



SHENANDOAH SHOWERS

With CVN™ Actuators for *Complete Coverage Cleaning*



Water Strategies

to improve performance

Other Systems From CVN Systems

- Nozzles
- Osprey™ Self Cleaning Water Backwash Strainer For White Water Recycling
- Crockett™ Vacuum Boxes
- High Pressure Shower Water Pump Systems



Greeneville, Tennessee, USA
Since 1984



Customers Improve Earnings With ROI Justification of CVN Products.

How?

CVN Capabilities and Skills.

- Business core started in 1979 with the Formex division of Huyck, Greeneville, TN to supply higher pressure showers for new technology forming fabrics.
- The CVN Systems business was formed in 1984 with the addition of shower oscillators that offered "Complete Coverage Cleaning."
- Today's manufacturing shop has skills from years of experience in producing rugged design with excellent quality.
- Custom fabrication capacity with the design and manufacturing skill to transfer many standard products into custom designs, Experience with engineering design staff assisted with CAD computers to design difficult fits into existing paper machines.

Core knowledge of the industry and applications.

- The application engineering personnel have worked with the business since its formation.
- Customer products records are maintained for service reference and duplication of product.
- Reference drawings are available for quick transfer of specifications to new requirements.

Years of established business serving worldwide paper industry.

- Regular supplier to major paper machine builders for shipments throughout the world.
- Resulting installed base is maintained with rebuild service and spare parts.

Global installed base.

- Over 3200 installations of showers, (both oscillating and fixed), and suction and Uhle boxes.
- Industry standard shower oscillator models still performing.

Focus on innovation and product development to meet changing environment, process chemistry and closed system water management.

- Newer design shower oscillators have been added to satisfy needs for more compact design, easier maintenance and higher reliability.
- Variable speed shower oscillators offer flexibility for changing paper machine speed.
- CVN offers self cleaning strainers to reuse white water for showers.
- Engineer design for cleanings per day.

Financial Strength

- Owner Chuck Wunner is an active owner manager of three businesses supplying engineered industrial products to process industries. Management is committed to offering value enhancing products. These are sold on a basis of financial justification looking at the cost of equipment ownership over the expected operating life.

Shenandoah™ Showers

Improve removal of water from the paper sheet through uniform and continuous cleaning of fabrics in the forming, press and dryer sections.

Overcome \$ annual variable costs of:	Caused by:	Capabilities from CVN:
<ul style="list-style-type: none"> • Less water being removed between scheduled fabric changes. • Requires more frequent fabric changes. Cost / year \$ _____ • Requires extra water removal in dryer section. Cost / year \$ _____ 	<ul style="list-style-type: none"> • Fabrics filling too quickly with fibers and minerals between changes. • Sheet crushing from press felt being too full of fibers and minerals, especially into the press nip 	<ul style="list-style-type: none"> • Engineered system of oscillated cleaning shower with needle sprays, lube shower with fan sprays, vacuum box, and strips
<ul style="list-style-type: none"> • Add all associated costs for total Cost per year: \$ _____ 	<ul style="list-style-type: none"> • Shower water not applied to fabrics uniformly. • Fibers and minerals not removed from press felt uniformly. • Fibers and stickies buildup on rolls and not removed • Fibre and minerals in shower water clog nozzles making non-uniform spray patterns and cleaning • Felts wearing too fast or unevenly 	<ul style="list-style-type: none"> • Mechanical oscillator pattern is related to fabric or roll revolutions for Complete Coverage Cleaning • Improve sheet release • Roll cleaning showers • Doctor blade cleaning showers • Remove fibers from shower water with CVN Osprey™ self cleaning water back wash strainer. • Lubrication showers on boxes with oscillation for non-streak wetting
<ul style="list-style-type: none"> • Cross Direction moisture variations and wet streaks • Excessive breaks. Cost / year \$ _____ • Rejects. Cost / year \$ _____ • High maintenance and replacement of shower oscillators, Cost / year \$ _____ • High maintenance and replacement of plugged nozzles, Cost / year \$ _____ 	<ul style="list-style-type: none"> • Fibers and minerals not removed from fabrics uniformly. • Lubrication shower spray inconsistent over width of machine • Cleaning shower inconsistent over machine width • Failure of shower oscillator • Sticking of hydraulic oscillators creating erratic shower movement • Nozzle blockage from fibers and minerals in shower water • Shower sagging • Uneven chemical application 	<ul style="list-style-type: none"> • <i>Complete Coverage Cleaning</i> mechanical actuators with stroke related to machine speed • Uniform wetting of felt through oscillation of lubrication showers • Uniform vacuum applied. • Brush cleaner installed in shower to swipe back of nozzles automatically • Clean shower water with CVN Osprey™ self cleaning gravity strainer • Pre-bowed shower to be straight when filled with water, providing consistent cross direction spray pattern • Oscillated chemical spray showers provide uniform chemical application related to machine speed
<ul style="list-style-type: none"> • Add all associated costs for total Cost per year: \$ _____ 		

