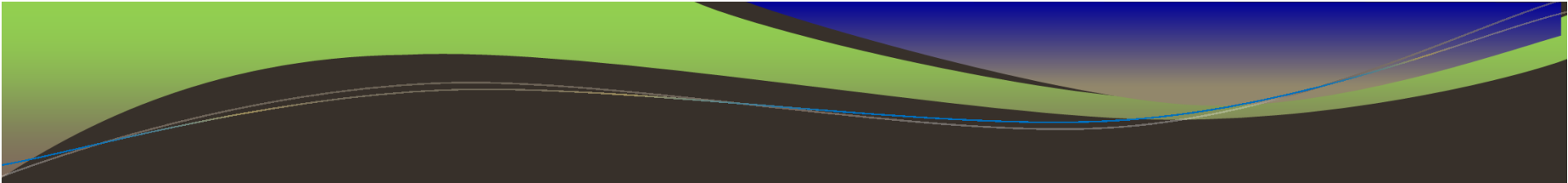
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Clean Racks = Good Grounding

Clean racks — and the good ground that they can provide — facilitate the best possible transfer efficiency from a given application system.



Clean Racks = Good Transfer

Of all of the factors that influence or impact first pass transfer efficiency, clean hooks and good grounding are the easiest to implement and have the most impact.

Coated racks will

- reduce transfer efficiency
- cause poor part quality and consistency
- introduce dirt and grime
- increase coating costs
- increase rejects
- decrease productivity

Rack Stripping...

- impacts overall quality and cost
- is usually not performed often enough
- is the most neglected coating line variable that can undermine all other process control initiatives

Does part size/shape matter?

- are big / heavy parts less sensitive to dirty racks than small / light parts?
- are solid / dense targets easier to coat than open targets
- what happens to ground as the number of passes between stripping increases?

How Bad Is It? - a test protocol

- obtain field data for part-to-ground resistance with clean and coated racks
- determine how quickly a ground goes from good to bad due to paint buildup
- measure influence on part film build at various stages of rack paint buildup

Comprehensive test program to:

- quantify benefits of rack stripping
- determine required stripping frequency



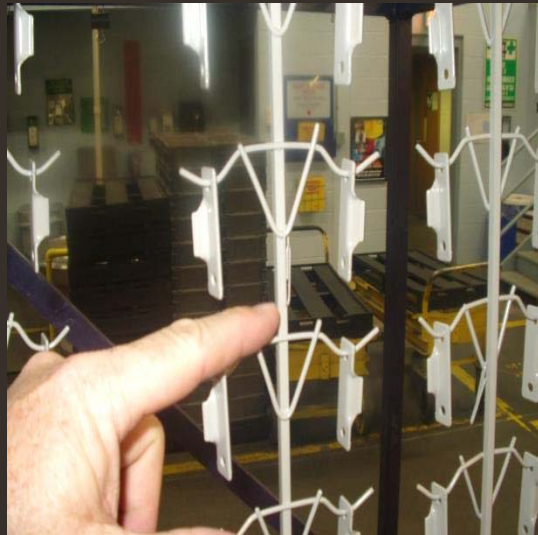
Program included three distinct targets :

- lab-scale testing
- field testing of large, heavy parts
- field testing of small, light parts

Program included three distinct targets :



lab tests



window hardware



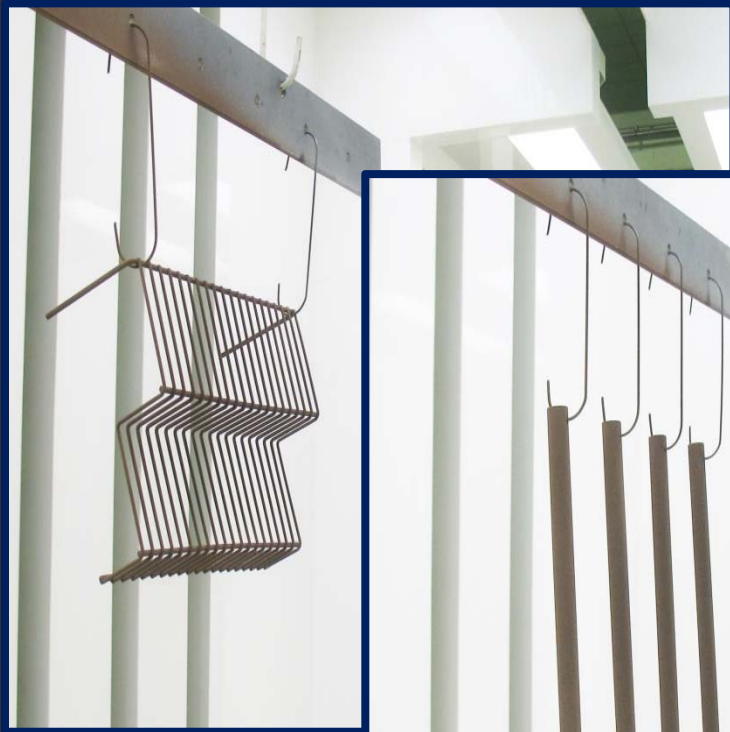
a/c compressor bases



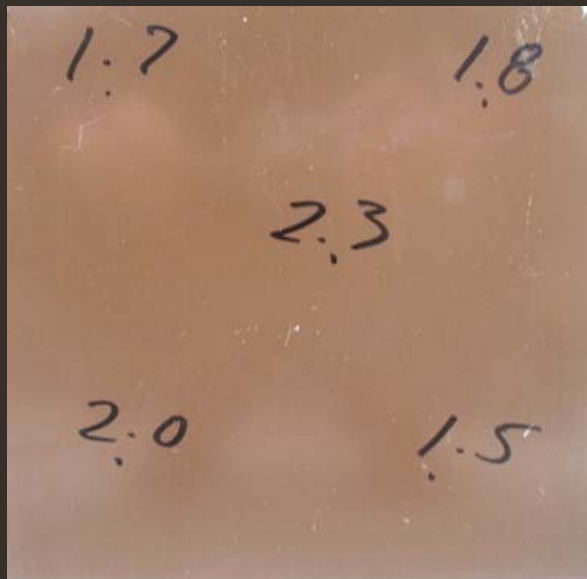
Laboratory Testing

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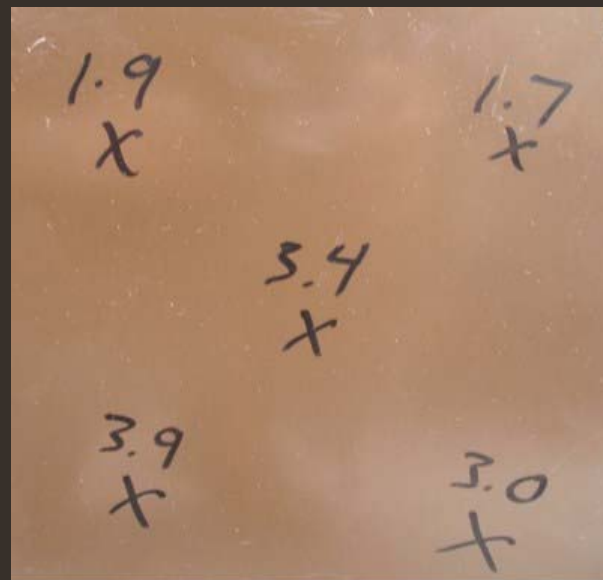
Lab Tests – 3 distinct target geometries



