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This fact sheet, which discusses &vantages and disadvantages of cartridge in-tank filtration, is one in the Metal Finishing series produced by the North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA). The series also includes <u>In-Tank Filtration Systems: Bag In-</u> <u>Tank Filtration Systems: Cartridge In-T' Filtration Systems: and Identifying and Reducing</u> <u>Contamination in Metal Cleaning, Plating, and Rinsing Baths.</u> These fact sheets are designed to assist industry professionals and others interested in waste and cost reduction opportunities associated with fabricated metal operations. Contact DPPEA at (919) 715-6512 for assistance or additional information.

- Metal Finishing Series -

**Disc In-Tank Filtration Systems** 

## **Operation and Uses of Horizontal Disc Media**

Horizontal disc media (HDM) filtration systems utilize a series of separate plastic discs screwed together to make a "stack" of 20 to 70 discs. The stack is contained in a chamber. Filter media are placed between the separate discs. Contaminated water flows through holes on the outside of the disc, through the filter media to a hollow central area where it is pumped to the end of the stack, and back to the solution bath. When it is time to replace the filter media, the stack of discs is removed from the

filtration chamber, each disc is, unscrewed from the stack, the filter media is removed and replaced, and then the stack is placed back in the filtration chamber. The in-tank systems can weigh up to 55 pounds. Table 1 provides a typical range of costs for in-tank disc filtration systems and the filtering area.

Table 1. Disc Filter Unit Cost									
Capacity, gph	Surface area, ft <sup>2</sup>	Filters per stack	Motor, hp	Cost					
50 - 150	1.28	22	1/15	\$600					
150 - 200	1.28	22	1/3	\$845					
150 - 250	2.62	45	1/15	\$740					
200 - 350	2.62	45	1/3	\$985					
300 - 450	3.9	67	1/3	\$1,110					
500 - 700	3.9	67	3/4	\$1,330					

Filter media consist of

Note: The approximate surface area of a lo-inch cartridge is  $0.6 \text{ ft}^2$ .

cellulose paper, reusable polypropylene cloth, reusable polypropylene felts, and carbon composite paper. The reusable media types are removed after an extended period of time, rinsed free of contaminant material, and placed back in the disc stack. A solution run through carbon impregnated paper on a periodic basis will remove Organics and further extend the life of the solution.

Table 2 provides information on the types of disc filter media and cost per filter surface area.

## **Advantages of Disc Filtration Systems**

- A major cost consideration when purchasing filter media is the system's dirt-holding capacity. The greater the filter surface area, the longer it will last. As media with longer life require less attention, obvious cost savings result. Less surface area also means more frequent cleaning. For these criteria, disc filters may provide more surface area than other types of filtration systems.<sup>1</sup>
- Another advantage of disc filter systems is the low volume of solid waste material. Spent disc filter media occupy 80 percent less volume than spent disposable cartridges. (It should be noted that reusable cartridge filters have not been considered in this comparison.)

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(919) 715-6500 800-763-0136 • A major advantage of the disc filtration system is its efficiency. The design of the disc filtration system allows removal efficiencies up to 70 percent.<sup>1</sup> The following example illustrates the importance of high efficiencies:

Current filtering practices aim for one to ten solution turnovers per hour. A plater will often elect to install the cheapest filter system with a pump rating that fulfills these turnover requirements. However, this simple methodology fails to consider the particle size and concentration, media removal efficiency, solution flow velocity, and dirt-holding capacity. A filter operating in a contaminated bath at 100-percent efficiency takes 7.5 hours to remove virtually all solids present; at 75-percent efficiency, more than 10 hours of filtration time will be required; and at 30-percent efficiency, approximately 25 hours will be necessary to eliminate virtually all solid contaminants. Therefore, higher turnover rates are required for less efficient filter media, and lower turnover rates are adequate for media with a higher efficiency

Material	Application	S i z e s, micron	Cost, \$/discs	Cost/ft <sup>2</sup>
Paper	Acidic solutions pH >2	10,50	49 per 500	\$1.68
Polypropylene cloth (reusable)	Tin lead, acid copper, and certain cyanide baths (not for use in chromic and nitric acid)	10	79 per 200	\$6.79
Polypropylene felts (reusable)	Rinsing solutions to remove suspended solids (not for use in chromic and nitric acid)	0.5, 1, 3, 10, 50,100	36 per 50	\$11- \$13
Carbon impregnated paper	High organic content solutions pH 2 to 11	10	55 per 200	\$4.73

Table 2	2. Disc	Filter	Media	Cost	per	Surface	Area
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Note: Each 3.5-inch disc provides approximately 0.06 ft<sup>2</sup> of filtration area.

The life of the filter media can also be substantially extended if a layer of filter aid is applied on the media prior to filtration. For example, an aid such as a diatomaceous earth precoat will produce a filter cake on the media (3 ounces per square foot of free surface area). A filter cake extends the life of the filter media and improves filtration efficiency such that particle retention can be improved to approximately 1 micron. For solutions with a high organic content, a precoat of activated powdered carbon will aid in the removal of Organics (0.5 ounces per square foot of free surface area). It should be kept in mind that additions of these aids will affect disposal quantity.

One major disadvantage of the disc filtration system is the time required for the removal and cleaning of each separate disc filter. These discs are placed separately in plastic housings screwed together. With 20 to 70 of these "housings," maintaining these systems may prove cumbersome and time consuming.

## The North Carolina Division of Pollution Prevention and Environmental Assistance provides fee, nonregulatory technical assistance and training on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal. Telephone DPPEA at (919) 715-6500 or 800-763-0136 or e-mail nowaste@owr.ehnr.state.nc.us for assistance with issues in this Fact Sheet or any of your waste reduction concerns.

DPPEA-97-22. 125 copies of this public document were printed on recycled paper at a cost of \$4.00 or \$0.036 per copy.

<sup>&</sup>lt;sup>1</sup> Raifman and Corvello. 'Filtration - A Focal Point for Cost Reduction.'' Proceedings: 79th AESF Annual Technical Conference, 1992, Atlanta.