Sanding Sense

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WIDEBELT "SANDING SENSE"

CLEANING WIDEBELTS, DOES IT MAKE SENSE?

Abrasive belt loading is a factor often encountered even in hardwoods and in most instances, not properly identified. It is assumed to be belt wear. Therefore, belts are prematurely discarded in spite of the fact that many usable hours of life remain. The true end point of any abrasive belt should be when the sharpness of the cutting mineral is worn so that the belts no longer cut, not when they no longer cut due to sanding residue building up in the voids between the mineral particles and masking the abrasive minerals.

Belt loading can occur when sanding virtually any wood specie, especially if excessive material removal is being attempted. To minimize belt loading, do not force the cut, keep material removal rates within the recommended maximum parameters for each specie being sanded, and within the feed speed parameters. Belt loading is especially encountered when sanding soft resinous woods.

Cleaning of abrasive belts can significantly increase belt life if belts are currently being discarded because they are loaded and there is still mineral life left. On cleaning methods #2, #3, #4, #5, &#6 [cleaning methods listed below], anywhere from to two to eight cleanings can be achieved on some belt grades when sanding wood such as ponderosa pine. Two to four cleanings can be achieved on some belt grades when sanding hardwoods, depending on cleaning method, wood type, and sanding procedure.

Note: The number of belt cleanings does not correlate directly to a measurement of belt life. Each time that belts are cleaned off of the sander, the period of time before subsequent cleaning is required is reduced. Therefore, six cleanings will not equate to an increased belt life of six times. However, on any cleaning system that preemptively cleans belts prior to loading while they are on the machine and it is in production, belt life improvement is measured by the number of extended belt life hours, which can then be equated to multiples of belt life.

On cleaning method #1 [Air nozzle blow off system], a belt life increase of 10% to 50% depending on, wood type, and sanding procedure may be realized. On cleaning method #7 [Dry ice blasting], belt life increases of two to seven additional lifetimes can be achieved on some belt grades when sanding hardwoods and significantly more when sanding softwoods,

Over the years, I have encountered and examined various types of abrasive belt cleaning. When I started my consulting business in 2001, I realized that there were several major problems/opportunities in the wide-belt sanding field and abrasive belt loading and cleaning was one of them. I analyzed the existing methods being sold and determined that there were disadvantages with all of them and started R & D on a new belt cleaning device. After spending several thousand dollars and a year of frustration, I came across an installation successfully using an improved dry ice blasting system. I was impressed with its performance to the point that I ceased all of my efforts to develop a system.

The following [**In chronological order**] is a compilation of belt cleaning methods and equipment; identification of the variables encountered and affected by abrasive belt cleaning; and a comparison of the belt cleaning methods using a grading from A to F.

Types of Abrasive Belt Cleaning Methods Reviewed

	Cleans during sanding
1. Air nozzle blow off system	Yes
2. Eraser-type removal	No
3. High-pressure water blasting or steam	No
4. Caustic soaking with brushes	No
5. Wire brushing	No
6. Glass bead blasting equipment	No
7. Dry ice blasting	Yes

Variables Considered in Comparison of Different Methods:

* Effectiveness and Increased belt life
* Types of belts able to be cleaned
* Cost
* Quality of sanding after belts are cleaned
* Effect on sander's production uptime or downtime
* Labor: Time required for cleaning
* Safety
* Ergonomics
* Floor-space requirements
* Waste: Trash and effluent
* Guarantee
* Other

Air Nozzle Blow-Off System:

	Grade
* Effectiveness and Increased belt life:	**C**: Removes light loading. Belt life increase from 10% to 50%
* Types of belts able to be cleaned:	**A**: All belts.
* Cost/Payback:	**B**: An initial cost of $2,000 to $3,000 per sanding head. Ongoing costs for high volume of compressed air at minimum of 80 PSI.
* Quality of sanding after belts are cleaned:	**A**: Nondestructive to abrasive, allows for cleaning prior to excessive loading. Consistent clean belts and reduced streaking extend life and enhance quality.
* Effect on sander's production uptime or downtime:	**B**: Clean on-sander while sanding, reduces sander downtime for every belt change that is saved.
* Labor/Time required for cleaning:	**A**: None, clean while sanding.
* Safety:	**A**: No personnel interaction with high rpm belts or components inside sander cabinet.
* Ergonomics:	**A**: No negative effect.
* Floor-space requirements:	**A**: No additional space, mounted on sander.
*Waste: Trash and effluent:	**A**: Reduced belts, no other effluent.
* Guarantee:	**C:** If heavy loading starts, belts must be discarded

Air Nozzle Blow-Off Summary: Nondestructive to belts, even paper-backed belts; some increased belt life. Uses large volume of clean compressed air. Does delay loading and streaking. Reduces belt changes. Due to marginal improvements, most systems not in use on older machines.

Eraser-Type Removal:

	Grade
* Effectiveness and Increased belt life:	**D**: Limited loading removal. Some extension of life on hardwood and softwood sanding.
* Types of belts able to be cleaned:	**C**: Were typically used on narrow widebelts [up to 37" wide]
* Cost/Payback:	**A**: No capital cost, ongoing cost of erasers
* Quality of sanding after belts are cleaned:	**C**: Reduced quality, as belt loading is not fully removed.
* Effect on sander's production uptime or downtime:	**D**: Need to stop production during cleaning.
* Labor/ Time required for cleaning:	**F**: Clean on sander, ten minutes per belt.
* Safety:	**F**: **Unsafe, hold eraser and insert arm into sander cavity with belt rotating, press eraser against high rpm rotating belt.**
* Ergonomics:	**F**: Increased labor, difficult job.
* Floor-space requirements:	**A**: None required.
* Waste/ Utility Trash and Effluent:	**D**: Slightly reduced disposal of belts.
* Guarantee:	**D**: None
* Other:	**C**: N/A

Eraser Type Load Removal Summary: Extends belt life marginally. Able to be used on paper belts. Belt width limited by manual reach. No cost for equipment. Erasers are consumed. Incomplete load removal reduces sanding quality. Belt cleaned on sander can slightly improve sander production time. Sanding ceases during cleaning. Requires significant amount of labor for cleaning on sander. **Unsafe cleaning method, direct interaction with high sfpm sanding belt inside sander cavity by pressing eraser against abrasive belt while rotating.** Poor ergonomics due to the need to maintain manual pressure of eraser on abrasive belt.

High-Pressure Water Blasting/Steam:

	Grade
* Effectiveness and Increased belt life:	**B**: Removes all of load. One to two additional belt cleanings for hardwood, up to 10 belt cleanings for softwood sanding.
* Types of belts able to be cleaned:	**C**: OK on cloth belts, not for paper belts.
* Cost/Payback:	**A**: Limited capital cost, fast return.
* Quality of sanding after belts are cleaned:	**C**: Reduced quality as water/steam has detrimental effect on belt backings and belt creasing. Damage from removal, transport, and reinstallation possible.
* Effect on sander's production uptime or downtime:	**F**: Requires removal of belt for cleaning, no improvement in sander downtime.
* Labor/Time required for cleaning:	**F**: Time and labor to remove, transport, clean, hang belts for drying, return, and reinstall is excessive. Up to 30 minutes per belt per cleaning.
* Safety:	**D**: Extreme care must be exercised when using high pressure water or steam.
* Ergonomics:	**F**: High torque from high-pressure wand.
* Floor-space requirements:	**D**: Area needed for cleaning and for drying racks.
* Waste/ Utility Trash and Effluent:	**D**: Reduced disposal of belts, higher use of water and disposal of high Biological Oxygen Demand water effluent.
-Guarantee:	**D**: None
-Other:	**C:** Requires ID method to record cleanings

