



SERFILCO® CASE HISTORY

Permanent Media Filter Proves Itself in Continuous Steel Strip Plant

Background

In the 90's, automation has been sought out more vigorously than in any other decade. Our present fast economic pace has had a very big impact on labor. Abundant labor is becoming an artifact of the past. We see this large rush for automation in almost all varieties of industry — especially automotive with robotics and computer aided manufacturing processes. The need for greater cleanliness in the deposition of high quality finishes has brought an evolution in the filtration of the process solutions involved.

Today, the factors to be considered in the selection of a filtration system are initial cost, operating cost, labor to service, frequency of service, amount of solution loss, media disposal cost, and, perhaps most important of all, what type of filter will give the desired results continuously with a minimum of laboratory checks.

The development of a permanent media filter in early 1990 has given electroplating finishers a fully automatic filter for the first time. Such systems are specifically designed for use with most aqueous process solutions including: treated waste and final effluents, cleaners, plating and other metal finishing solutions. The units are gaining worldwide acceptance in the United States, Japan, U.K., Germany, Canada, Mexico, etc.

Automatic cleaning is the main reason for its success. Proper restoration of the filter bed after each cleaning cycle is of utmost importance. A continuous measurement of the flow rate allows the Programmable Logic Controller (P.L.C.) to control the frequency of cleaning. Should any system depend upon manual cleaning, the media bed would be susceptible to over-contamination because of bad timing by the operator. Once this occurs, no amount of backflushing will restore the media to its optimum porosity.

Potential Benefits Recognized

Weirton Steel Corporation is a major supplier of hot and cold rolled steel sheet including tin plate, electroplated zinc and galvanized sheet. The company has been in business 60 years and employs over 5,000 people in its Weirton, WV facility.

In today's global economy, quality and price are extremely important. Always alert to ways to improve their competitiveness, the process engineers at Weirton recognized the potential advantages that automatic filtration would offer to the operation of their continuous electroplated zinc steel strip line. Permanent media filtration could eliminate the expense of media disposal as well as provide a savings in labor cost to maintain the filter system.

Weirton zinc plates steel coil at 500 feet/minute. The plating bath composition is detailed in Fig. 1. Strip width averages 36" x .025" thick. The plating line consists of 29 cells of 250 gallons each with 10,000 amps of rectification on each. River water is used to chill the plating solution and maintain it at a temperature of 150°F. The total solution volume of 12,500 gallons is recirculated between a 12,500 gallon work tank and the 29 plating cells. The system also includes a 20,000 gallon storage tank.

Plating Bath Composition	
Zinc sulfate	12 oz. / gal.
Magnesium sulfate	.1 gr. / liter
Sodium sulfate	.25 gr. / liter
Sulfuric acid	to 2.2 pH
Temperature	140°F to 160°F
Total gallonage	12,500 gal.

Figure 1

Without adequate filtration, dents and surface defects in the strip resulted in rejected or downgraded plate. Also without adequate filtration, solids built up in the cells and work tank which led to the need for additional maintenance.

After evaluating cartridge, bag, belting screen and filter press systems, along with conical settling tanks, Weirton decided to install a permanent media filter. Their overall goals for the selection and installation of such a system compared to the other choices were:

1. To reduce labor requirements by eliminating the time consuming tasks of precoating and servicing precoat filters
2. To eliminate solution loss which occurs when servicing other filter types
3. To avoid the use of filter aid or disposable media
4. To assure consistently high quality work and prevent high-to-low quality cycles resulting from variations in filter rate
5. To extend the interval between plating bath maintenance, thereby reducing downtime and the need to pump out and transfer solution back to the storage tank

Weirton's specific objective was to reduce dents and surface defects of the steel strip resulting from embedded particles on the contact rolls. Particles can be introduced into the process from numerous sources, such as anode supports, anode beds, steel substrate, rust from steel structure, build-up on walls and wood-work on cells, to name a few. All of these sources and many more can and will cause rejectable plated steel coils, if not addressed. Then, with every revolution, the rolls will dent the strip.

