

A Report on Laminating Operations at D&R Henderson Benalla

Introduction

I visited the Benalla site on 30-31st July 2015 at the request of Richard Caine to investigate the “crazing” issue on what appeared to be carcass grade white. It was the worst example of crazing that I had ever seen. Crazing is normally caused by severe precure i.e. curing before the MF resin has adequately flowed. This is usually as a result of overcured paper ex the treater and/or press temperatures being too high. I was told that the immediate response was to reduce press temperatures from about 214°C to about 195°C. The result produced water marks which is also caused by flow problems with the curing resin in the press. The resin coverage on the paper looked light which would have exacerbated the precure problems. This added to overcure from the treater would result in paper that had very little life left in it. Notwithstanding this any press temperature of over 210°C appears quite high.

Site Visit Notes

The pallets of treated paper examined from both suppliers appeared very smooth, brittle and light on resin. Pallet presentation in the main was acceptable with only two pallets having uneven stacking. One of the operators said he has noted a change in the smell of the resin during pressing. This is a very telling point as operators do this day in and day out and notice changes. He also said the paper was too smooth. It would suggest some formulation change in the MF coating resin.

However there was no actual specification for any treated paper except for a fairly loose B stage cure and volatiles requirement found on the certificates of compliance. These did not appear to be formally agreed to and documented. I suspect that the specifications originated from the supplier based on transport performance i.e. no blocking rather than good pressing performance. It is important to note that these are not mutually exclusive; a good non-blocking paper can still perform well in the short cycle press.

The two major suppliers of treated paper to D&R Henderson are Vasatech and Coveright, both situated in Malaysia. Both companies supply a certificate of compliance however in the case of Coveright the specification for total weight for white was 170 +/- 10gsm. This is a nonsensical spec as a paper of 160gsm while in specification according to the supplier would create severe problems such as blotch, porosity and almost certainly crazing, not to mention poor Taber abrasion performance, steam, stain and impact resistance. Also I believe their B stage cure specifications are too high and the volatile spec too low.

It was also found that locally obtained volatiles and B stage cure values were significantly different from supplier values demonstrating the possibility of different test methods between Coveright and D&R Henderson. Volatiles are not oven dry moisture content (are always a much lower value) and hence test method i.e. length of time the sample is in the oven and of course oven temperature will have a major effect. As the same method of drying is also used in B stage cure testing, these results will also be higher.

There are also no specifications for raw paper either, raw paper characteristics are critical to successful treating and laminating. I spent six years directly studying this for my PhD.

As stated the specifications for treated paper (in the form of a C of A) originated from the suppliers are mainly based on eliminating blocking during transport and storage. This shows a basic lack of understanding of how to separate B stage cure and volatiles. The former is affected by the reactivity of the MF resin mix and oven temperatures in the second stage ovens, the latter is mainly affected by fan speeds in the second stage ovens removing the highly moist boundary layer of air immediately adjacent to the paper.

The white paper from both suppliers appeared very smooth which will cause slipping in the layup stage ending up with missing paper ends or sides and even paper chips if there is too much overhang. Ideally treated paper should have a slightly rough surface and a small amount of dust. This is caused in the early stages of cure after the MF coating stage caused by the very top skin of the MF curing before full moisture evaporation in the first two ovens in the second stage of the treater creating mini volcanoes of steam causing bubbles which burst leaving the rough surface and small amount of dust. This stops paper slipping and is a good visual indicator of the quality of the treated paper.

Effects of poor quality treated paper

Paper related defects can be summarised as follows:

- Torn paper layup, (overcure, poor quality raw paper high ash causing brittle treated paper, poor paper formation leading to inadequate penetration of UF resin prior to coating with MF resin)
- Missing paper, (slippery paper/ poor curing of MF),
- Misaligned paper (inaccurate layup into the press, paper too smooth or poorly presented stacking of the treated paper).
- Paper chips, (brittle paper, overcure)
- Blotch, (poor MF resin flow), poor quality raw paper
- Porosity, (poor UF resin impregnation, low quality raw paper)
- Crazing, (insufficient resin/overcure, poor UF impregnation)
- Undercure, (watermarks snail trails)
- Overcure, (insufficient resin flow poor finish)
- Poor Taber abrasion, steam, stain and impact resistance as defined in AS1859.3 2005

Impact of poor quality treated paper on D&R Henderson

It is axiomatic that when you produce defects at the laminating line, these are the highest value defects produced, i.e. full value substrates either particleboard (usually MR) or MDF, plus of course full value paper.

Currently the total process reject and downgrade rate directly related to paper quality is approximately 3-4% per month. The reject rate alone is approximately 1-2% per month. The dollar value of rejects would be approximately \$600,000 per year. This is based upon:

- Total LPM production of about 70,000m³ / year
- This is the equivalent of 1,522,000 boards of 2.4x1.2m 16mm thick per year i.e. 4,400,000m²
- Assuming sale price of \$8.16/m² for whites and \$9.72/m² for colours
- Total potential revenue is \$30million for whites and \$9 million for colours.
- A reject rate of 1.5% is a lost opportunity of nearly \$600,000 per year.