Financial Justification

Economic Analysis Methods

1. Return on Investment

$$\frac{\text{Annual fixed } \$ \text{ costs to be reduced}}{\$ \text{ Investment in new equipment}} \times 100 = \text{ROI } \%$$

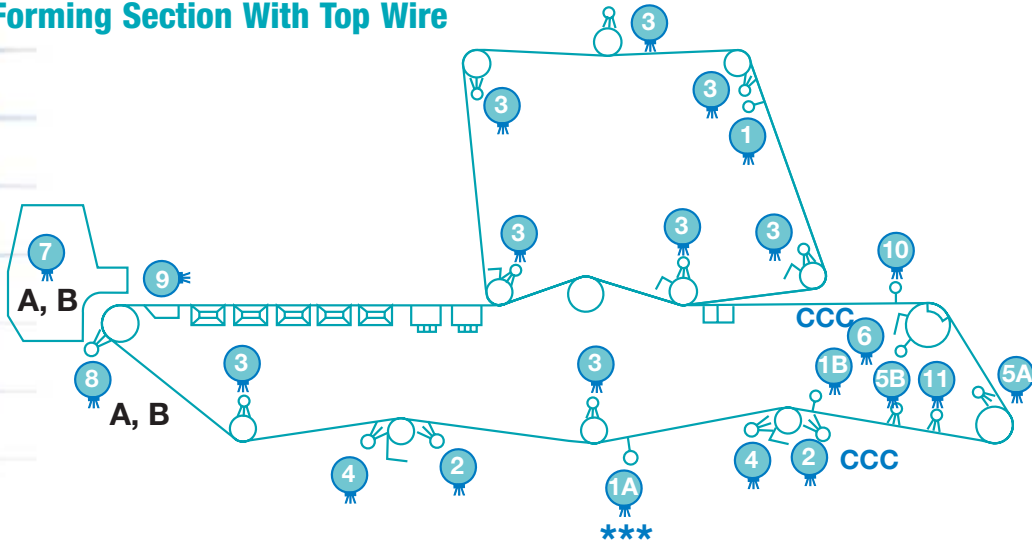
Compare to corporate approval percentage

2. Months Payback

$$\frac{\$ \text{ Investment in new equipment}}{\text{Monthly fixed } \$ \text{ Costs to be reduced}} = \text{Months to pay for investment}$$

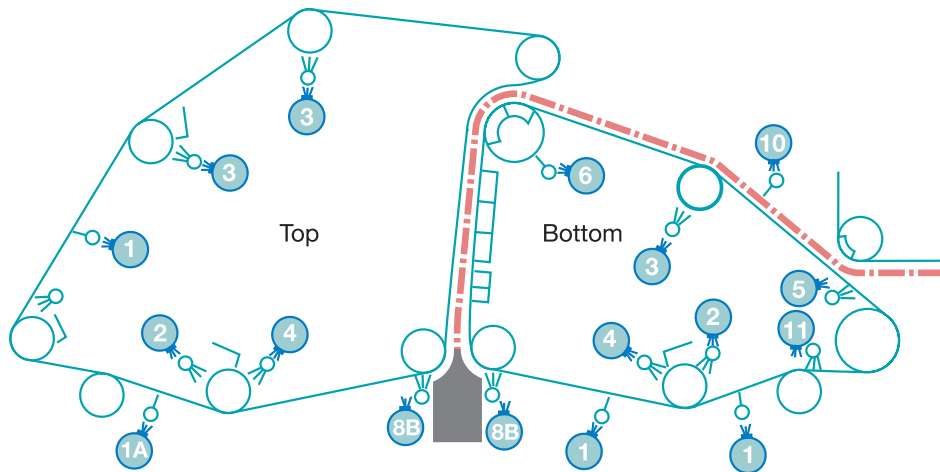
Compare to corporate approval months payback