High-Pressure Water/Steam Blasting Summary: Extends belt life. Unable to be used on paper belts. Low cost of equipment. Water saturation/shrinkage affects belt backings. Belt removal for cleaning reduces sander production time. Requires significant amount of labor for belt removal, transport, cleaning, drying, return, and reinstallation of belt. Poor ergonomics from increased labor and high torque from high pressure spraying wand. Additional floor space for cleaning and drying racks is needed. Increased water use, reduced belt disposal, increased high BOD water effluent. Need to track belt life manually per belt. Periodic maintenance of high –pressure spray pump and equipment required.

Caustic Soaking with Removal Brushes:

	Grade
* Effectiveness and Increased belt life:	**B**: Removes most of the loading. One to two additional belt cleanings for hardwood, up to 5 belt cleanings for softwood.
* Types of belts able to be cleaned:	**C**: OK on cloth belts, not for paper belts.
* Cost/Payback:	**B**: Medium capital cost, fast return, ongoing cost of chemicals and brushes.
* Quality of sanding after belts are cleaned:	**C**: Reduced quality as moisture-caustic/shrinkage has detrimental effect on belt backings and belt creasing. Damage from removal, transport, and reinstallation possible.
*Effect on sander's production uptime or downtime:	**F**: Requires removal of belt for cleaning, no improvement in sander downtime.
* Labor/ Time required for cleaning:	**F**: Time and labor to remove, transport, clean, hang belts for drying, return, and reinstall is excessive. Up to 12 hours per belt per cleaning on larger belts.
* Safety:	**D**: Care must be exercised when dealing with caustic solutions.

* Ergonomics:	**F**: Handling of caustic.
* Floor-space requirements:	**D**: Area needed for cleaning and for drying racks.
* Waste/ Utility Trash and Effluent:	**D**: Reduced disposal of belts, higher use of chemicals and disposal of chemical effluent.
-Guarantee:	**D**: None
-Other:	**C:** Requires identification method to account for belt life.

Caustic Soaking with Removal Brushes Summary: Extends belt life. Unable to be used on paper belts. Low cost of equipment. Water saturation/shrinkage affects belt backing and sanding quality. Belt removal for cleaning reduces sander production time. Requires significant amount of labor for belt removal, transport, cleaning, drying, return, and reinstallation of belt. Poor ergonomics from working with caustic solutions. Additional floor space for cleaning and drying racks is needed. Increased water use, reduced belt disposal, increased high BOD water and chemical effluent. Need to track belt life manually per belt.

Wire Brushing:

	Grade
* Effectiveness and Increased belt life:	**D**: Limited loading removal. Some extension of life due to eliminating belt streaking.
* Types of belts able to be cleaned:	**C**: All types of belts, generally on finer grits.
* Cost/Payback:	**A**: No capital cost, ongoing cost of brushes and sander down time
* Quality of sanding after belts are cleaned:	**C**: Streaking can sometimes be eliminated.
* Effect on sander's production uptime or downtime:	**D**: Small improvement in sander downtime, need to stop production during cleaning.
* Labor/ Time required for cleaning:	**F**: Clean on sander, ten minutes per belt.
* Safety:	**F**: **Unsafe, brushes brought into contact with abrasive belts rotating. If steel bristle brushes are used, there is a risk of sparks and fire.**
* Ergonomics:	**F**: Increased labor, difficult and skilled job.
* Floor-space requirements:	**A**: None required.
* Waste/ Utility Trash and Effluent:	**D**: Slightly reduced disposal of belts.
* Guarantee:	**D**: None
* Other:	**C**: N/A

Wire Brushing Summary: Some extension of belt life due to eliminating streaking. Some cost for equipment. Wire brushes are consumed. Incomplete or excessive brushing reduces sanding quality. Belt cleaned on sander can slightly improve sander production time. Requires some downtime labor for cleaning on sander**. Unsafe cleaning method, direct interaction with high sfpm sanding belt inside sander cavity by pressing brushes against abrasive belt while rotating. Also risk of fire**. Poor ergonomics due to the need to maintain manual pressure of brushing tool. No additional floor space for cleaning is needed. Need to track belt life manually per belt.