They selected a permanent media filtration system to filter their zinc sulfate plating solution. The filter system utilizes a 48" diameter x 78" high rubber lined steel chamber which requires 35 cubic feet of permanent media to filter at the design filtration rate of 200 GPM or 12,000 GPH. Also included is a 700 gallon capacity heat resistant FRP backflush tank. (See Fig. 2)

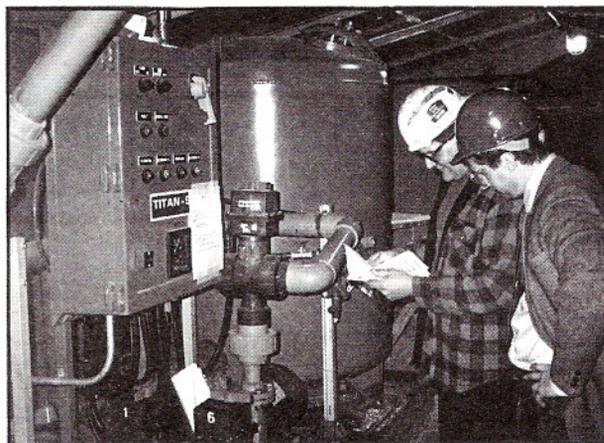
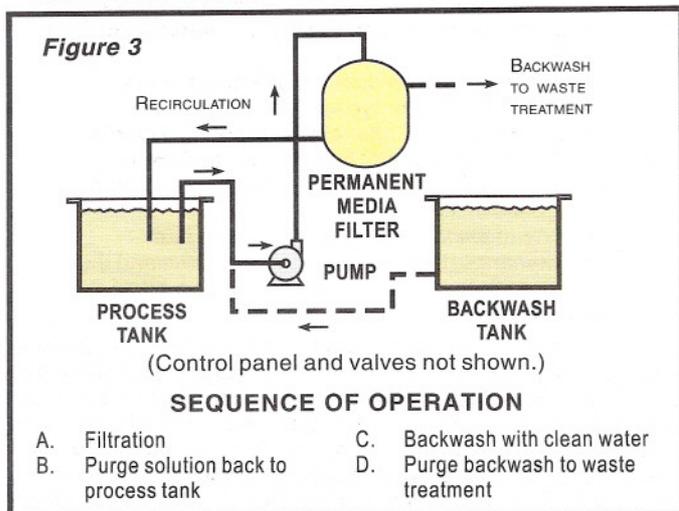


Figure 2

Tony Georgetti, Weirton Steel Corp. senior manufacturing engineer (l) and Marc Stanley, SERFILCO, Ltd. district sales manager (r) review operating log sheet in front of control unit and filter vessel of Titan-90 permanent media automatic backwash filtration system.

In early 1997, the filter system was installed in the basement of the plant. The filter system recirculates the plating bath from a 12,500 gallon work tank through the filter and returns clean solution to the work tank at the design rate of 200 GPM. The system is completely automatic and controlled by a P.L.C. The backwash cycle is initiated by a flow meter which senses when the solids loading has caused a 25% reduction in the filtration rate. Plating solution is purged from the filter chamber by air to the work tank. Backflush water from the 700 gallon backwash tank floods the bed and flushes the accumulated solids out to the waste treat system without media carryover. Selective density of the filter media provides for depth loading of the bed without impacting the particles into the bed, thereby extending the operating life between backwash cycles. Again, the filter tank is air purged of backflush water to the waste treat system so as not to dilute the plating solution. Then the system returns to the filtration mode. (See Fig. 3)

FLOW SCHEMATIC — METAL FINISHING PROCESS



The average flow rate through the filter is high, approximately 175 GPM. (See Fig. 4) Clear solution is maintained in the work tank and pumped to the plating cells. (See Fig. 5)

Since the installation of the filter, Weirton's records indicate a dramatic decrease in the need to downgrade plate produced at the facility and the reject rate has dropped radically. Weirton has calculated the payback is less than three months! Their calculations are based on increased revenue due to the improved product quality as well as the reduced cost for downtime needed to accomplish plating line maintenance. Perhaps the most significant advantage derived from the system was the knowledge that the equipment maintains the clarity of the plating bath so that high quality plated work is being produced on a consistent basis.