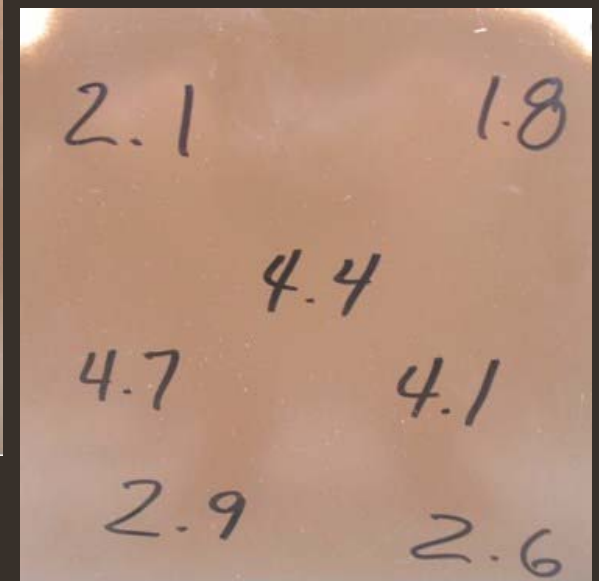
Lab Tests - Film Uniformity vs. Ground



good ground
 $\sigma = 0.32$



poor ground
 $\sigma = 0.97$



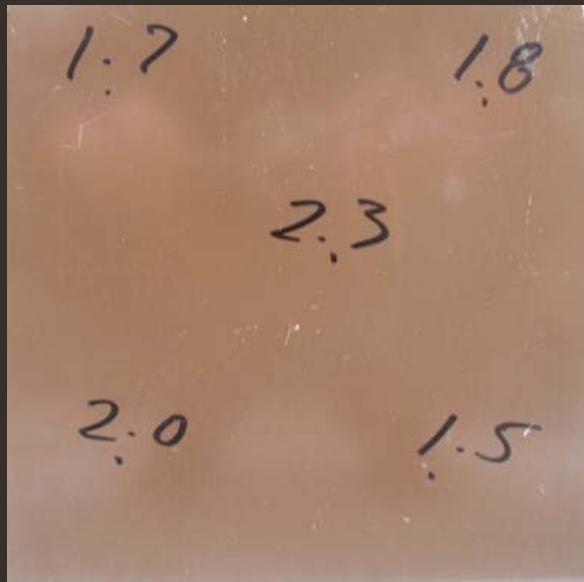
no ground
 $\sigma = 1.10$

Lab Tests - Film Uniformity vs. Ground

GOOD GROUND – RESISTANCE <1.0 MEGOHM

Part Type	Grams Sprayed	Grams on Part	Transfer Efficiency	Film Build Min	– mils Max	Sigma	First Pass Quality
Flat Panel	28.1	7.8	28%	1.7	2.3	0.32	Excellent
Wire Shelf	27.0	8.9	33%	1.9	2.0	0.20	Excellent
Tubes	30.4	8.8	29%	1.8	2.4	0.35	Excellent
Average			30%				

Lab Tests - Film Uniformity vs. Ground

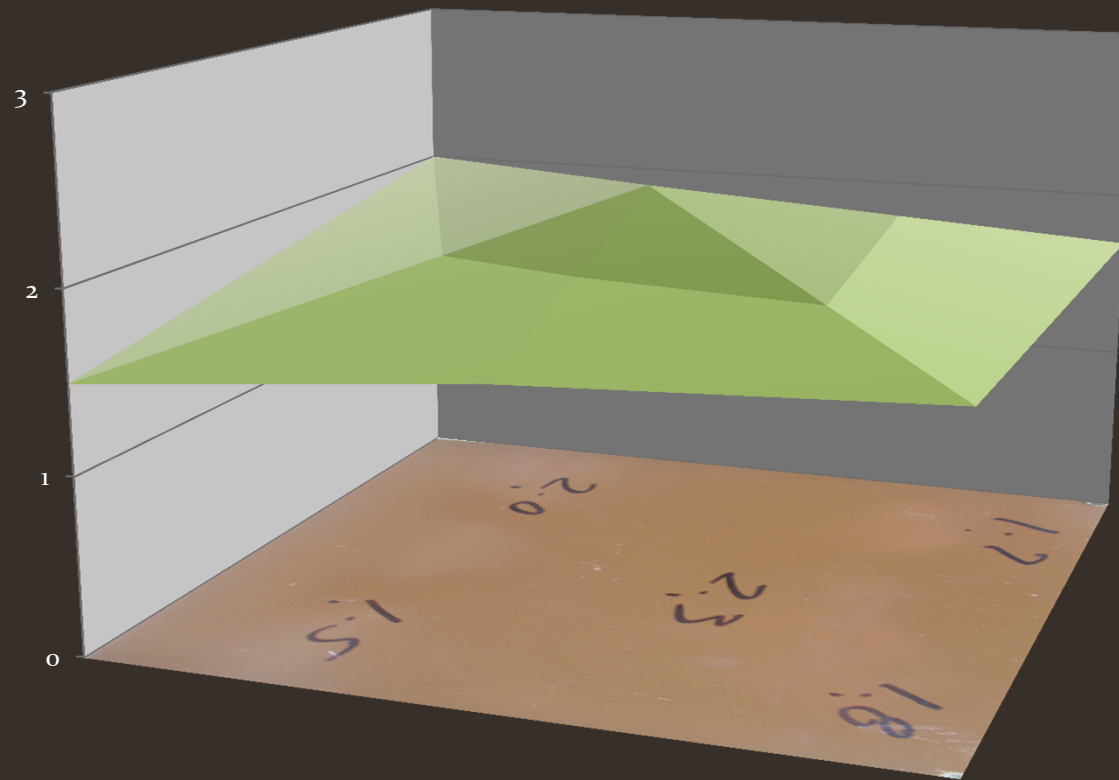


good ground
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good ground
 $\sigma = 0.35$

Lab Tests - Film Uniformity vs. Ground



0-1 1-2 2-3

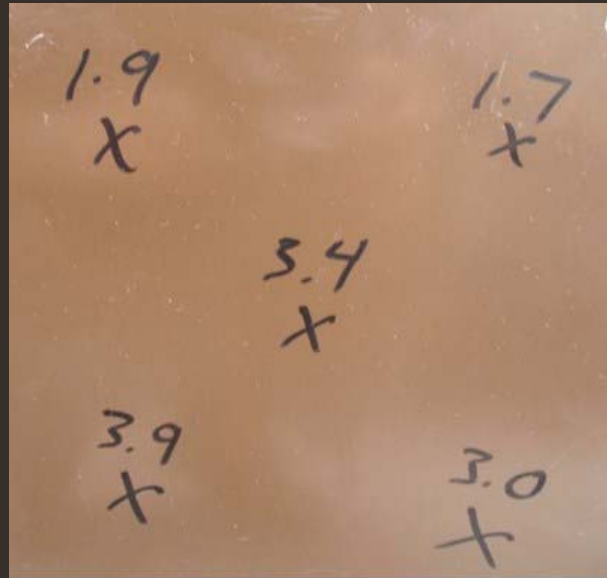
good ground
 $\sigma = 0.32$

Lab Tests - Film Quality vs. Ground

POOR GROUND – RESISTANCE >1.0 MEGOHM

Part Type	Grams Sprayed	Grams on Part	Transfer Efficiency	Film Build – mils Min	Max	Sigma	Uniformity
Flat Panel	35.1	9.2	26%	1.7	3.9	0.97	POOR
Wire Shelf	28.0	7.9	28%	1.8	3.8	0.95	POOR
Tubes	38.0	10.2	27%	2.1	4.0	0.99	POOR
Average			27%				

