



Our popular Ask Joe Powder blog has made its way to the pages of PCI magazine. What are your powder coating questions and challenges? Joe Powder, aka Kevin Biller of ChemQuest Powder Coating Research, shares his powder coating knowledge and expertise by answering questions sent in from around the world.

### Hi Joe,

I have a technical question to ask. I hope you have the answer. I read some non-technical articles mentioning powder coatings used on wood. How is this possible when wood is a non-magnetic material?

Dr. Jinwen Zhang Washington State University

# Hello Dr. Zhang,

Electrostatics, not magnetism, are used to deposit dry powder onto a substrate. Nevertheless, this is still a good question. Most wood has surface characteristics that allow electrostatic deposition of powder onto its surface. In some cases, like MDF (medium density fiberboard), the "wood" needs to be preheated to allow moisture to migrate to the surface of the board. This moisture provides enough conductivity to deposit the charged powder.

One of the challenges to coat wood is having a powder coating chemistry that cures at low temperatures. If the cure temperature is too high, the wood emits volatiles that damage the coating appearance. The powder coating industry has developed chemistries and processes that allow MDF to be coated commercially. Please let me know if you would like to know more about these chemistries.

#### Best regards,

Joe

## Dear Joe,

I hope that you and your family are well. Long time no see. How is your business?

I have a question regarding Qualicoat Class 1 approval. For polyester TGIC powder coatings, the gloss should not be less than 50% after 1,000 hours xenon arc exposure. I want to know if a powder, based on a standard polyester TGIC resin, will pass this test (approximately equivalent to one year in Florida). Do we need another type of polyester resin for Class 1?

#### Regards,

Mohammed Seddighian Tehran, Iran

# Hello Mr. Seddighian,

All is well here. We just wrapped up the holiday season and are prepared for the onset of winter in Columbus. I have been enjoying family gatherings and good cheer. I hope you and your family are well. Our business is doing well – we are now part of ChemQuest and continue to grow each year.

A standard architectural-grade TGIC polyester will meet the Qualicoat Class 1 specification. Qualicoat Class 1 essentially requires a powder coating finish to maintain color and gloss after one year of exposure to a south Florida climate. The specification also requires chemical resistance, so it is important to confirm mortar and sulfuric acid resistance performance. In addition, it is important to select your polyester resin from a



# ASK JOE POWDER



reputable supplier. Furthermore, make sure that the pigments and additives in your formula are weather resistant. Some waxes are not UV-durable. Keep in mind that many organic pigments will fade from one year of Florida exposure. So, choose your additives and pigments wisely.

Please let me know if you have any further questions and have a pleasant rest of your day.

#### Kind regards,

Joe

#### Hello Joe,

I just read an article you wrote in 2012 titled Options for Low Temperature Cure Powder Coatings. In the article, you included a table that compared energy consumption at 325 °F and 375 °F. My company has been using a low-cure powder for quite some time, but we are considering a switch to a dry-on-dry (DoD) process that requires 375 °F cure temperature.

I have done some testing on the DoD process and the results look promising, but no one has quantified what this type of change would cost in materials, energy, and throughput. I would like to use your spreadsheet to provide data for the team.

Please provide a copy at your earliest convenience.

#### Thanks,

Bob Branstad Iowa

## Good morning, Mr. Branstad,

Thanks for reading my work. The spreadsheet is below. I have an Excel version that is interactive with inputs for energy costs and parts mass and dimensions. I encourage readers to contact me for that version.

Good luck with your project. Be sure to conduct adequate testing and proof of concept before making this major switch. Dry-on-dry is a great idea, however, the appearance can be variable.