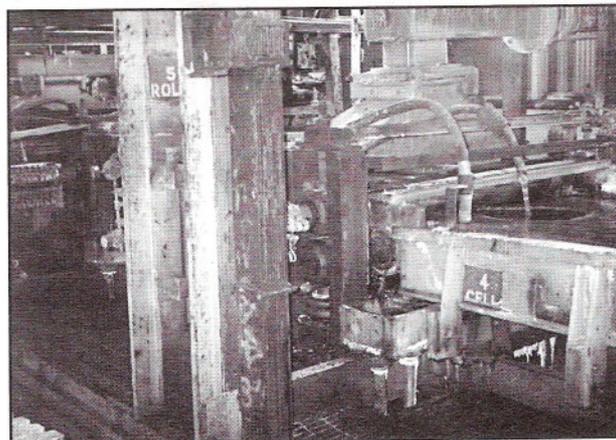


Figure 5 Clear plating solution is pumped to the plating cells via return piping from the 12,500 gallon work tank.

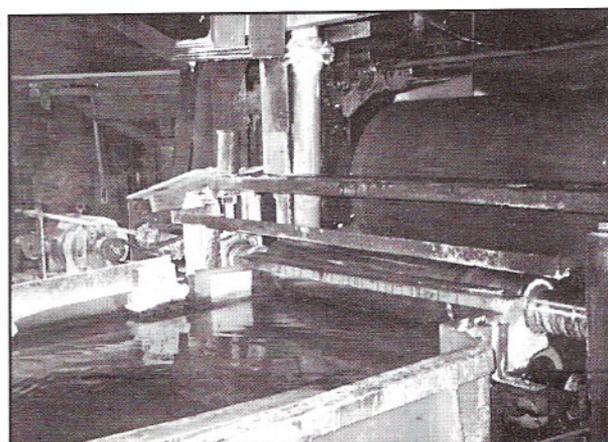


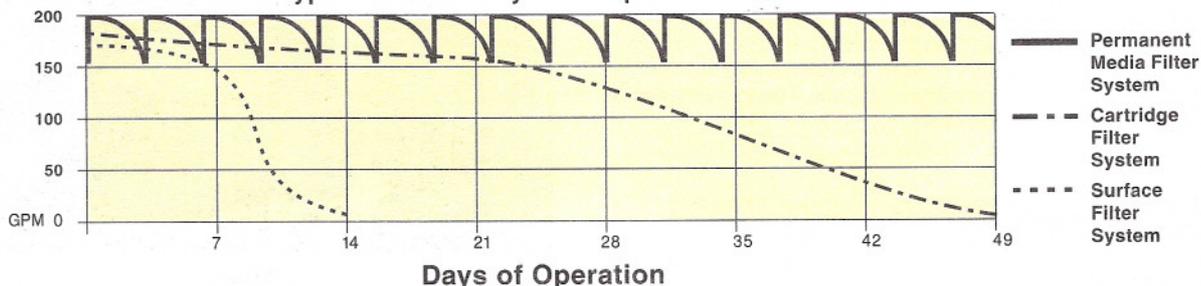
Figure 6 Portion of one plating cell showing clear plating solution in the tank and process line roll at the right.

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Presented at 9th Continuous Steel Strip Plating Symposium, Chicago, IL, May, 1999.

Figure 4 Typical Filtration Cycle Comparison Chart



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