Lab Tests - Film Uniformity vs. Ground

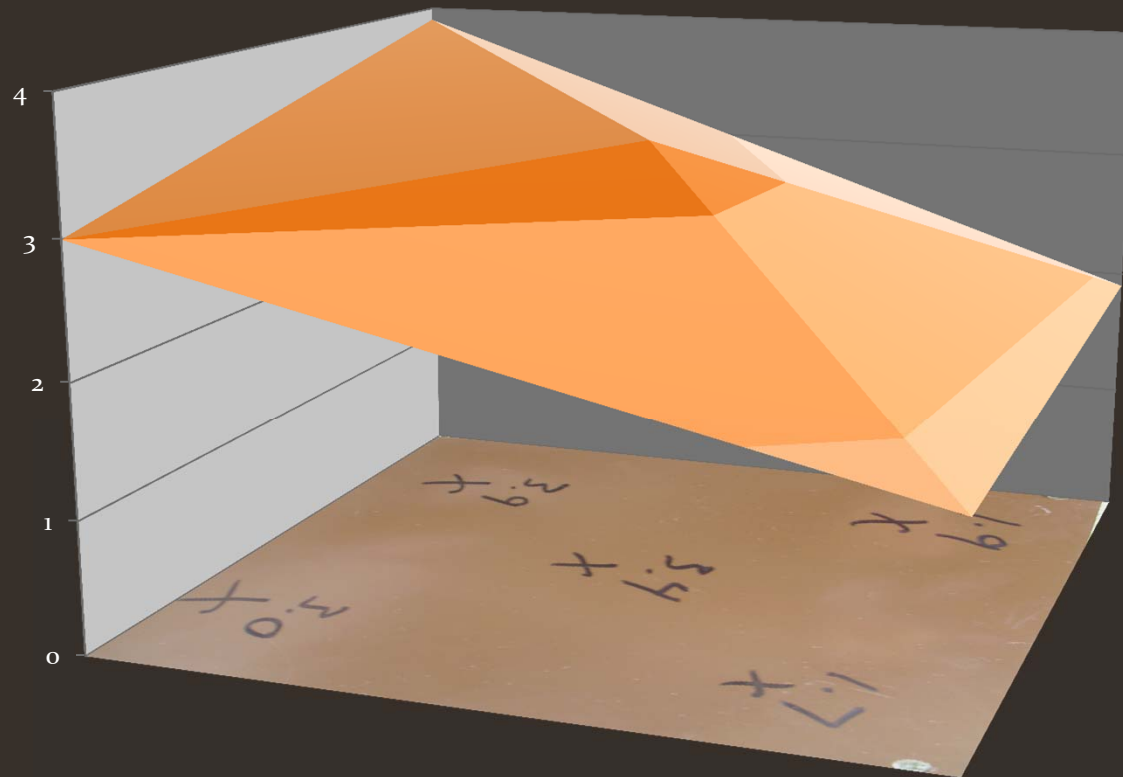


poor ground
 $\sigma = 0.97$



poor ground
 $\sigma = 0.99$

Lab Tests - Film Uniformity vs. Ground



0-1 1-2 2-3 3-4

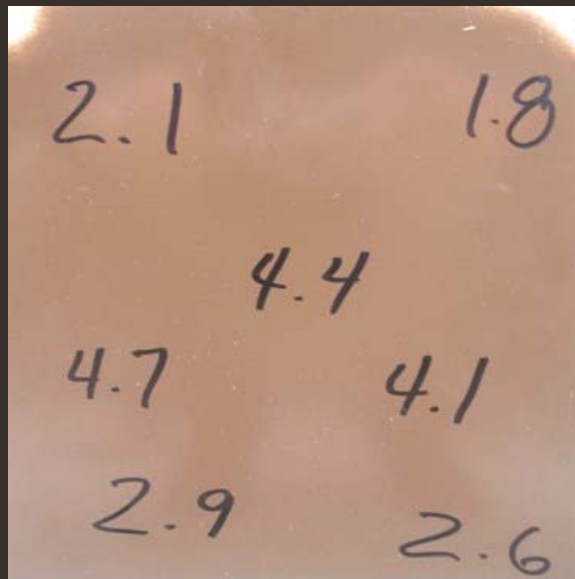
poor ground
 $\sigma = 0.97$

Lab Tests - Film Quality vs. Ground

NO GROUND – INFINITE RESISTANCE

Part Type	Grams Sprayed	Grams on Part	Transfer Efficiency	Film Build – mils Min	Max	Sigma	First Pass Quality
Flat Panel	36.3	9.7	26%	1.8	4.7	1.1	Reject
Wire Shelf	35.6	7.9	27%	1.7	4.5	1.2	Reject
Tubes	37.9	8.1	21%	1.7	4.9	1.5	Reject
Average			25%				

