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PAI-KOR
PLAFORIZATION™

Economics of the Process

1. PLAFORIZATION™ & Economics: Introduction

Industrial pretreatment of metal surfaces prior to the application of paint poses a problem, the solution to which usually demands a complex and costly installation.

Companies that operate by **wiping down and degreasing by hand** often eventually conclude that they must modernize their process to enable them to speed up production, improve the quality of their finishing and ensure that they meet the latest health and safety requirements.

Many industries that decided to use a conventional multi-stage water-based process **will find they must install costly equipment for treating effluent.** Many existing plants are spending up to 10% of their revenue on effluent: conserving water, treating waste and dumping.

Furthermore, in many countries, companies end up paying additional fees **to dump their effluent** far away because of limited availability of sites.

Many companies faced with these high costs of installing a conventional aqueous degreasing/phosphating system are content to partially resolve the problem by installing a system of solvent degreasing. This does not completely meet their requirements, however, for several reasons. They still have high capital costs. They must also cover the cost of solvents and heating. And paint adhesion is not improved because solvent degreasing does not phosphate the metal surface. Finally, often manual wiping down is necessary to remove the smut still present after solvent degreasing.

Plaforization™ can help to meet today's demand for a better finish while cutting capital and consumable costs.

The total cost of the process is quite low when compared with costs relating to conventional phosphating processes, because both fixed and variable costs are reduced.

The costs of the Plaforization™ process can be easily identified, while the calculation of the total costs associated to a conventional aqueous phosphating process is always complicated. In other words, a comparative analysis of the costs cannot be made simply by taking into consideration the cost of the chemicals.

2. Variable & Fixed Costs:

It is known that the total costs to treat a certain number of square feet of metallic surface are given by the sum of the **Variable Costs** and of the **Fixed Costs.**
If we indicate with: **S** = Total Costs **A** = Fixed Costs **K** = Variable Costs per surface unit **N** = Total Number of treated square feet

We have: **S = A + KN**

The Fixed Costs consist of the following:

A = A1 + A2 + A3 + A4 + A5

Where: **A1** = Financial Costs of Capital (C) invested in the Plant. **A2** = General Direct Costs charged to the Products produced in the Plant **A3** = Maintenance Costs, Insurance, etc. **A4** = Imputed Costs - imputed rent (use of the plant) **A5** = Financial costs - Capital invested in waste management.

The Variable Costs consist of the following:

K = K1 + K2 + K3 + K4 + K5 + K6

Where: **K1** = Heating Costs per sq. ft. **K2** = Electrical Energy Costs per sqm **K3** = Costs for Chemicals per sqm **K4** = Cost for Water usage per sqm **K5** = Cost for Effluent Depuration/Disposal per sqm **K6** = Direct Labor Cost per sqm

The importance of the Fixed and Variable Costs in Plaforization™ is shown on the enclosed Tables.

Some savings of PLAFORIZATION™ include the following:

1. LOW CAPITAL INVESTMENT:

Plaforization™ takes place in a simple, compact and low-cost plant. Only one tank is necessary to clean and phosphate simultaneously. No rinsing tanks are necessary, resulting in less floor space used. And there are no costly auxiliary plants for water treatment of effluent.

Financial costs are limited because the capital invested in the plant is less than that required for other pretreatment processes, and amortization of the plant is longer than that required for a conventional aqueous phosphating plant, because corrosion is much more prevalent in operations based upon aqueous systems. There are, of course, no costs for water treatment and for disposal, which are not required for Plaforization™.

2. NO HEATING COSTS ARE INVOLVED IN THE TREATMENT PHASE:

Plaforization™ cleans and phosphates simultaneously in a single tank at room temperature, so no energy is required to heat up the phosphating solution.

That results in great savings in comparison with the conventional aqueous phosphating process, where heating costs are often high.
Furthermore, there is no lost operating time waiting for warm-up as with heated systems.

