	APPLICATIONS MANUAL	DOC NO.:
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EFFICIENCY PREDICTION BY HIS

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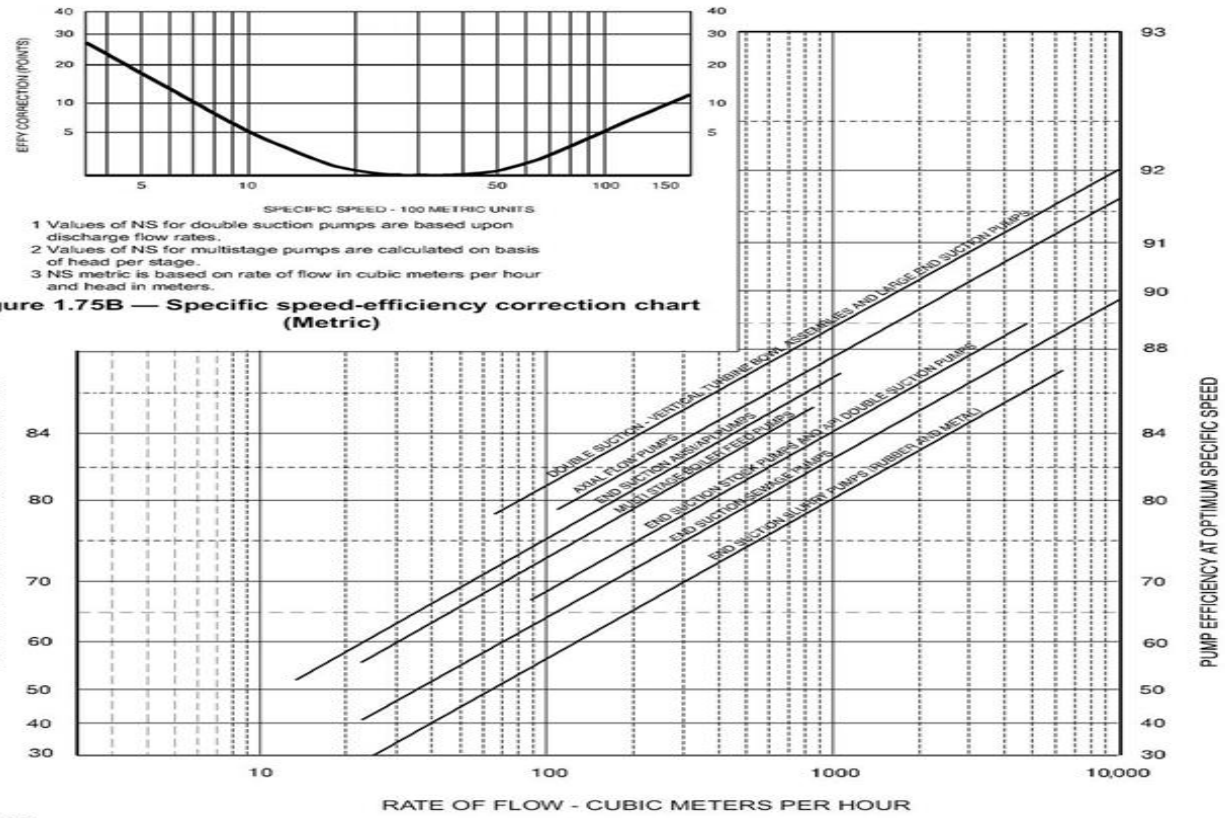
Objective: The aim of this document is to lay-out a method to predict the generally attainable range of efficiency from empirical charts for a pump whose flow rate, differential head and rotational speed is known.

The major influences on centrifugal pump efficiency are specific speed (NS), pump size, NPSHA or (NPSHR) and the type of pump selected to meet the service conditions.

Fig 1.76B relate to industrial class pump designed, manufactured and tested in accordance with recognized industry standard. Deviation in efficiency shown in Fig 1.76B is influenced by following:

- Desired curve shape (rise to shutoff, etc.);
- Dimensional conformance and quality (i.e., shaft run out);
- Surface roughness;
- Internal clearances;
- Design compromise for manufacturability;
- Mechanical losses;
- Solids handling capability;
- Test tolerances.