Lab Tests - Film Uniformity vs. Ground

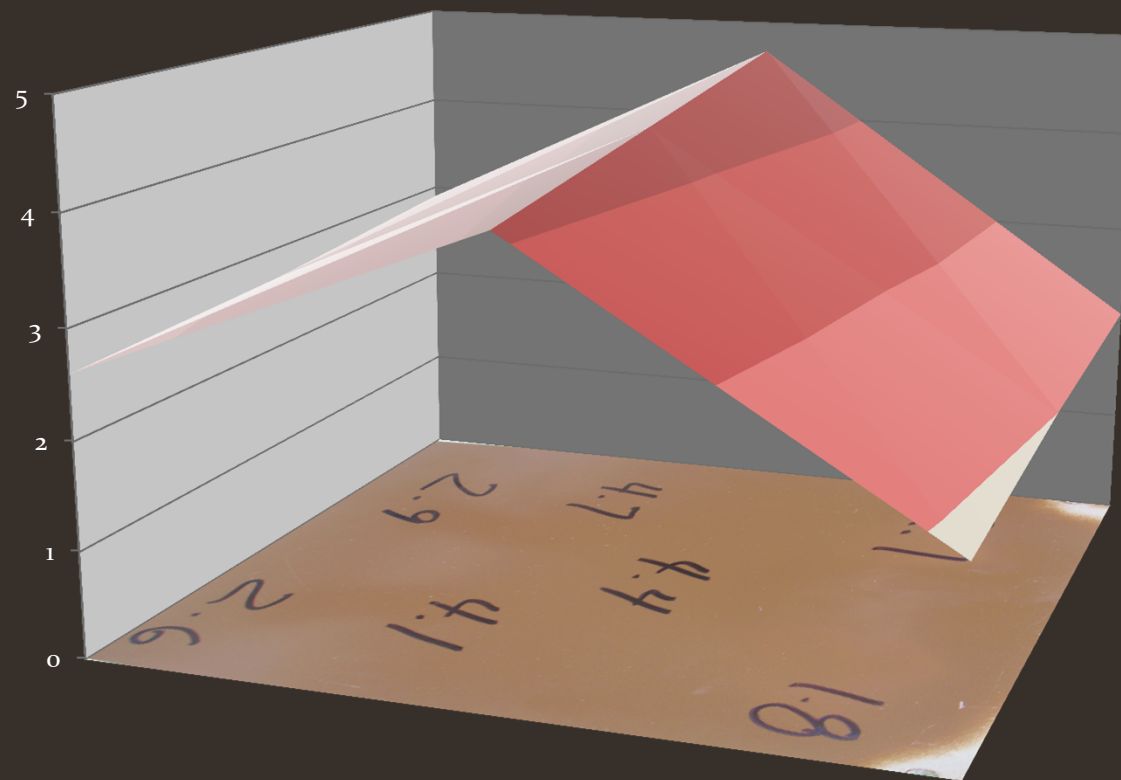


no ground
 $\sigma = 1.10$



no ground
 $\sigma = 1.5$

Lab Tests - Film Uniformity vs. Ground

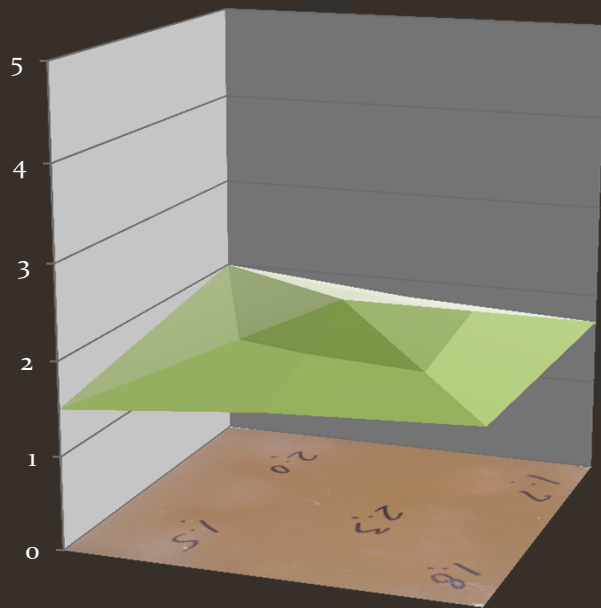


■ 0-1 ■ 1-2 ■ 2-3 ■ 3-4 ■ 4-5

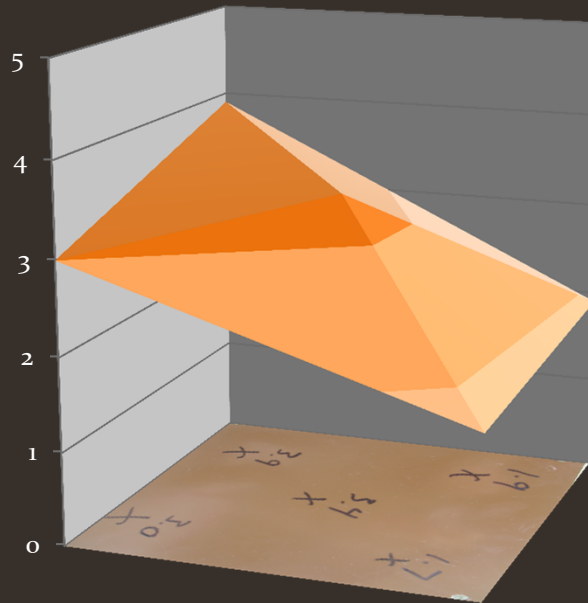
no ground

$\sigma = 1.10$

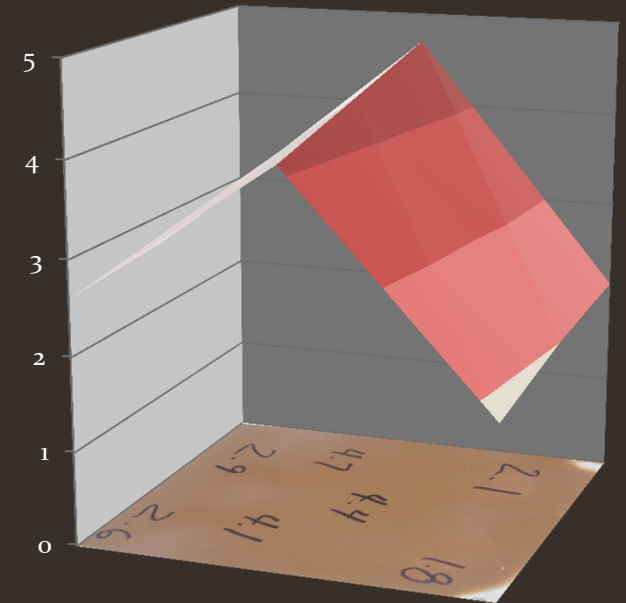
Lab Tests - Film Uniformity vs. Ground



good ground
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poor ground
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no ground
 $\sigma = 1.10$

Lab Tests - Film Uniformity vs. Ground



good ground

$$\sigma = 0.35$$



poor ground

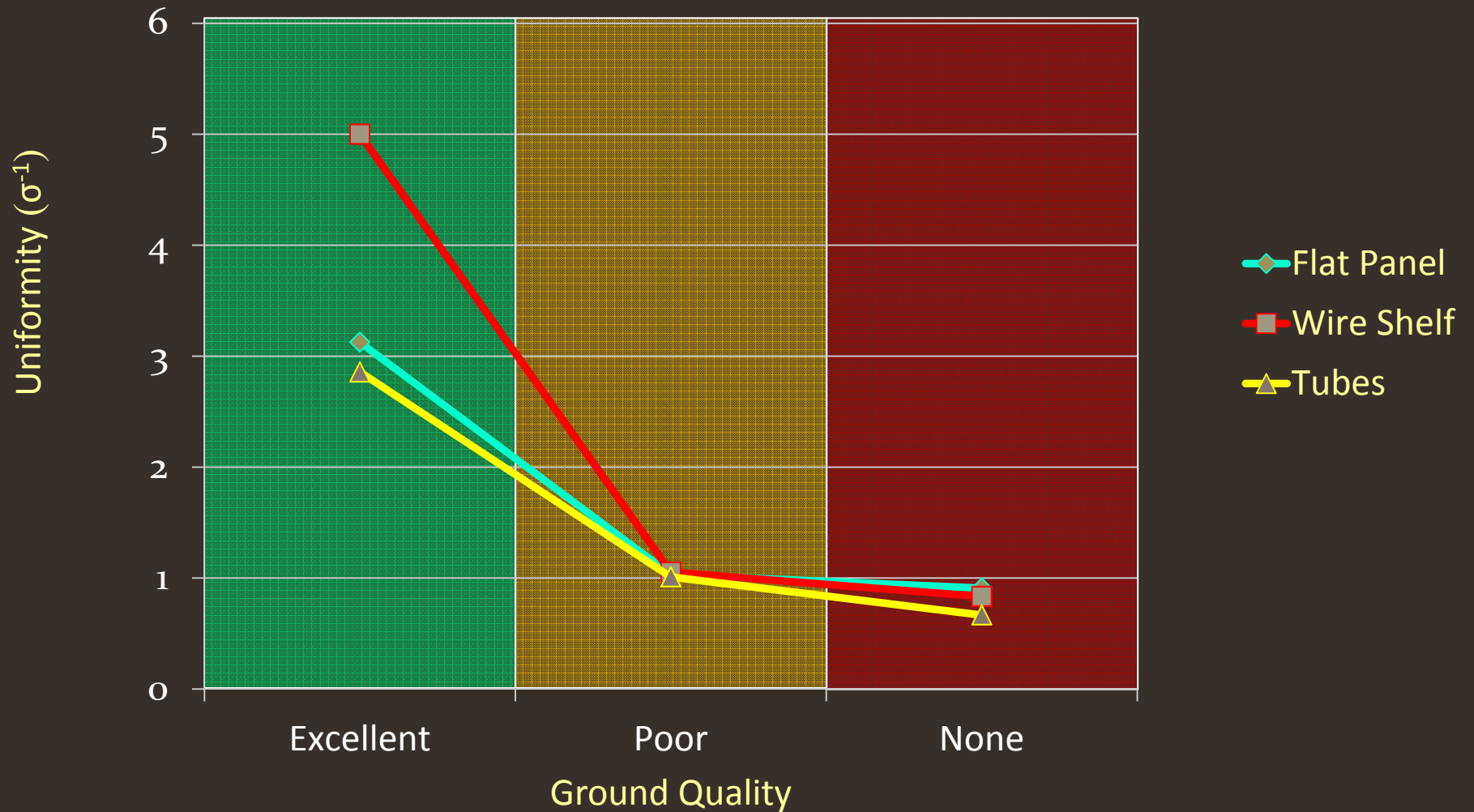
$$\sigma = 0.99$$



no ground

$$\sigma = 1.5$$

Lab Tests - Film Quality vs. Ground





Large, Heavy Part Testing Industrial Coating Line

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Test results – heavy parts

- heavy parts can initially cut through coating buildups to establish grounding
- as coating thickness increases, the ground path becomes unreliable
- ... or grounding fails completely