#### Kind regards,

Joe

#### Oven Energy Savings

Oven Size (ft) Oven Surface (sq ft) Start-up Temp (deg F) Oven Temp (deg F) Temp Rise (deg F) Panel Thickness (in) Panel Loss Factor Panel Heat Loss (btu's) Parts Specific Heat Chain Chain Weight (lbs/ft) Trolley Centers (in) Trolley Weight (lbs/ft) Racks (lbs/ft) Part Weight (lbs/rack) Total Weight (lbs) Eine Speed (ft/min) Load per Minute (lbs) Btu's/hr Exhaust Volume (CFM) Exhaust Loss (btu's) Total Cu ft Nat Gas/hr Total cu ft Nat Gas/hr Total cu ft Nat Gas \$\frac{325^{\text{F}}}{70}\$  20x50x10 20x		Oven Temperature	
Oven Surface (sq ft)         3400           Start-up Temp (deg F)         70           Oven Temp (deg F)         375         325           Temp Rise (deg F)         305         255           Panel Thickness (in)         4         4           Panel Loss Factor         0.35         362,950         303,450           Parts         Steel         Steel           Specific Heat         0.12         Chain         X348           Chain Weight (lbs/ft)         2.14         Trolley Centers (in)         12           Trolley Centers (in)         12         2.34         2.00           Conveyor Weight (lbs/ft)         2.34         2.00         2.34           Conveyor Weight (lbs/ft)         2.00         2.00         2.00           Part Weight (lbs/rack)         1.00         1.00         1.00         1.00           Total Weight (lbs/rack)         9.82         2.00         1.00         <		375°F 325°F	
Start-up Temp (deg F)	Oven Size (ft)	20x50x10	
Oven Temp (deg F)         375         325           Temp Rise (deg F)         305         255           Panel Thickness (in)         4           Panel Loss Factor         0.35           Panel Heat Loss (btu's)         362,950         303,450           Parts         Steel           Specific Heat         0.12           Chain         X348           Chain Weight (lbs/ft)         2.14           Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         4.48           Racks (lbs/ft)         2.00           Part Weight (lbs/reck)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/hr         1,086         908 <tr< th=""><th>Oven Surface (sq ft)</th><th colspan="2">3400</th></tr<>	Oven Surface (sq ft)	3400	
Temp Rise (deg F)         305         255           Panel Thickness (in)         4         4           Panel Loss Factor         0.35         362,950         303,450           Parts         Steel         59ecific Heat         0.12         0.12           Chain         K348         0.12         0.1	Start-up Temp (deg F)	70	
Panel Thickness (in)         4           Panel Loss Factor         0.35           Panel Heat Loss (btu's)         362,950         303,450           Parts         Steel           Specific Heat         0.12           Chain         X348           Chain Weight (lbs/ft)         2.14           Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         2.00           Part Weight (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         1,086,444         908,339           Total btu's/hr         1,086,444         908,339           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/hr         1,086         908           Total c	Oven Temp (deg F)	375	325
Panel Loss Factor         0.35           Panel Heat Loss (btu's)         362,950         303,450           Parts         Steel           Specific Heat         0.12           Chain         X348           Chain Weight (lbs/ft)         2.14           Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         4.48           Racks (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Eu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas         9,7778         8,175 <t< th=""><th>Temp Rise (deg F)</th><th>305</th><th>255</th></t<>	Temp Rise (deg F)	305	255
Panel Heat Loss (btu's)   362,950   303,450     Parts   Steel     Specific Heat   0.12     Chain   X348     Chain Weight (lbs/ft)   2.14     Trolley Centers (in)   12     Trolley Weight (lbs/ft)   2.34     Conveyor Weight (lbs/ft)   4.48     Racks (lbs/ft)   2.00     Part Weight (lbs/rack)   1.00     Total Weight/ft (lbs)   9.82     Line Speed (ft/min)   3.0     Load per Minute (lbs)   29.5     Load per Hour (lbs)   1767.6     Btu's/hr   64,694   54,089     Exhaust Volume (CFM)   2,000     Exhaust Loss (btu's)   658,800   550,800     Total btu's/hr   1,086,444   908,339     Total Btu's/9 hr shift   9,777,997   8,175,047     Heating Type   Nat Gas     Total cu ft Nat Gas/9hr st   9,778   8,175     \$1,00 cu ft Nat Gas   \$0.83     \$5/hr Energy Cost   \$9.02   \$7.54     \$100 cu ft Nat Gas   \$0.83     \$100 cu ft Nat Gas   \$0.83	Panel Thickness (in)	4	
Parts   Steel	Panel Loss Factor	0.35	
Specific Heat	Panel Heat Loss (btu's)	362,950	303,450
Chain         X348           Chain Weight (lbs/ft)         2.14           Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         4.48           Racks (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Btu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas         \$0.83         \$/100 cu ft Nat Gas           \$/hr Energy Cost         \$9.02         \$7.54	Parts	Steel	