3. LOW INSTALLED ELECTRICAL POWER:

Plaforization™ does not require the installation of complex and costly equipment.
There is only one simple filter unit with a low-capacity filter/spray pump, and fans for air extraction and air blowing. In some cases heating is required to produce solvent flash-off, but this cost is also present in conventional aqueous phosphating, since water must be evaporated at the end of the treatment.
In a conventional aqueous phosphating process, on the other hand, we have a multi-stage plant where several medium-capacity spray pumps and auxiliary electrical equipment are all necessary (i.e., pump in the water demineralization unit, pumps in the water purification unit, etc.).

4. NO COSTS FOR WASTE MANAGEMENT:

Plaforization™ works in an anhydrous medium where a clean reaction takes place. No hazardous muds, sludge or similar by-products are generated in the process.

Consequently, there is no down-time for messy cleaning of tanks, because there is no accumulating effluent.

5. NO COSTS FOR WATER USE OR WATER PURIFICATION:

Plaforization™ works in an anhydrous medium. No water is involved in the process, so there are no costs either for water usage or for water treatment/disposal.

6. NO COSTLY EQUIPMENT TO PROTECT THE ENVIRONMENT AND THE WORKPLACE:

Plaforization™ does not require the installation of costly water purification plants, effluent treatment plants, or air purification equipment.
There is no need to install active carbon filters or post-combustion units when the amount of VOCs that is extracted to atmosphere remains in compliance with legislative standards.

7. LOW DIRECT LABOR COSTS:

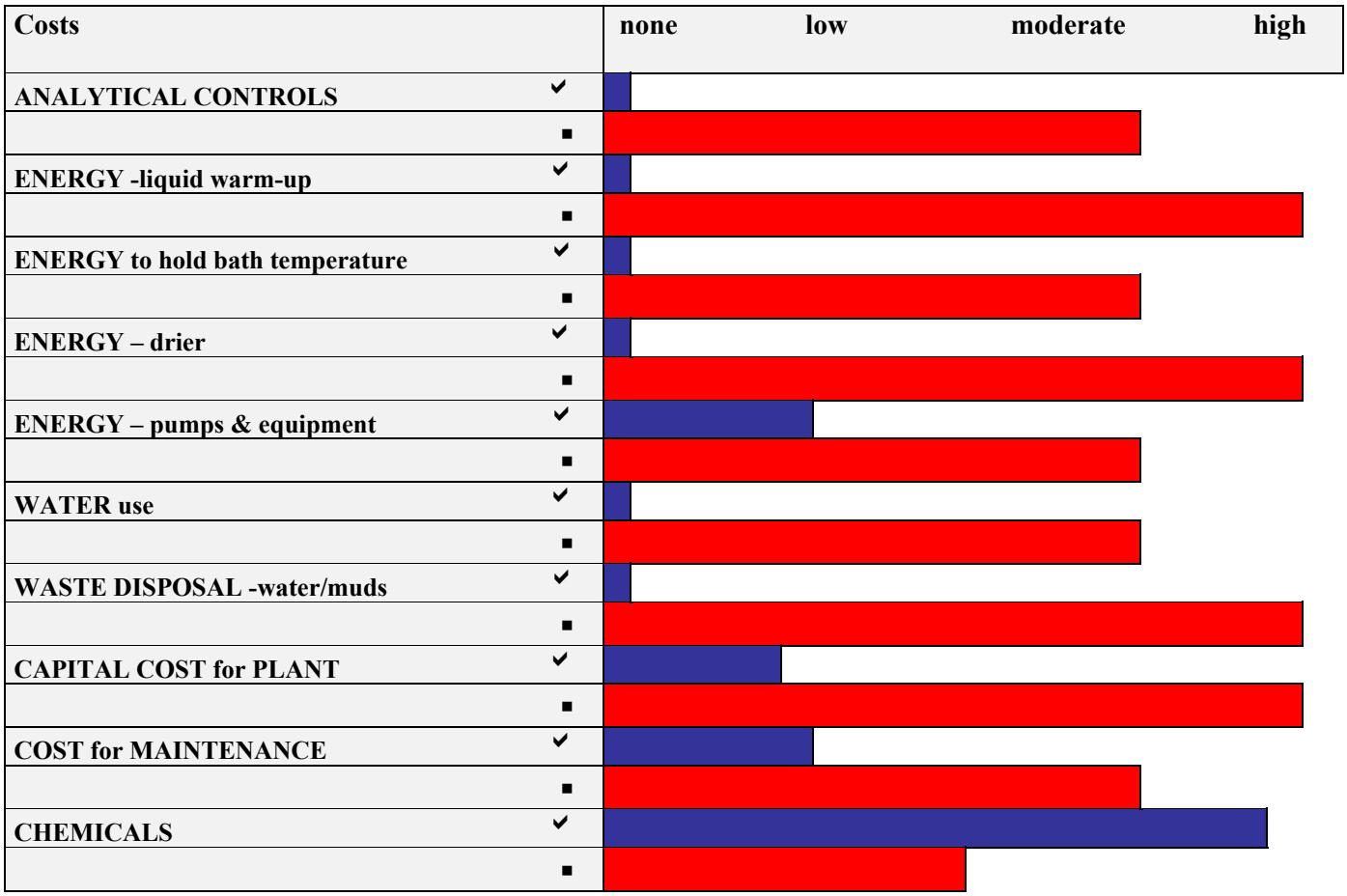
The simplicity of the process does not require skilled personnel. Plaforization™ does not require a daily or weekly control of the phosphating bath and general maintenance is limited. No continuous watchman service.

