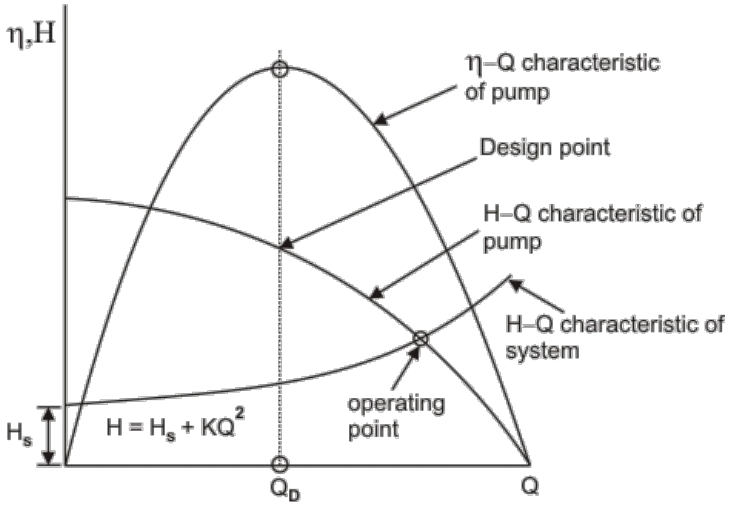

Figure 37.3 H-Q Characteristics of pump and system

Effect of Speed Variation

Head-Discharge characteristic of a given pump is always referred to a constant speed. If such characteristic at one speed is know, it is possible to predict the characteristic at other speeds by using the principle of similarity. Let *A, B, C* are three points on the characteristic curve (Fig. 37.4) at speed N_1 .

For points *A, B* and *C* , the corresponding heads and flows at a new speed N_2 are found as follows:

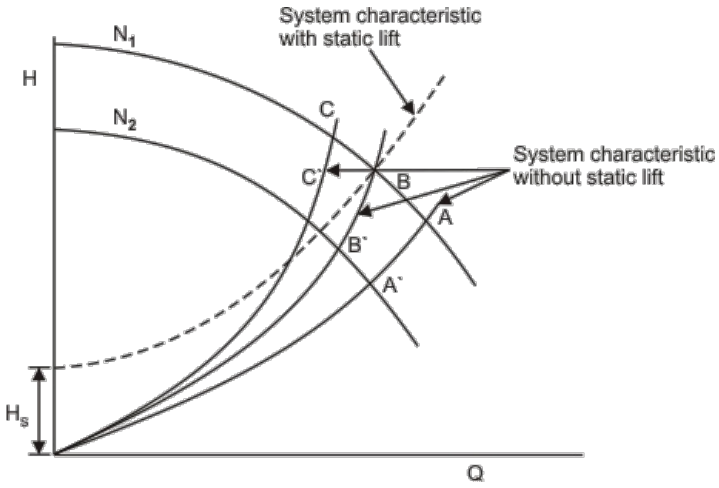

Figure 37.4 Effect of speed variation on operating point of a centrifugal pump

From the equality of π_1 term [Eq. (3.1)] gives

$$Q_1 / N_1 = Q_2 / N_2 \quad \text{(since for a given pump } D \text{ is constant)} \quad (37.6)$$

and similarly, equality of π_2 term [Eq. (3.1)] gives

$$H_1 / N_1^2 = H_2 / N_2^2 \quad (37.7)$$

Applying Eqs. (37.6) and (37.7) to points *A, B* and *C* the corresponding points A' B' and C' are found and then the characteristic curve can be drawn at the new speed N_2

Thus,

$$Q_2 = Q_1 N_2 / N_1 \text{ and } H_2 = H_1 (N_2)^2 / (N_1)^2$$

which gives

$$\frac{H_2}{H_1} = \frac{Q_2^2}{Q_1^2}$$

or $$H \propto Q^2 \quad (37.8)$$

Equation (37.8) implies that all corresponding or similar points on Head-Discharge characteristic curves at different speeds lie on a parabola passing through the origin. If the static lift H_s becomes zero, then

the curve for system characteristic and the locus of similar operating points will be the same parabola passing through the origin. This means that, in case of zero static life, for an operating point at speed N_1, it is only necessary to apply the similarity laws directly to find the corresponding operating point at the new speed since it will lie on the system curve itself (Figure 37.4).

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