Field results – heavy parts ground

Fixture ID	Pass #1	Pass #2	Pass #3	Pass #4	Pass #5	Pass #6
a	R	R	R	U	U	U
b	R	R	R	R	F	F
c	R	R	R	R	R	R
d	R	R	U	U-F	U-F	F
e	R	U	F	F	F	F
f	R	R-U	R-U	U	U	U
g	R	R	R	R	U	U
h	R	R	U	U	U	F

Reliable

Unreliable

Fail

Test results – heavy part

- even after one or two passes through the line, transfer efficiency starts to suffer
- higher film build variations are seen, along with lower transfer efficiencies
- clean racks are essential for optimal coating line results





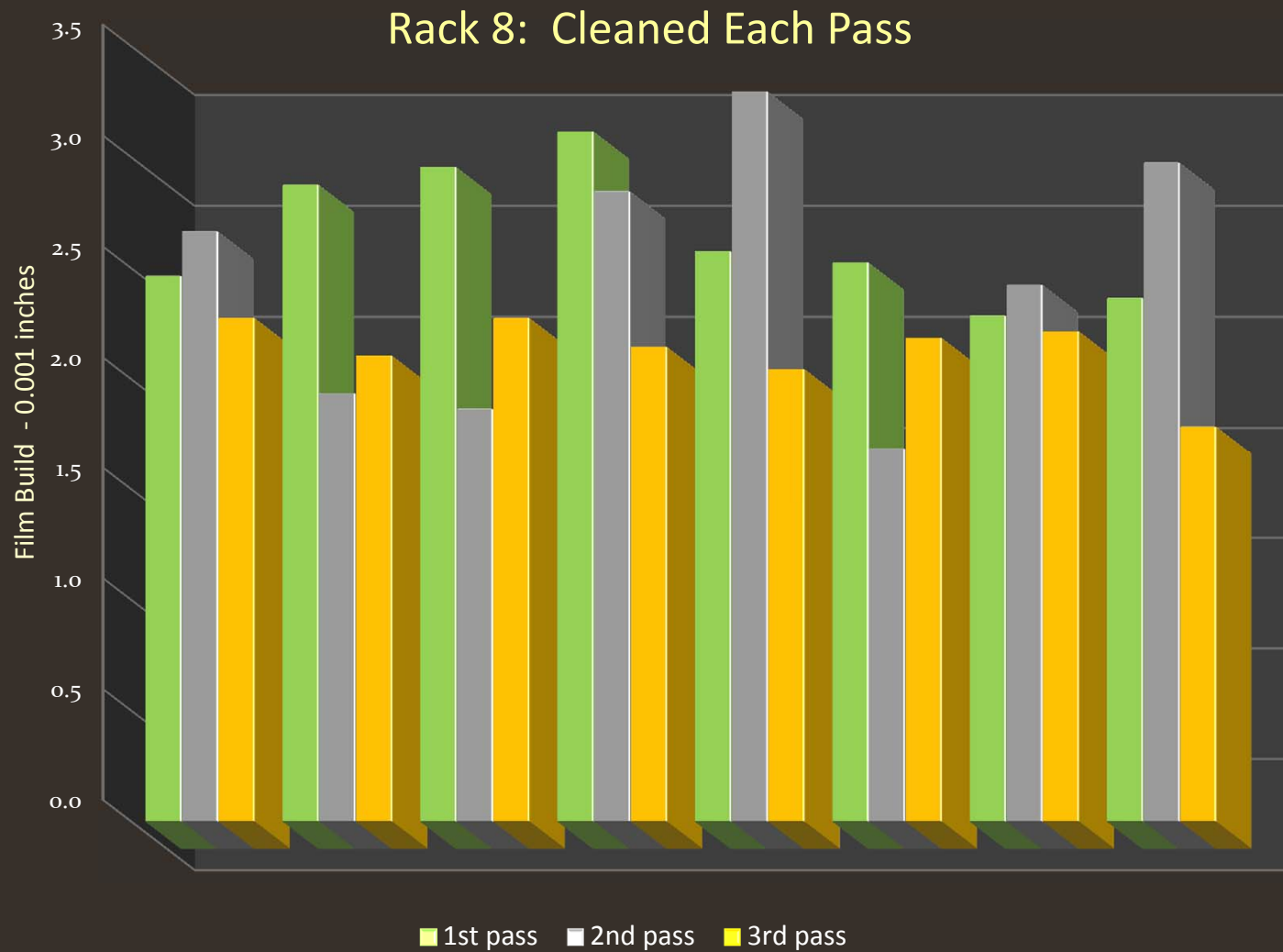
Small, Light Part Testing Industrial Coating Line

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Test results – light parts

- ground path reliability was non-existent after one pass through the line
- all parts showed 100% failed ground after two passes through the line
- all parts on the stripped control racks showed reliable grounding on every pass