The downgrade rate of 1.5%, even if the material is recovered as B grade at 75% of the full value product still leaves a loss to the business of \$150,000.

Thus the total opportunity cost of poor quality paper is estimated to be about \$750,000 per year. This figure is basically lost profit. Even if only half of this figure was recovered this is still nearly \$400,000 per year. These costs do not include any rework required. Savings of this magnitude could be achieved if treated paper was supplied at an agreed specification that is suitable for transport to and storage at Benalla and use on the Dieffenbacher short cycle press.

The overall objective should be to source the best quality treated paper at an agreed price that is readily available so that D&R can produce a quality LPM product with the least amount of full value rejects and gain at least \$400,000 savings per year.

This will involve setting accurate specifications for raw and treated paper, ensuring the suppliers have systems to produce to the agreed specifications and to be able to audit the compliance results produced by the supplier meaning that both supplier and D&R will have to have agreed to the test methods in the specifications. It is a given that the technical competence of the suppliers will have to be determined first to ensure that they are capable of producing to the agreed to specifications in the long term.

Recommendations

The most important recommendation is that defects are reported as a dollar value of direct cost to the business rather than as a percentage with the aim of maximising A grade full value production. It is too easy to hide behind the disposal of anything but A grade product. From experience customers expect product to be priced at this lower level thus you are competing against yourself with product pricing. Like production of reject, every square metre of downgrade board sold is a direct cost to the business.

Rejects should also be classified by supplier and by colour so that corrective action can be specifically made.

It is further recommended that detailed specifications for all raw paper products used for treating be determined such as, Gurley porosity, Ash content and type of filler, Klem values, calendaring specifications, Density, minimum paper weights, tensile strength etc.

Specifications for the treated paper should include; desired coat weight plus or minus what the treater is capable of not just a set of random numbers, B stage cures for each paper type, as well as volatiles, cross panel variation etc. These have all been determined by me for similar colours for CSR Tumut and I am able to use them as firstly they are my intellectual property and secondly the company is no longer in a true decorative market, (now part of Formica range with Laminex).

Test methods for treated paper at the supplier and with D&R Henderson must be coordinated so that regular checks can be made to the veracity of the data coming in with the certificates of compliance. It is further recommended with my experience in treating both from an operational and research perspective that the treating companies be assisted in setting up systems to ensure a stable supply of quality product and are trained in the fundamentals of treating décor paper. These should include resin types, agreed gel times, oven settings both first and second stages, acceptable volatiles after the first stage, second stage, agreed coat weights, B stage cure and final volatile content. In particular the latter two test methods will have to be the same at both supplier and D&R Henderson in order to be meaningful and for audits to be carried out.

It is also recommended that operators at both treating operations be fully trained on the implications of their actions, i.e. effect of oven temperature, fan speed, resin reactivity, line speed, B stage cure and volatiles etc. It is essential to have skilled operators in critical supply situations to ensure continuity of supply of product to the agreed and meaningful specifications.

I did a similar project while employed at CSR Tumut during my PhD studies and saved the Tumut site alone nearly two million dollars per year, so I am very confident that I can save D&R Henderson hundreds of thousands of dollars in reduced defects.

Proposal

It is proposed that D&R Henderson employ me as a specialist consultant given my experience in both the operational and research side of treating and laminating, (giving me an almost unique position). This would include:

- Determining raw paper specifications for décor paper to be treated by suppliers
- Determining the specifications for treated paper based on the current operation of the Dieffenbacher short cycle press at Benalla, based on those that existed at Tumut that I developed.
- Set up systems with suppliers to ensure this is the case by:
 - Identifying the optimal suppliers of raw paper based on consistent performance and costs.
 - Training the suppliers of treated paper the principles of treating and the importance of this process to the success of laminating specific to press type.
 - Determining product specifications based on the process capability of the treatment plants rather than arbitrary numbers as is currently the case.
 - Getting both parties to sign off on the agreed to specifications and making these meaningful with the necessity if need be of rejecting delivery ahead of shipment.

- Ensuring that all parties' test methods are the same i.e. B stage cure and volatiles.
- Set up an audit system at Benalla to determine the efficacy of the implementation of systems at the suppliers.
- Identifying ways of further cost reduction from both supplier and end user perspective.

It is proposed that I visit both of the major treatment facilities for a 5 day period to implement the above. Communications with raw paper suppliers can be done remotely and would take two days. Two days' work on site at Benalla would be required to implement the audit system and to fine tune specifications. One day would be required to write and present the final report.

It is estimated that the total time required would be 15 days. Given that D&R Henderson are already clients I will hold the consulting rate to that of 2007 i.e. \$1,200 per day which is a considerable reduction on my current rate.

Travel and accommodation expenses will be met by D&R Henderson. Actual travelling time is not charged.

Given my research and operational experience and given the fact that I saved CSR Tumut nearly 2 million dollars on identical issues I have no doubt that I will save over a multiple of at least ten times the costs of my services to D&R Henderson.

I understand the physics and process of treating and using that knowledge I will improve the cost structure of the production of LPM panels at D&R Henderson Benalla.

Ray Roberts