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Integrated Cleaning Solutions

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A Proceco Technical Analysis: Mart's Pump Technology Demystified

It is not the intent of this analysis to speak negatively of our competition but rather to provide our sales people with the facts regarding Mart's pump technology, which Mart often claims to be superior to Proceco's. Proceco started designing and building their own high-pressure pumps (over 70 psi) in the mid-eighties, when they could not source pumps that operated reliably under the harsh conditions of power spray washing.

Our competition would have you believe that they not only invented spray washing, but also invented pump technology! Unfortunately, they often get away with this because, most of us in our busy everyday lives do not have the time or information to challenge their claims. Fortunately, facts speak for themselves and the information below will help to demystify their claims.

Who does the engineering?

Mart claims they have engineered their pump systems. However, the truth is that they use standard pumps manufactured by the Carver Pump Company. These are catalogue items available to the general industry.

In fact, Mart's entire pump line-up from 20 to 90 HP is made up of either **a single pump** model with varying impeller diameters or a **combination of two pumps**, again with varying impeller diameters. This is illustrated with several examples:

1. **Mart 20HP pump, rated at 269 USGPM at 107 psi (247 ft).**
   Mart uses a vertical cantilevered pump, with 3"×2½"×10" wet end*.
   The power curve for this pump with an 8" diameter impeller corresponds to the above ratings (provided the motor operates beyond its normal service factor. More on this later in this document).

2. **Mart 55HP pump, rated at 356 USGPM at 187 psi (432 ft).**
   Mart uses two pumps in a series arrangement. The primary pump is a vertical cantilevered model, with 3"×4"×13" wet end, and the secondary pump is a 3"×2½"×10" wet end. The combined curves for this pump arrangement achieve a total of 55HP (25HP + 30HP) with the above ratings.

3. **Mart 70HP pump, rated at 371 USGPM at 203 psi (469 ft)**
   This is the same model combination as above but with different impeller sizes producing 70HP (20HP + 50HP) with the above ratings.

Note: This information was obtained from http://www.carverpump.com/pdf/sales/gvc.pdf.

* This designation signifies that the pump has a 3" suction inlet, 2-1/2" outlet and maximum 10" diameter impeller.

The truth about efficiency

Another claim made by Mart is the efficiency of their pumps. There are different ways to interpret efficiency. Let's take for example, the following horsepower formula, published on Mart's web site at http://www.martwash.com/html/seminars_articles/pumptech.htm.

$$\text{EFF} = \frac{\text{GPM} \times \text{Head} \times \text{Specific Gravity}}{\text{Horsepower} \times 3960}$$

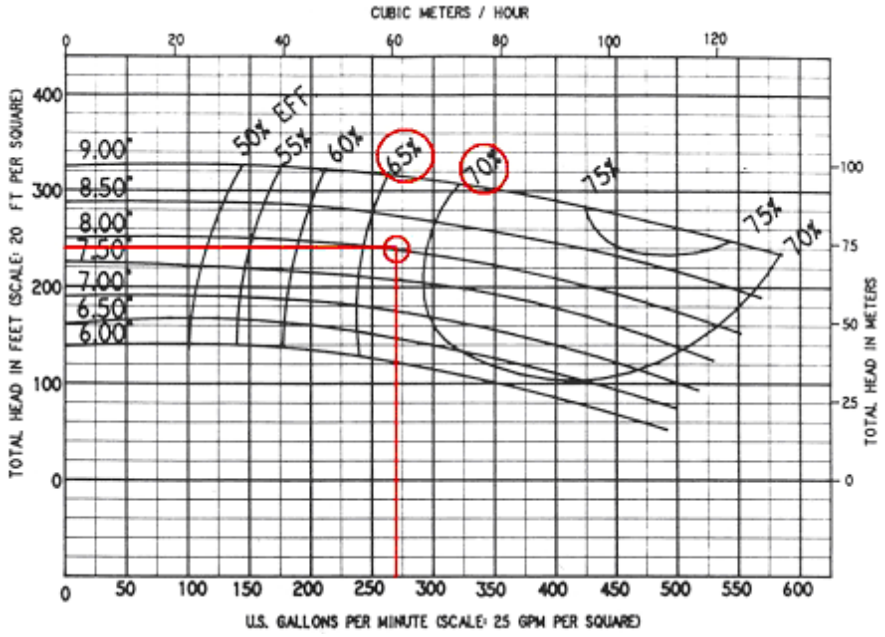
Mart claims that their 20 HP pump described above is 88.3% efficient. Sounds a bit exaggerated to me, so let's see if this is right! By applying the pump rating provided by Mart to the formula above:

$$\text{EFF} = \frac{269\text{gpm} \times 247' \times 1.0}{20\text{HP} \times 3960}$$

EFF = 83.8% (there appears to be a typo on Mart's website)

After further analysis of what appears to be an extremely efficient centrifugal pump, it becomes clear from the horsepower curve for the model in question (not shown) that 25HP is actually required at 269gpm (247' head). One can get 25HP from a 20HP motor by operating it at 25% above its nominal rating (1.25 service factor). If this were the case (which in most cases is not good practice) the above formula would yield an efficiency of 66.7%. Incidentally, this is what the Carver Pump Company publishes as the efficiency of this pump model at that flow rate (see curve below).