Test results – light parts



Test results – light parts

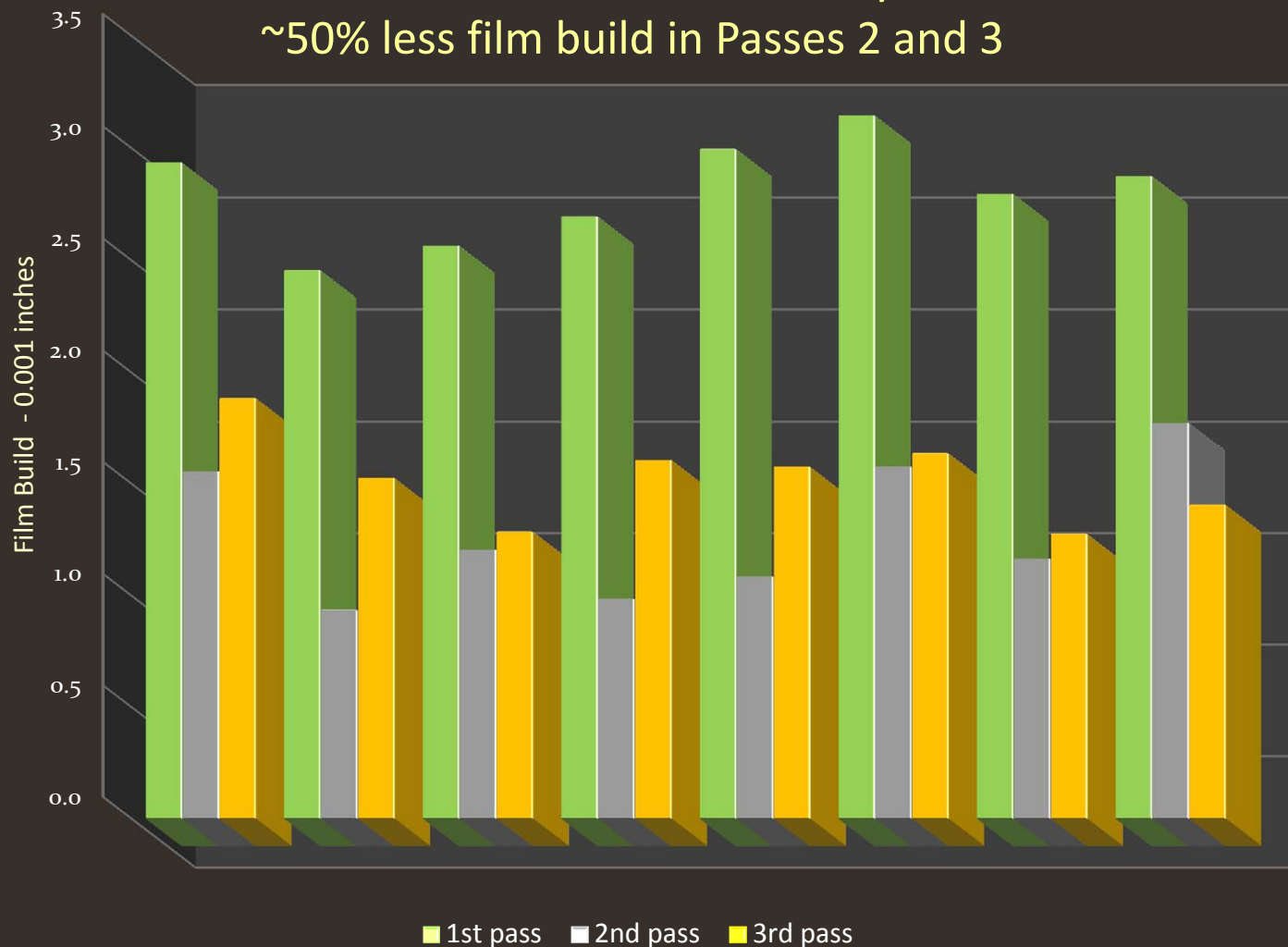
clean rack &
good part ground

rack after 2 passes
& poor part ground

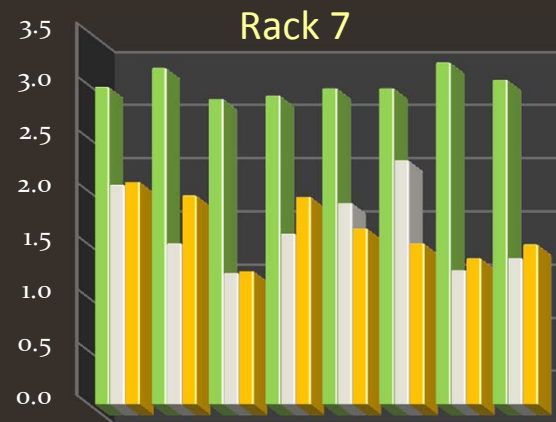
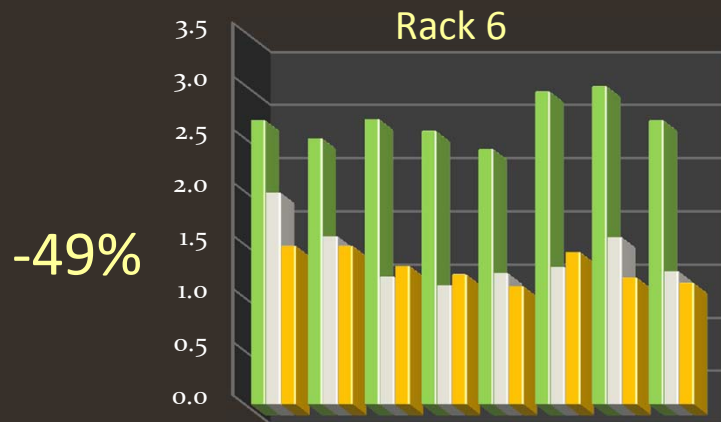
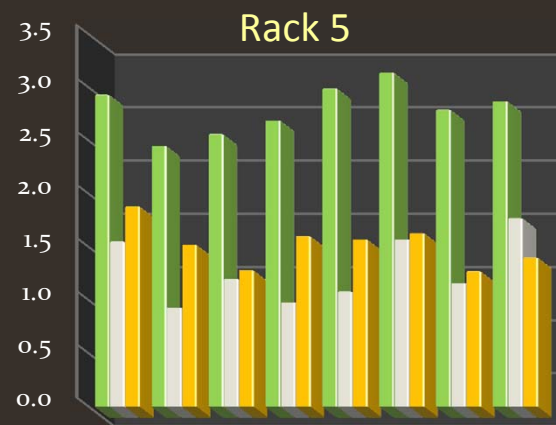
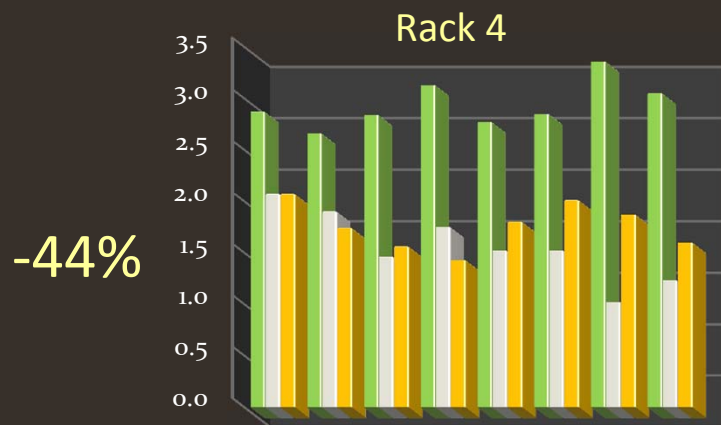


Test results – light parts

Rack 5: Clean 1st Pass Only
~50% less film build in Passes 2 and 3



Test results – light parts



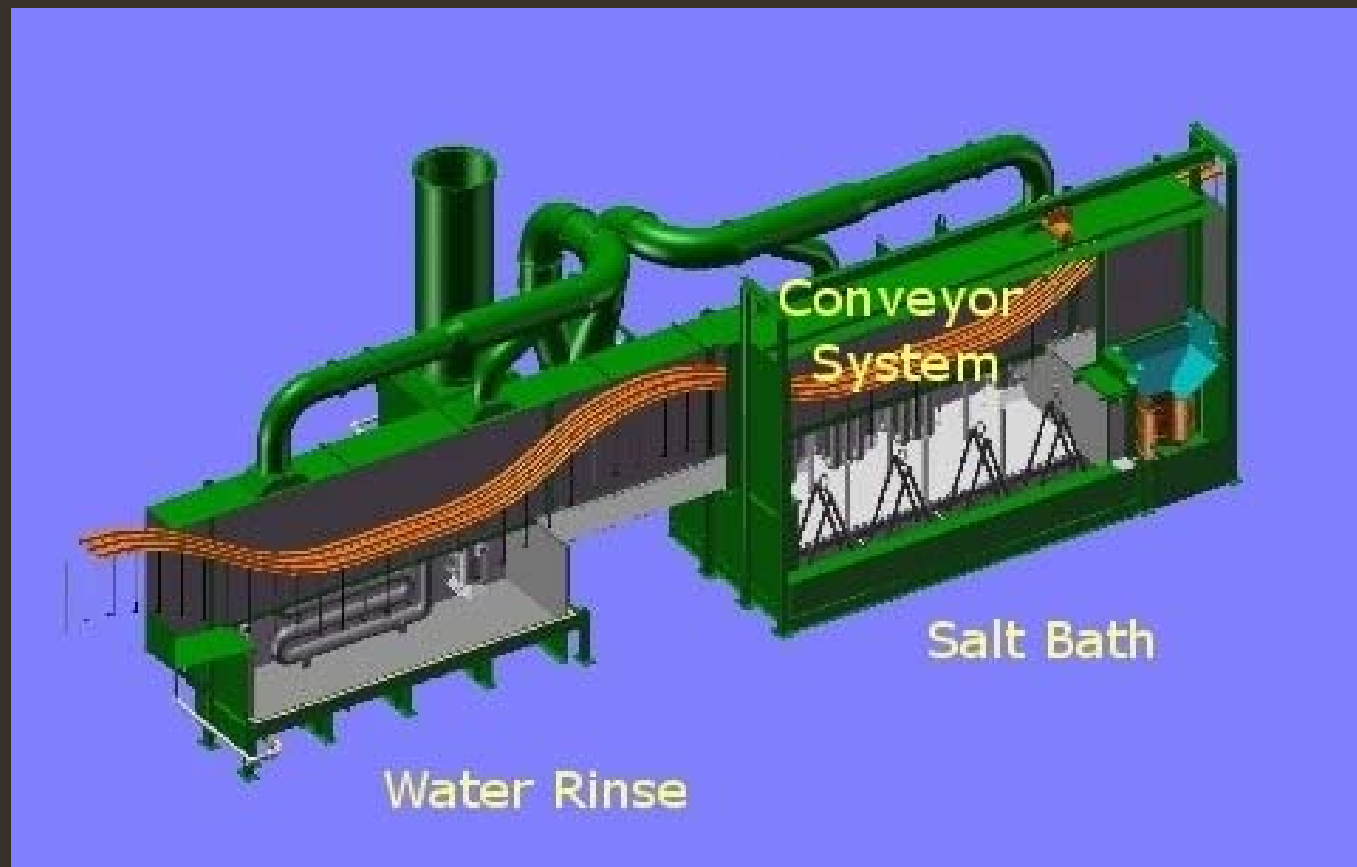
average film build change - clean stripped rack vs 1 or 2 coats on rack