Glass Bead Blasting Equipment:

	Grade
* Effectiveness and Increased belt life:	**B**: Removes all of loading. One to two additional lifetimes for hardwood or softwood sanding but may require three to four cleanings to achieve. Destructive to belts.
* Types of belts able to be cleaned:	**C**: Cleans all types of belts but number of cleanings on paper belts are limited. Belt lengths are limited.
* Cost/Payback:	**B**: More capital cost up front, fair return.
* Quality of sanding after belts are cleaned:	**C**: Reduced quality as glass beads are destructive to abrasive. Belt creasing and damage from removal, transport, and reinstallation possible.
* Effect on sander's production uptime or downtime:	**F**: Requires removal of belt for cleaning, no improvement in sander downtime.
* Labor: Time required for cleaning:	**F**: Time and labor to remove, transport,

	install on cleaner, clean, remove from cleaner, return, and reinstall is excessive, up to 30 minutes per belt per cleaning.
* Safety:	**F**: Glass dust mess, inhalation of silica dust is health hazard.
* Ergonomics:	**F**: In addition to labor above, glass dust issue.
* Floor-space requirements:	**D**: Area needed for machine and belt storage.
* Waste/ Utility Trash and Effluent	**C**: Reduce belt disposal. Glass dust disposal
* Guarantee:	**D**: None.
* Other:	**C:** Requires identification method to account for belt life.
	F: * The holder of this patented process and manufacturer of this type of equipment is no longer in business.

Glass Bead Blasting Summary: Limited extension of belt life. Destructive to belts. Mid-price initial cost of equipment, fair return of investment. Glass beads are destructive to abrasive, affecting the belt and sanding quality. Belt removal for cleaning decreases sander production time. Requires significant amount of labor for belt removal, transport, installing on cleaner, cleaning, removal from cleaner, return, and reinstallation of belt. Poor ergonomics from exposure to silica dust. Additional floor space required for cleaning equipment and belts. Reduced belt disposal. Need to track belt life manually per belt. Periodic maintenance of glass bead blasting cabinet equipment required. Manufacturer of glass bead blasting cabinets unable to be contacted- assumed out of business.

Dry Ice Blasting:

	Grade
* Effectiveness and Increased belt life:	**A**: Removes all of loading. Two to five additional lifetimes for hardwoods reported and significantly more [over ten] for softwood sanding.
* Types of belts able to be cleaned:	**A**: All belts.
* Cost/Payback:	**B**: High initial cost, fast return of investment though, continuing cost of dry ice. Cost for each cleaning under $1.00 per belt.
* Quality of sanding after belts are cleaned:	**A**: Nondestructive to abrasive, allows for cleaning prior to excessive loading. Consistent clean belts and reduced streaking extend life and enhance quality.
* Effect on sander's production uptime or downtime:	**A**: Clean on-sander while sanding, reduces sander downtime for every belt change that is saved.
* Labor/Time required for cleaning:	**A**: Clean while sanding, belts under 52" in width cleaned within one minute.
* Safety:	**A**: No interaction with high sfpm belts or components inside sander cabinet.
* Ergonomics:	**A**: Fill hopper with dry ice, push button.
* Floor-space requirements:	**A**: No additional space, mounted on sander.
*Waste: Trash and effluent:	**A**: Reduced belts, no other effluent.
* Guarantee:	**A**: Manufacturer guarantees 50% reduction in belt costs.
*Other:	**A**: Camera viewing system option; system has automatic belt logging feature.

Dry Ice Blasting Summary: Nondestructive to belts, even paper-backed belts; maximizes belt life, with maximum decrease in quantity of belt changes; minimizes streaking and burning.