Forming Section With Top Wire



Location	Shower Description	Location	Shower Description
1 A and B	*** 1A Outside, Very Critical, High Pressure Wire cleaning, needs Complete Coverage Cleaning	7A	Rotating Headbox
2	High Pressure into nip on return roll to clean void volume of contaminants, needs Complete Coverage Cleaning	7B	Fixed Headbox defoaming
3	Roll Wash, clean and lubrication	8A	Breast roll flood shower
4	Doctor Blade Lubrication and roll cleaning	8B	Breast roll apron cleaning
5A	Nip Flooding - Sheet knock off / wire cleaning	9	Formation Shower
5B	Knock off in case of break	10	Trim squirts
6	High Pressure Couch Roll wash and clean, needs Complete Coverage Cleaning	11	Trim knock off

Forming Section, Gap Former

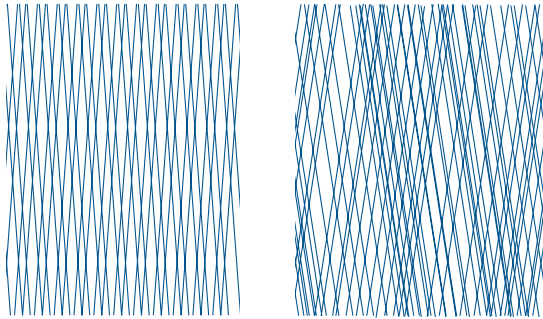


Location	Shower Description	Location	Shower Description
1 A and B	*** 1A Outside, Very Critical, High Pressure Wire cleaning, needs Complete Coverage Cleaning	8B	Breast roll apron cleaning
2	High Pressure into nip on return roll to clean void volume of contaminants, needs Complete Coverage Cleaning	10	Trim squirts
3	Roll Wash, clean and lubrication	11	Trim knock off
4	High Pressure Doctor Blade Lubrication and roll cleaning		
5	Nip Flooding - Sheet knock off / wire cleaning		
6	High Pressure Couch Roll wash and clean, needs Complete Coverage Cleaning		

Complete Coverage Formula

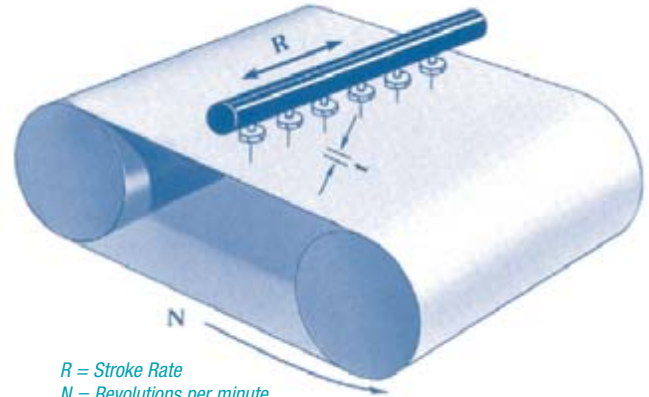
Complete Coverage

Complete Coverage Cleaning (CCC)



The CVN Way
After 100 revolutions of the fabric

The Other Way



R = Stroke Rate
 N = Revolutions per minute
 t = Nozzle Coverage
 $R = \text{Stroke Rate} = N \times t$