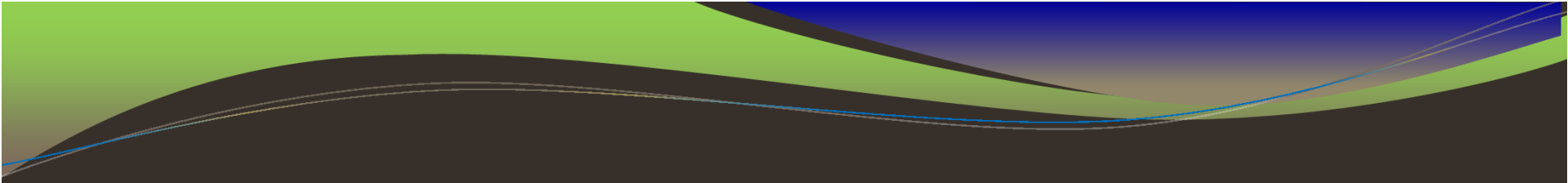
In-Line, On-Line Stripping ... at normal line speeds



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In-Line, On-Line Stripping ... at normal line speeds



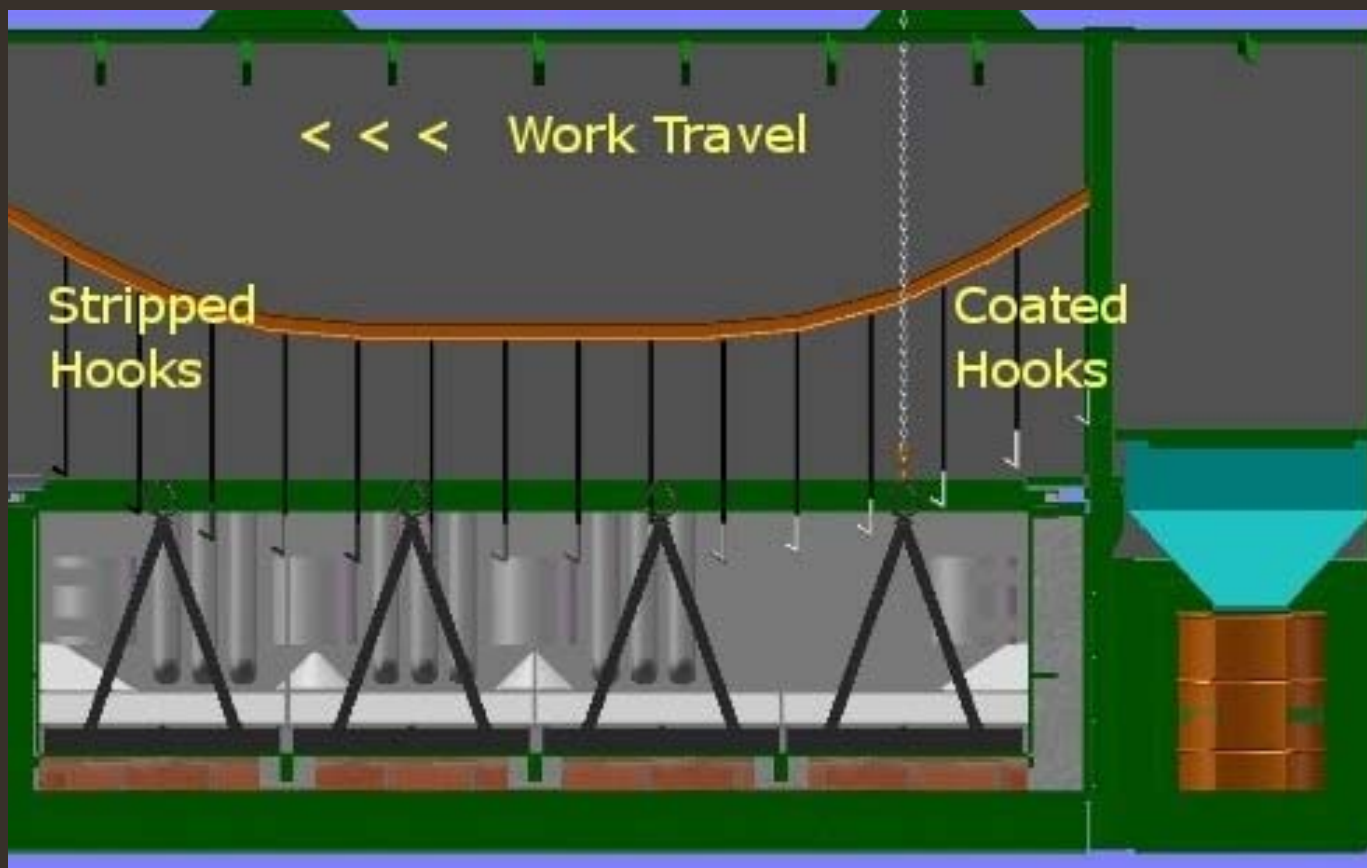


In-Line, On-Line Stripping System Capabilities Example

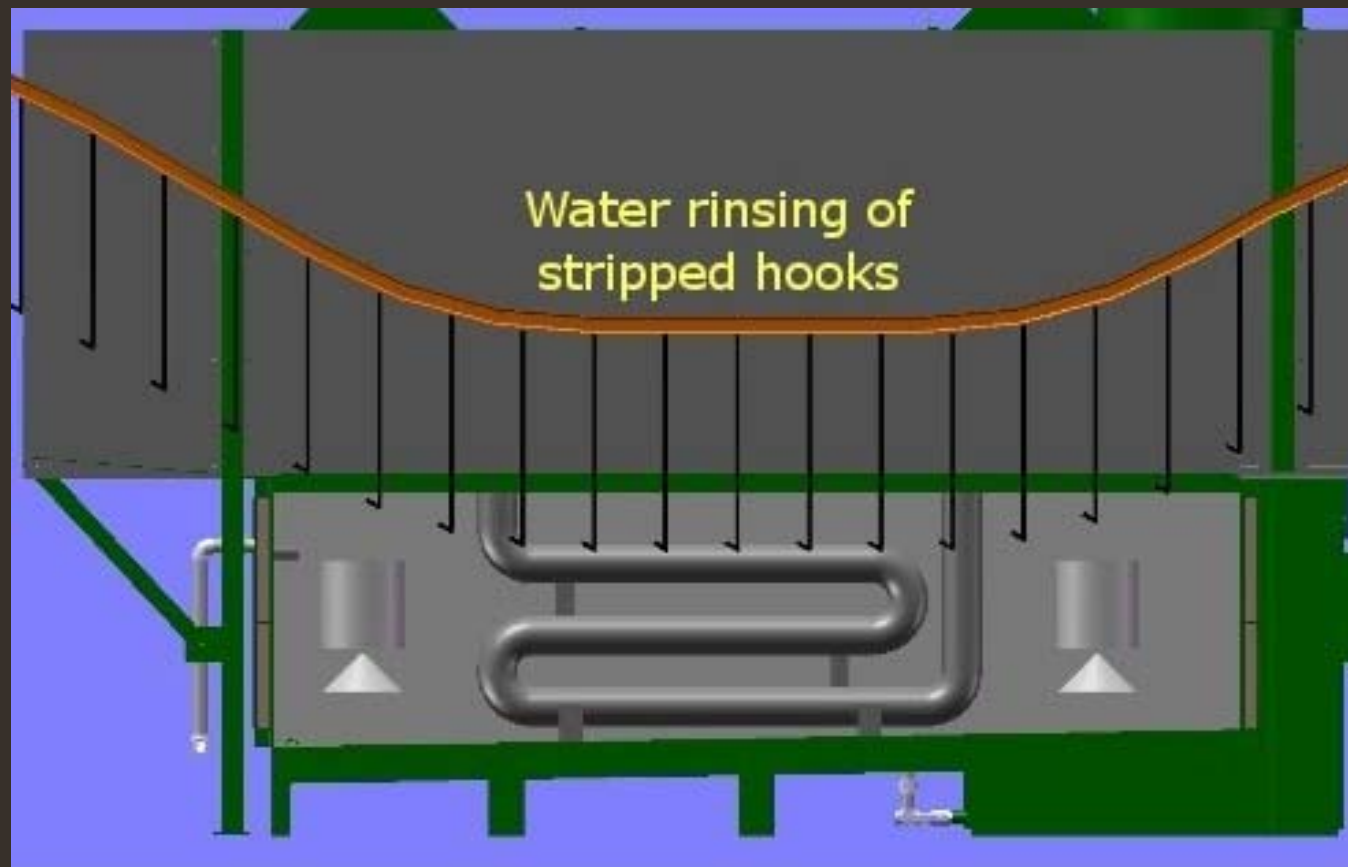
Footprint:	45' x 13' wide x 12' tall
Line speed:	14 feet per minute
Throughput:	5,040* hooks per hour

**system services three conveyor lines simultaneously*

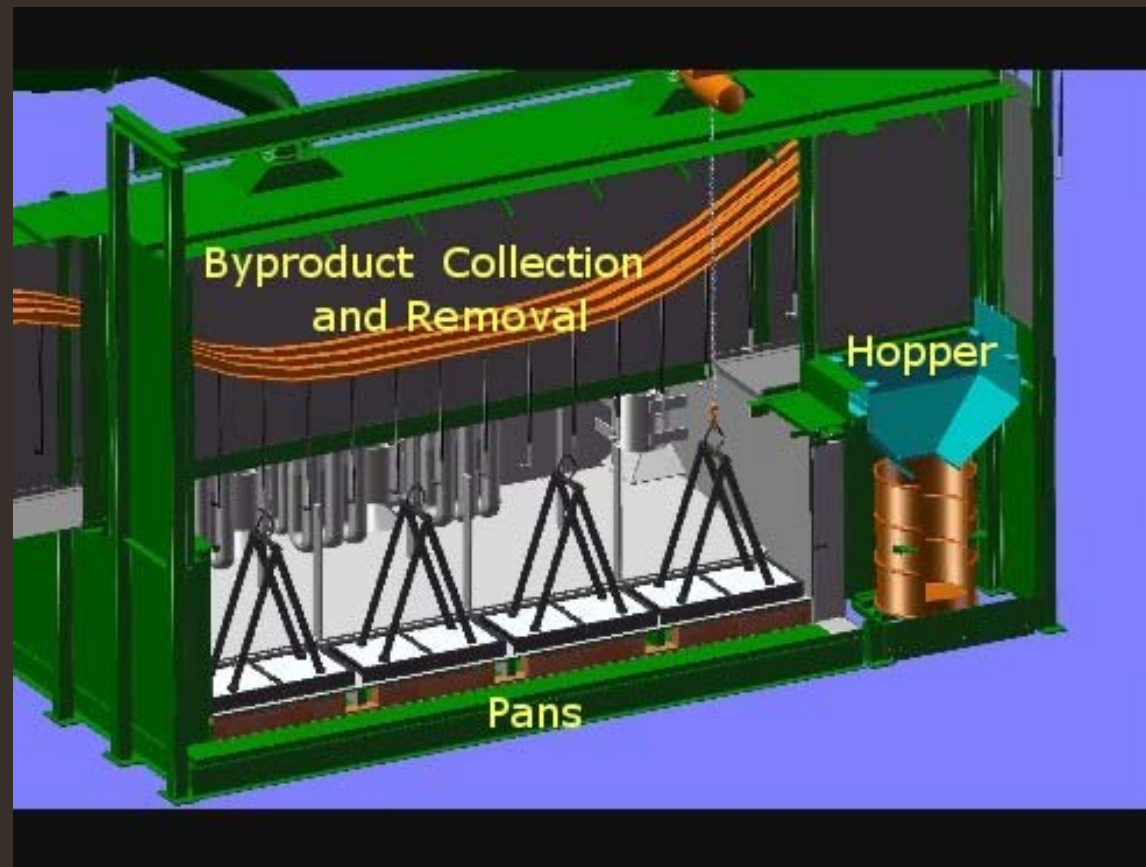