Chain Weight (lbs/ft)         2.14           Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         4.48           Racks (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Btu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas         \$0.83         \$/100 cu ft Nat Gas           \$/hr Energy Cost         \$9.02         \$7.54	Specific Heat	0.12	
Trolley Centers (in)         12           Trolley Weight (lbs/ft)         2.34           Conveyor Weight (lbs/ft)         4.48           Racks (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Btu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas         9,778         8,175           \$/100 cu ft Nat Gas         \$0.83         \$0.83           \$/hr Energy Cost         \$9.02         \$7.54	Chain	X348	
Trolley Weight (lbs/ft)  Conveyor Weight (lbs/ft)  Racks (lbs/ft)  Part Weight (lbs/rack)  Total Weight/ft (lbs)  Line Speed (ft/min)  Load per Minute (lbs)  Load per Hour (lbs)  Btu's/hr  Exhaust Volume (CFM)  Exhaust Loss (btu's)  Total btu's/hr  Total Btu's/9 hr shift  Heating Type  Total cu ft Nat Gas/hr  Total cu ft Nat Gas/9hr st \$\frac{1}{3}\text{100}{3}\text{200}{3}\text{200}{3}\text{200}{3}\text{200}{3}\text{2000}{3}2	Chain Weight (lbs/ft)	2.14	
Conveyor Weight (lbs/ft)	Trolley Centers (in)	12	
Racks (lbs/ft)         2.00           Part Weight (lbs/rack)         1.00           Total Weight/ft (lbs)         9.82           Line Speed (ft/min)         3.0           Load per Minute (lbs)         29.5           Load per Hour (lbs)         1767.6           Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Btu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/9hr st         9,778         8,175           \$/100 cu ft Nat Gas         \$0.83         \$0.83           \$/hr Energy Cost         \$9.02         \$7.54	Trolley Weight (lbs/ft)	2.34	
Description	Conveyor Weight (lbs/ft)	4.48	
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Line Speed (ft/min)  Load per Minute (lbs)  Load per Hour (lbs)  Btu's/hr  Exhaust Volume (CFM)  Exhaust Loss (btu's)  Total btu's/hr  Total Btu's/9 hr shift  Heating Type  Total cu ft Nat Gas/hr  Total cu ft Nat Gas/9hr st \$\frac{1}{3}\text{100}{3}\t	Part Weight (lbs/rack)	1.00	
Load per Minute (lbs)  Load per Hour (lbs)  Btu's/hr  Exhaust Volume (CFM)  Exhaust Loss (btu's)  Total btu's/hr  Total Btu's/9 hr shift  Heating Type  Total cu ft Nat Gas/hr  Total cu ft Nat Gas/9hr st \$\frac{1}{3}\frac{1}\frac{1}{3}\frac{1}{3}\frac{1}{3}\frac{1}{3}1	Total Weight/ft (lbs)	9.82	
Load per Hour (lbs)       1767.6         Btu's/hr       64,694       54,089         Exhaust Volume (CFM)       2,000       550,800         Exhaust Loss (btu's)       1,086,444       908,339         Total Btu's/9 hr shift       9,777,997       8,175,047         Heating Type       Nat Gas         Total cu ft Nat Gas/hr       1,086       908         Total cu ft Nat Gas/9hr st       9,778       8,175         \$/100 cu ft Nat Gas       \$0.83         \$/hr Energy Cost       \$9.02       \$7.54	Line Speed (ft/min)		
Btu's/hr         64,694         54,089           Exhaust Volume (CFM)         2,000           Exhaust Loss (btu's)         658,800         550,800           Total btu's/hr         1,086,444         908,339           Total Btu's/9 hr shift         9,777,997         8,175,047           Heating Type         Nat Gas           Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/9hr st         9,778         8,175           \$/100 cu ft Nat Gas         \$0.83           \$/hr Energy Cost         \$9.02         \$7.54	Load per Minute (lbs)		
Exhaust Volume (CFM)  Exhaust Loss (btu's)  Total btu's/hr  Total Btu's/9 hr shift  Heating Type  Total cu ft Nat Gas/hr  Total cu ft Nat Gas/9hr st \$\frac{1}{3}\text{100 cu ft Nat Gas}\$	Load per Hour (lbs)		
Columbia	Btu's/hr	64,694	54,089
Total btu's/hr	Exhaust Volume (CFM)		
Total Btu's/9 hr shift	Exhaust Loss (btu's)	658,800	550,800
Nat Gas   Total cu ft Nat Gas/hr   1,086   908   908   1,086   908   9,778   8,175   9,778   8,175   9,778   1,000 cu ft Nat Gas   \$0.83   \$1,000 cu ft Nat Gas   \$0.83   \$1,000 cu ft Nat Gas   \$1,000 cu f	Total btu's/hr	1,086,444	908,339
Total cu ft Nat Gas/hr         1,086         908           Total cu ft Nat Gas/9hr st         9,778         8,175           \$/100 cu ft Nat Gas         \$0.83           \$/hr Energy Cost         \$9.02         \$7.54	Total Btu's/9 hr shift	, ,	
Total cu ft Nat Gas/9hr sl         9,778         8,175           \$/100 cu ft Nat Gas         \$0.83           \$/hr Energy Cost         \$9.02         \$7.54			
\$/100 cu ft Nat Gas \$0.83 \$/hr Energy Cost \$9.02 \$7.54	Total cu ft Nat Gas/hr	1,086	908
\$/hr Energy Cost \$9.02 \$7.54	Total cu ft Nat Gas/9hr sh	9,778	8,175
	\$/100 cu ft Nat Gas		
\$/9hr shift Energy Cost \$81.16 \$67.85	\$/hr Energy Cost	\$9.02	\$7.54
	\$/9hr shift Energy Cost	\$81.16	\$67.85

Energy Cost Savings/shift Percent Savings \$13.30 16.4%

# Do you have a question for Joe Powder?

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