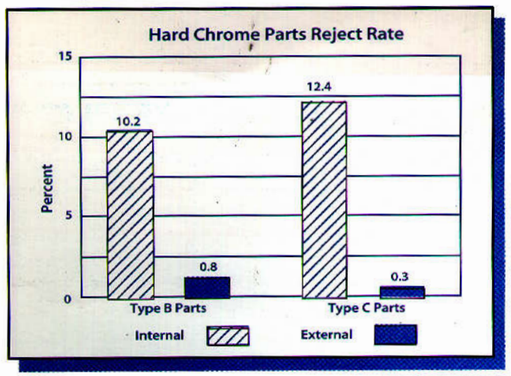


**Figure 5: Decreased Reject Rates**

ing system, and found that the reject rate for the internal cooling system was reduced by over 90 percent. The reject rate for Type B parts decreased from 10.2 percent with the internal cooling system to 0.8 percent with the external cooling system. The contrast was most evident for Type C parts, as the reject rate decreased from 12.4 percent to 0.3 percent with an external cooling system (see Figure 5).

Microplate also found that the external cooling system significantly reduced waste associated with the electroplating process. Microplate calculates that production of sludge containing chrome generated during stripping decreased over 90 percent because of the installation of the external cooling system. Microplate also tracked the labor associated with replating rejects and found that the decrease in reject rates immediately reduced labor costs associated with rejects (that is, the labor costs for troubleshooting, stripping, reracking, and replating) and by about $300 per month when combined with other savings (see Figure 6).

| Costs Category Due to Rejects | Monthly Savings |
|---|---|
| Raw Materials | $ 5 |
| Sludge Disposal | $ 40 |
| Labor (14hrs @ $18/hr) | $252 |
| **Total** | **$297** |

**Figure 6: Savings Due to Pollution Prevention**

Long-term cost savings will result from Microplate's use of the external cooling system. Although Microplate estimates that the installation cost for an internal cooling system is less than that for an external cooling system, the company is most impressed with the increase in production capacity (at least 25 percent) resulting from its use of the external cooling system. Previously, Microplate had to limit the load (amperage) into the electroplating system because of the cooling system's limitations. With the installation of the external cooling system, cooling capacity and solution mixing are no longer limiting factors. Without these restrictions, Microplate is able to load the tanks with more parts and increase the amperage applied to the plating solution. Additional sources of increased productivity associated with the external cooling system include improved mixing, simplified racking, and diminished setup time.

**Calculating Costs**

Guidance for Calculating Costs for Raw Materials and Waste Disposal from Rejects

- 0.59 ounce of chromium per square foot of chrome plating per 0.001 inch of thickness
- average cost of chromic acid is $3/pound
- 3-5 pounds of sludge generated for each 1 pound of chrome plating stripped
- cost of sludge disposal is $300/ton
- fume-suppressing foam is $50/gallon

| | |
|---|---|
| • External cooling | $8-$15/gallon of plating solution cooled |
| • Internal cooling | $6-$10/gallon of plating solution cooled |

**Figure 7: Comparing Capital Costs for Cooling**

## OTHER APPLICATIONS OF THE EXTERNAL COOLING SYSTEM

The external cooling system is potentially applicable to other electroplating processes, with different heat exchange materials being used:

- Decorative chrome electroplaters could use a heat exchanger made of niobium (columbium).
- Acid copper electroplaters could use a heat exchanger made of titanium or stainless steel.
- Cadmium cyanide platers could use a heat exchanger made of steel.

## ADDITIONAL SOURCES OF INFORMATION

For more information about the Merit Partnership, external cooling systems, or chrome emission regulations, you can contact any of the following individuals:

| | |
|---|---|
| Laura Bloch (EPA Region 9) | (415) 744-2279 |
| John Siemak (CMTC) | (310) 263-3097 |
| Dan Cunningham (MFASC) | (818) 445-3303 |
| Steve Peterman (Microplate) | (310) 478-0837 |
| Ali Ghasemi (South California Air Quality Management Division) | (909) 396-2451 |

Assistance for this fact sheet was provided by Tetra Tech EM Inc.