In-Line, On-Line Stripping ... at normal line speeds

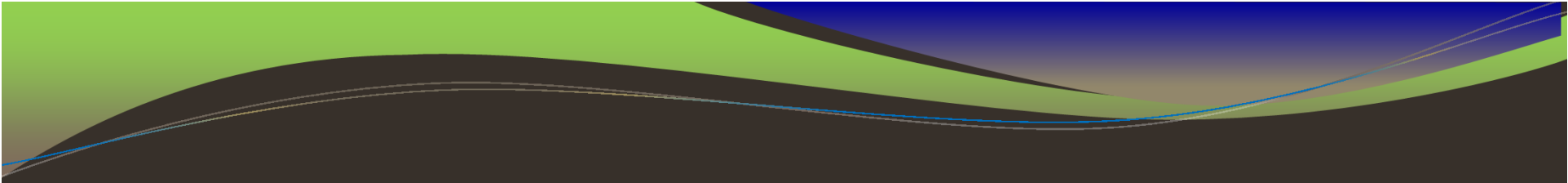


In-Line, On-Line Stripping ... at normal line speeds



In-Line, On-Line Stripping ... at normal line speeds





In-Line, On-Line Stripping System Benefits

- 40% reduction in reject rates
- Increased transfer efficiency
- Improved coating uniformity & quality
- Significant decrease in annual operating costs

Thank You



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