• For Fabric CCC

MS	machine speed of paper machine	ft/min
FW	fabric width	ft
L	loop length of fabric	ft
N	fabric revolutions per minute, $N=MS/L$	rev/min
t	traversed coverage width of one nozzle per fabric revolution	inches
S	number of spray nozzles over width	

For the Oscillator

P	minimum stroke length; FW/S	inches
R	stroke rate of oscillator; $R=MS/L \times t$, or $N \times t$	inches/min
T	time for CCC with S, number of nozzles; $T = FW / (S \times R)$	minutes

• For Roll CCC

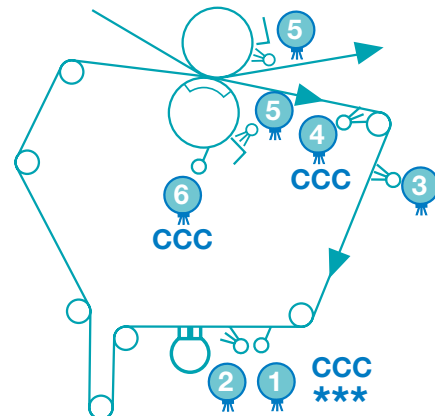
MS	machine speed of paper machine	ft/min
RW	roll width	ft
C	circumference of roll	ft
N	roll revolutions per minute, $N=MS/C$	rev/min
t	traversed coverage width of one nozzle per roll revolution	inches
S	number of spray nozzles over width	

For the Oscillator

P	stroke length; RW/S	inches
R	stroke rate of oscillator; $R=MS/C \times t$, or $N \times t$	inches/min
T	time for CCC with S, number of nozzles; $T = RW / (S \times A)$	minutes

Press Section

Location	Shower Description
1	*** Very Critical, Sheet Side, High Pressure Felt Cleaning, needs Complete coverage Cleaning
2	Suction (Uhle) Box Lubricated strips or cover to protect fabric and seams and uniformly seal vacuum, recommend oscillation, not fixed
3	Chemical Application, recommend oscillation, not fixed
4	Inside roll into nip, high pressure felt cleaning and nip flooding
5	Roll Doctor blade Lubrication and roll wash and clean
6	Suction roll High Pressure wash and clean, needs Complete Coverage Cleaning



Shenandoah™ Showers from CVN Systems	Schematic Shower Number	Application of shower	Stationary Fan Spray	Oscillating		Pressure Range, psi, Bar
				Fan Spray	Needle Jet	
Head Box Rotating Spray	7A	Wash down walls of head box				1.38-2.07 20-30
Defoaming	7B	Defoaming	■			
Forming Section						
Formation Shower	8A	Breast roll flood shower to fill wire voids with water	■			2.07-2.76 30-40
	8B	Breast roll apron cleaning				
Forming Fabric Cleaning	9	Improves formation on Fourdrinier table			CCC*	13.79-31.03 200-450
	1A and B	***Very Critical Sheet side, plus inside high pressure wire cleaning			CCC*	13.79-31.03 200-450
	2	Inside sheet high pressure wire remove contaminants from void volume			CCC*	13.79-31.03 200-450
	3	Wire Return Roll wash, clean and lubricate	■			2.76-4.14 40-60
	5	Nip Flooding, Sheet knock off, Wire-Cleaning				
Roll Cleaning/spray	6	Couch roll wash and clean			CCC*	24.13-31.03 350-450
	13	Dandy roll wash and clean			CCC*	6.89-13.79 100-200
	14	Lump Breaker roll wash and clean	■			1.38-2.07 20 -30
Doctor Blade Cleaning/spray	4	Doctor Blade Lubrication and roll cleaning	■			2.07-2.76 30 -40
Knock off	10	Trim Squirt	■			
	11	Trim knock off	■			5.52-10.34 80-150
PRESS SECTION						
Fabric Cleaning/ saturate	1	***Very Critical, Sheetside High Pressure felt cleaning			CCC*	10.34-20.68 150-300
	3	Chemical application		Yes		2.76-4.14 40-60
	4	Inside roll into nip High Pressure felt cleaning and nip flooding			CCC*	13.79-24.13 200-350
Lubricate, wet uniformly and Seal vacuum with spray	2	Suction (Uhle) Box lubricate-strips and covers to protect fabric and seams and seal vacuum	Common	Yes (Recommended)		1.38-2.07 20-30
Roll Cleaning/ spray	5	Roll Doctor Blade lubrication and roll wash and clean	■			2.07-2.76 30-40
	6	Suction Roll high pressure-wash and clean mpm			CCC*	10.34-24.13 150-350 150-350
Edge Wash Cleaning spray Dryer Section Chemical or Rinse Fabric cleaning			■ ■	Combination		