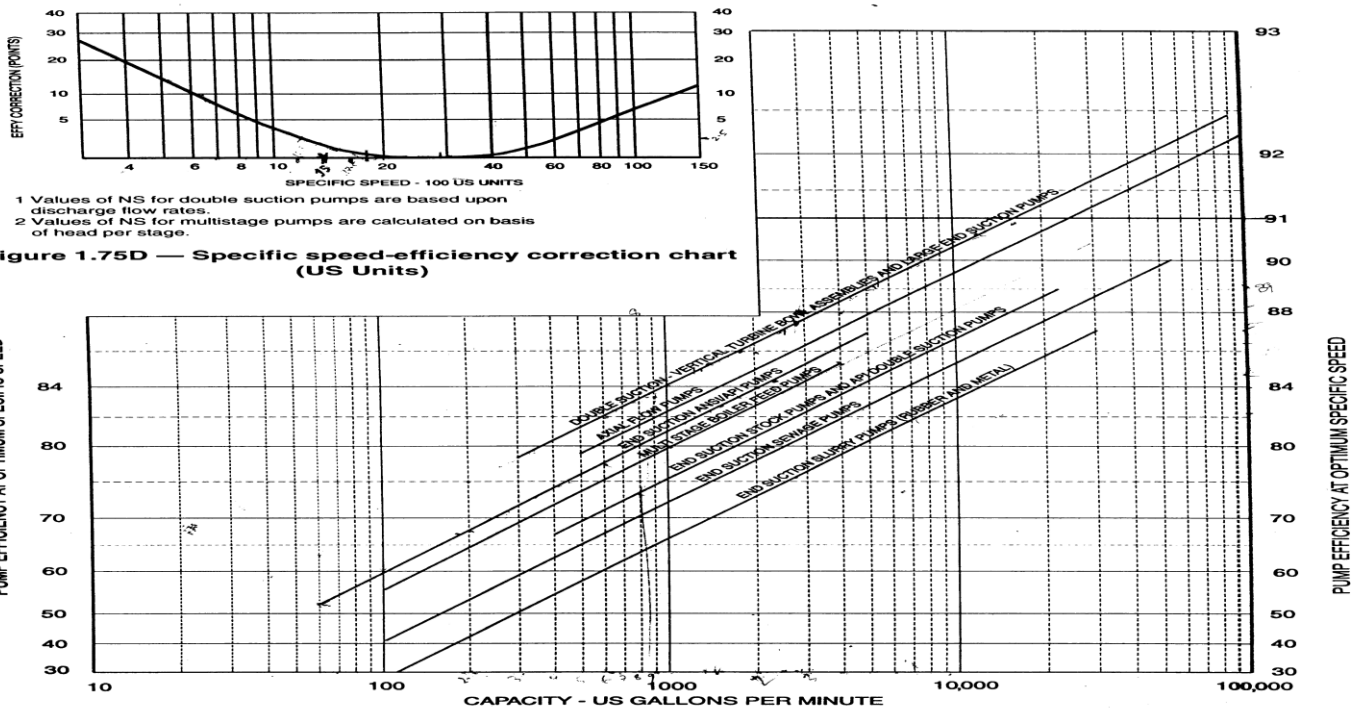
A method is presented for predicting generally attainable efficiency levels at the best efficiency point of selected types of centrifugal pumps when the rate of flow (Q) , total head per stage (H), net positive suction head available (NPSHA) and the service conditions are known.



1 Values of NS for double suction pumps are based upon discharge flow rates.
2 Values of NS for multistage pumps are calculated on basis of head per stage.
3 NS metric is based on rate of flow in cubic meters per hour and head in meters.

Figure 1.75B — Specific speed-efficiency correction chart (Metric)

NOTES:
1 The above charts depict the generally attainable efficiency levels of centrifugal pumps at best efficiency point with maximum diameter impeller when pumping clear water at 30°C (85°F).
2 The above charts relate to industrial class pumps designed, manufactured and tested in accordance with recognized industry standards.



1 Values of NS for double suction pumps are based upon discharge flow rates.
2 Values of NS for multistage pumps are calculated on basis of head per stage.

Figure 1.75D — Specific speed-efficiency correction chart (US Units)

NOTES:
1 The above charts depict the generally attainable efficiency levels of centrifugal pumps at best efficiency point with maximum diameter impeller when pumping clear water at 30°C (85°F).
2 The above charts relate to industrial class pumps designed, manufactured and tested in accordance with recognized industry standards.

Figure 1.75C — Optimum generally attainable efficiency chart (US Units)

Sample Calculations

Model: 6HFT12

Type: Axially split case two stage

Volute construction: Two single volute

At BEP:

Impeller maximum diameter = 295 mm

Discharge, Q = 438 m^3/ h

Head, H = 214 m

Speed, N = 2930 rpm

Specific speed,

(Metric) $N_s = (N\sqrt{Q})/ H^{0.75} = (2930\sqrt{438})/ 214^{0.75}$ = 1096 rpm

(US) $N_s = [N\sqrt{(Q \times 4.403)}/ (H \times 3.28)^{0.75}]$ = 944 US Units

From the chart 1.75 A, ɳ = 86.2% (for axially split case two stage)

Enter the chart 1.75 B with the calculated N_s = 1096 rpm and read off efficiency correction is 4.

Predicted efficiency = optimum efficiency – efficiency correction = 86.4 – 4 = 82.4%

Form the chart 1.76A, at 438 m^3/ h, the normal deviation is 5%. Therefore, the predicted efficiency is **78.3% to 86.5%.**

Bibliography

1. **ANSI/HI 20.3 - 2013**