8. GREATER PRODUCTIVITY:

The simplicity of the process (1 minute to clean and phosphate) increases productivity.

PLAFORIZATION™ vs. Conventional Aqueous-based Phosphating

Costs	none	low	moderate	high
ANALYTICAL CONTROLS ✔				
▪				
ENERGY -liquid warm-up ✔				
▪				
ENERGY to hold bath temperature ✔				
▪				
ENERGY – drier ✔				
▪				
ENERGY – pumps & equipment ✔				
▪				
WATER use ✔				
▪				
WASTE DISPOSAL -water/muds ✔				
▪				
CAPITAL COST for PLANT ✔				
▪				
COST for MAINTENANCE ✔				
▪				
CHEMICALS ✔				
▪				

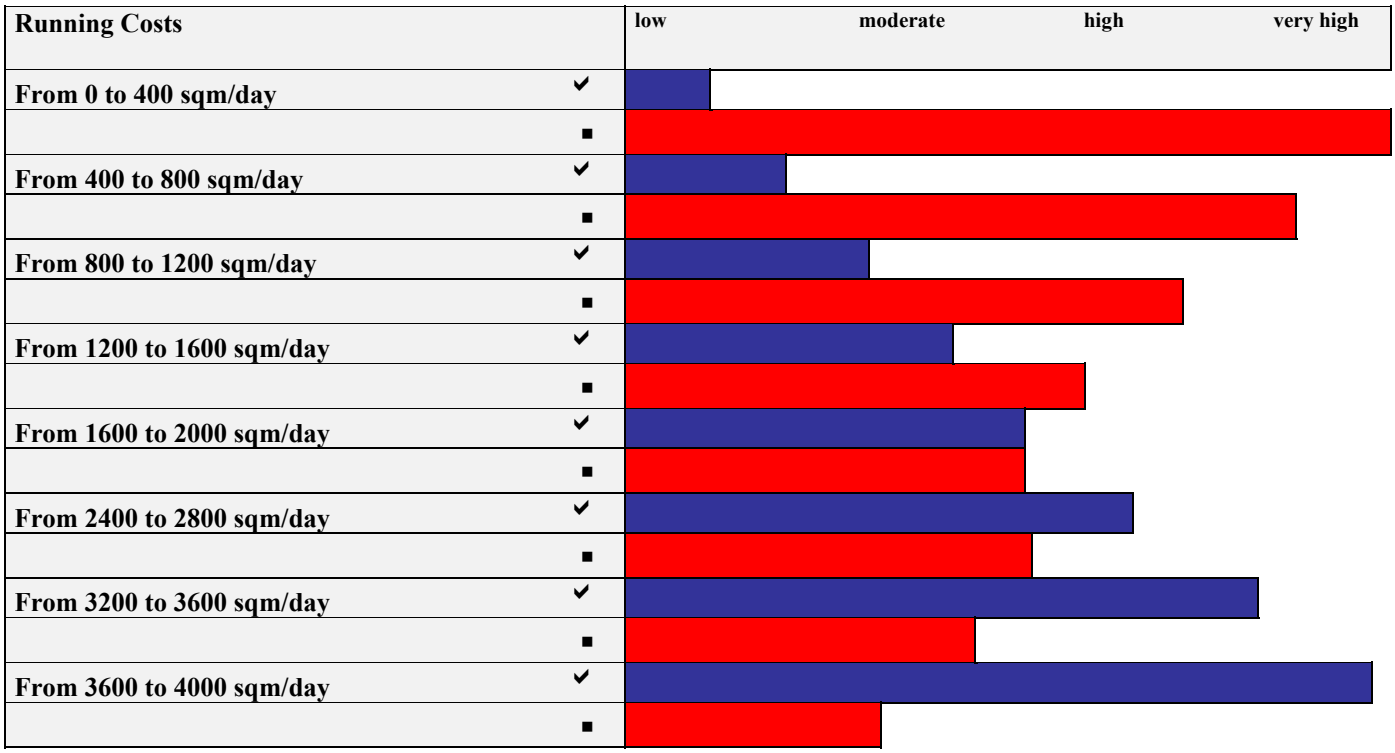


✔ Plaforization™ ▪ Conventional

The above data represent the average of all data collected from various markets and countries. The information is approximate and should be used only for a general indication.

PLAFORIZATION™ vs. Conventional Aqueous-based Phosphating

Running Costs - Comparative Table



✔ **Plaforization™** ▪ **Conventional**

The above data represents the average of all data collected from various markets and countries. The information is approximate and should be used only for a general indication.

PLAFORIZATION™
How To Determine the Cost per sqm

	DESCRIPTION	FORMULA
Cost for chemicals - CHEM	Calculate the cost of the Ready To Use solution, RTU	Cost of the Ready to Use Solution - (price/lt) / Average yield (sqm/lt) (1)
Cost for Electricity - ELEC	List the electrical equipment and calculate the total electrical power installed. Use the following formula to determine the Cost per sqm.	(Power in kW x cost of 1 kW x 8 hrs) / no. of sqm treated per day
Cost for ENERGY	Calculate fuel consumption in the drier to perform fluid flash-off **(applicable only to Oven Drying Plaforization™ systems).**	Total Cost for Fuel Consumption / no. of sqm treated per day