*CCC: Complete Coverage Cleaning From CVN Systems. Oscillator stroke speed set to speed of surface being cleaned

Shenandoah™ Showers

Standard options available with all CVN Oscillators

- “Complete Coverage Cleaning” can be achieved by setting shower speed to relate to paper machine fabric or roll speed.
- 316L Stainless steel construction.
- Fabric protection from a control panel with an “on/off” control and motion sensing (proximity switch) to shut off high pressure shower water in case of paper machine stop or oscillator stop.
- DCS interface for automatic control.
- Installation conversion kits to replace any brand.

• CVN Oscillators

ROLLTECH® Shower Oscillator (The “Strong One!”)

Moved by roller with low friction line contact in a track for longer life... designed for tough applications of up to 1000 lbs linear force ... can oscillate a shower up to 12.7m wide ... variable speeds and adjustable stroke length of up to 300mm... control panel with controls for varying speed and stroke length... uses a low speed AC motor and a planetary gear reducer... reverses direction with AC motor switching circuit.

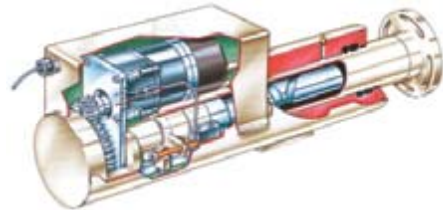


Dolphin™ (formerly SRA1200) three balls in tracks for mechanical reversing... lightweight and economical... ideal for 50 to 100mm showers... good when stroke rate does not need to relate to machine speed... designed for fabric width of up to 7 meters... fixed or variable speed with stroke lengths of 150 or 300mm.



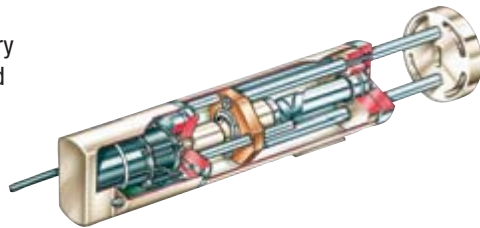
General Morgan™ (formerly SRA2000)

CVN System's original three ball reverser introduced in 1981... industry standard of “Complete Coverage Cleaning” ... control panel to set shower speed to paper machine fabric or roll speed ... high reliability with thousands still running throughout the world... rebuild and swap program by CVN... powered by Direct Current, DC motor for variable speed. Fixed mechanical stroke lengths.



SRA5000

Heavy duty three balls reverser design. Uses a low speed AC motor and a planetary gear reducer. Can oscillate up to a 12.7m wide shower. Another industry standard by CVN for “Complete Coverage Cleaning.” Control panel to set shower speed to paper machine fabric or roll speed... fixed speed with or without electrical control panel.



• Automated Brush Rotation

Highly recommended to keep nozzles clean and free of clogging... simple and reliable... programmable automatic rotation for consistent 1-12 hours between cleaning and prevent hardened buildup... random operator initiated cleaning possible... deduct for manual brush rotation design available.



Automated Brush Rotation System



Manual Option

Shower in a pipe

Designed for strength in a environment of foreign material and easy cleaning. Both pipe and inner shower oscillate together... inner shower can be easily removed for cleaning... reinstallation guided by simple positive locking design ensuring correct spray angle every time.



WATER STRATEGIES TO IMPROVE PERFORMANCE™

Improve Earnings With CVN Products.



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