That is a more than a 20% gap in efficiency!



Ref: Carver Pump Company, Pump Curve PC-1010-12

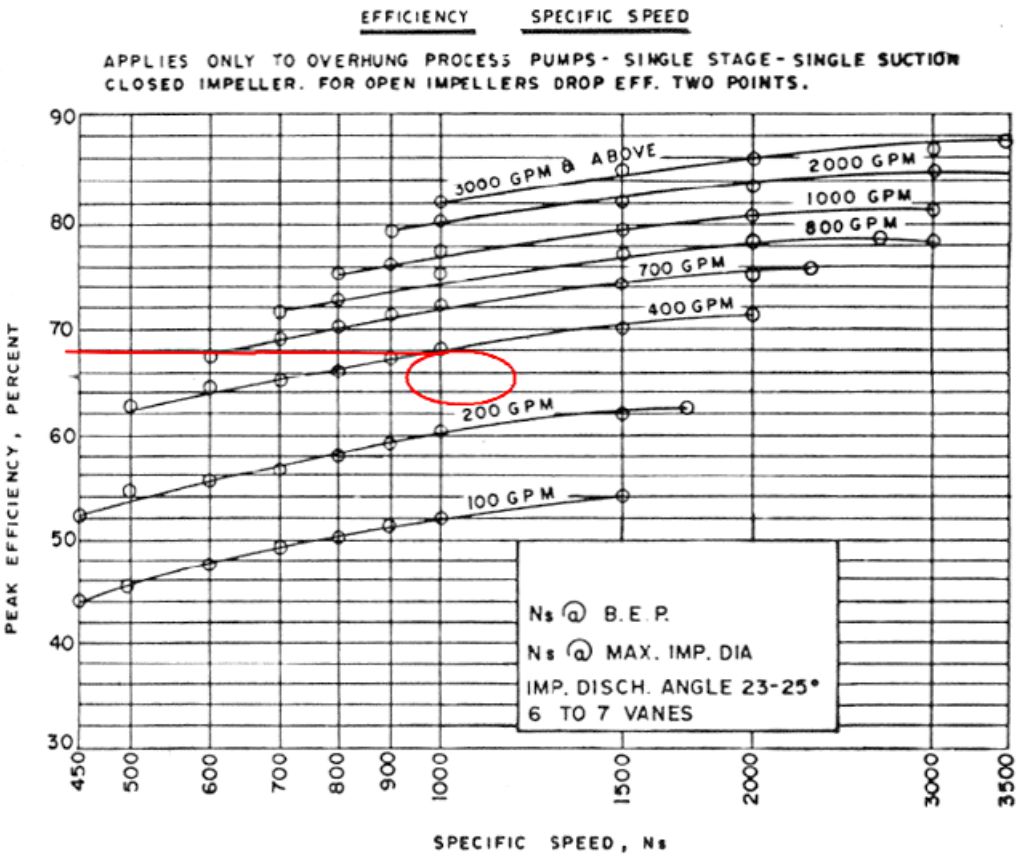
For the record, single-stage centrifugal pumps usually have less than 70% efficiency when operated at the low-flow and high-pressure conditions in question.

To further elaborate the point, the graph below shows that such a pump with a specific speed (a dimensionless parameter used in pump engineering) of less than 1000 is not capable of achieving efficiencies greater than 68% at that given flow rate (269 gpm).

$$\text{Specific Speed } (N_s) = \frac{RPM * GPM^{1/2}}{\text{Head (FT)}^{3/4}}$$

$$(N_s) = \frac{3500 * 269^{1/2}}{247^{3/4}}$$

$$(N_s) = 921$$



Ref: Centrifugal Pumps, Design and Application 2nd Edition, Val S. Lobanoff, Robert R. Ross

Our competition also claims that *"Duplex and Quadroplex Pump Systems operate at the highest efficiency".* In fact, the overall efficiency of these centrifugal pumps in series (duplex) can never increase. The overall efficiency of a series arrangement is simply the combined output over input of the individual pumps; assuming of course both efficiency points were taken at the same flow rate.

To demonstrate this in an example, the Mart 55HP Duplex pump will be used:

Mart duplex 55HP; rated at 356 gpm / 187 psi (432 ft)
uses 2 pumps in series (Pump1 + Pump2)

Pump1: 25HP; rated at 356 gpm @ 175 ft; (Efficiency rated at 63%)
Pump2: 30HP; rated at 356 gpm @ 257 ft; (Efficiency rated at 73%)

Note: The final pressure and horsepower of pumps combined in series is simply the sum of both pressures and horsepowers respectively.

Therefore, the efficiency of the pumps combined:

$$\textbf{EFF} = \frac{\textbf{356gpm x (175+257)' x 1.0}}{\textbf{(25+30) HP x 3960}}$$

$$\textbf{EFF = 70\%}$$

Conclusion

As you can see, if information goes unchallenged, it can lead to improper decision-making.

Thank-you,

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