IceClean Systems, the manufacturer of dry ice abrasive belt cleaning systems, reports:

- Upfront capital cost of about $6,000 per sanding head on a multi-head sander.
- Average return on investment with one full hardwood sanding shift under one year; with two or more full hardwood sanding shifts under 6 months.
- Softwood sanding has much faster payback.
- Has portability option, with quick disconnect/reconnect for cleaning non-widebelts off sander.

- Process is patented. IceClean Systems guarantees a fifty percent reduction in abrasive cost.
- Automated system is mounted on-sander, improves both safety and ergonomics.
- Improves sanding quality by maintaining clean belts on sander.
- Cleans belts on sander, with zero moisture. Dry ice converts to CO2 gas upon impact.
- Dry ice cost per belt/cleaning about $1.00/each. Each belt cleaned in about one minute.
- CO2 gas and removed particulate extracted through existing sander ductwork.
- Reduced quantity of belts to landfill. Belts cut more efficiently due to exposed grit.
- Weekly dry ice supplier required, normally available.
- Minimum compressed air requirement while cleaning is 90 psi, normal plant compressed air.
- Remote camera system allows belt inspection anytime, even while cleaning.
- New system, IceClean-On, fully automated, includes belt management and accounting software and tracks belt use and cost.
- Blaster can also be used for other cleaning functions throughout a plant
- **IceClean has developed dry ice belt cleaning cabinet, patent pending.**

Summary of Belt Cleaning Methods:

Belt cleaning is not for everyone, but……in many cases, it is a cost saving and quality improvement tool that should not be ignored.

- Belt loading can occur when sanding virtually any wood specie, especially if excessive material removal is being attempted. Do not force the cut. Keep material removal rates within the recommended maximum parameters for each specie being sanded and within the feed speed parameters.
- Multi-headed machines in production lines offer the greatest savings potential. Large sanding operations and anyone sanding resinous materials such as Ponderosa or Loblolly pine should investigate its use.
  Applications that have a low tolerance for longitudinal streaks are also prime candidates for this concept.
- The true end point of any abrasive belt should be when the sharpness of the cutting mineral is worn, so that the belts no longer cut, not when they no longer cut due to sanding residue building up in the voids between the mineral particles and masking the abrasive minerals.
- Cleaning of abrasive belts can significantly increase belt life if belts are currently being discarded, because they are loaded and there is still mineral life left.
- Small shops are not normal candidates for automated abrasive belt cleaning.
- Depending on the application, mid-size shops using two or more multi-headed sanders might consider an off line High-Pressure Water Blasting System, or a machine mounted Dry Ice Blast System.
- Depending on the application, large shops using multi-headed sanders in a production line should consider a machine mounted Dry Ice Blast System.
- Belt cost reductions of 50% and more can be guaranteed by the manufacturer of the Dry Ice Blast System after an analysis of the application and current belt costs.
- Air blow off systems usually are inoperable and not being used on older machines.
- Only three of the above listed belt cleaning concepts remain as viable solutions to me:
  Air Jet Blast, Water Blast, and Dry Ice Blast

Comparison of Viable Methods	**Air Blast**	**Water Blast**	**Dry Ice Blast**
Relative initial cost	Moderate	Low	High
Relative operating cost	High	Low*	Moderate
Total cleaning costs including labor	High	High	Moderate
Relative cleaning results	Poor	Fair	Excellent
Clean on machine during sanding	Yes	No	Yes
Degrading to belt mineral or backing	No	Yes	No

* *Water Blasting requires a significant amount of water. Depending on where the operation is located, this can be a significant expense.*

FINAL CAVEAT

Belt cleaning systems cannot be installed on a machine and obtain optimum results without someone in plant managing the process. They can't be installed and expected to succeed without sound process and sanding management. Belt life targets need to be established for each sanding head, and then accountability assigned to operators and supervision to meet or exceed them.