Mortgage Cost - Plant Depreciation & Charge, CHARGE	Calculate the Charge per sqm on the basis of the Total Estimated Cost of the Plant. Use the following formula:	***Ca(annual charge)*** **=** $i(1+i)^n / i(1+i)^{n-1}$ ***Charge per sqm (Charge)*** **= (Ca/230) / no. of sqm treated per day**
	Running Cost per sqm, RUN =	**CHEM + ELEC + ENERGY + CHARGE**

(1) Yield: yield must be determined by taking into account the following parameters: geometrical shape - nature of the surface presence of folds, pockets, and areas where liquid drainage could be difficult, welded areas - porosity of the metal surface, etc.
Direct Labor Cost and Cost for General Maintenance are not significant.

PLAFORIZATION™
How To Determine the Cost per sqm

Table a) Fixed Costs

Cost	Incidence (1)	Calculation
A1	**limited**	mortgage cost per year (conventional formula)
A2	**not determined**	independent from the plant
A3	**limited**	no daily checks - limited maintenance
A4	**extremely low**	encumbrance / cost per sqm
A5	**absent**	no purification plants

Table b) Variable Costs

Cost	Incidence (1)	Calculation
K1	**absent**	cold process,
K2	**limited**	(H x 0.736 x kW x 8 hours) / N
K3	**high**	cost of 1 lt RTU / average expected yield
K4	**absent**	no water use, no rinsing stages
K5	**absent**	no water effluent to be purified / disposed of, no waste disposal
K6	**very limited**	the plant is simple to run

Notes: H = electrical power installed - KW= cost of 1 kW - N= number of sqm treated per day RTU= Ready To Use Solution - (1) = incidence on the total cost of the process