

2.1.1 SAE Publications

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SAE J1339 Test Method for Measuring Performance of Engine Cooling Fans

SAE J1349 Engine Power Test Code—Spark Ignition and Compression Ignition—Net Power Rating

3. METHOD OF PRESENTING TEST DATA

To evaluate the power requirement differential between the fixed ratio fan drive and a speed modulating or on/off drive the following formula will be utilized for all duty cycle conditions. Typical curves are shown in Figure 1

To evaluate the power, use the equation:

$$\text{Total Power} = (N_i - N_o)(N_o^2)(K) + (N_o^3)(K) + P_i \quad (\text{Eq. 1})$$

where:

$(N_i - N_o)(N_o^2)(K)$ = Slip/drag power

$(N_o^3)(K)$ = Fan power

N_i = Input speed

N_o = Fan speed

K = Fan constant

P_i = Power loss associated with the fan drive system minus the fan and clutch but including belts, pulleys, and pulley bearings

"K" fan constant is obtained by dividing fan power by the (fan speed)³ required to consume that power.

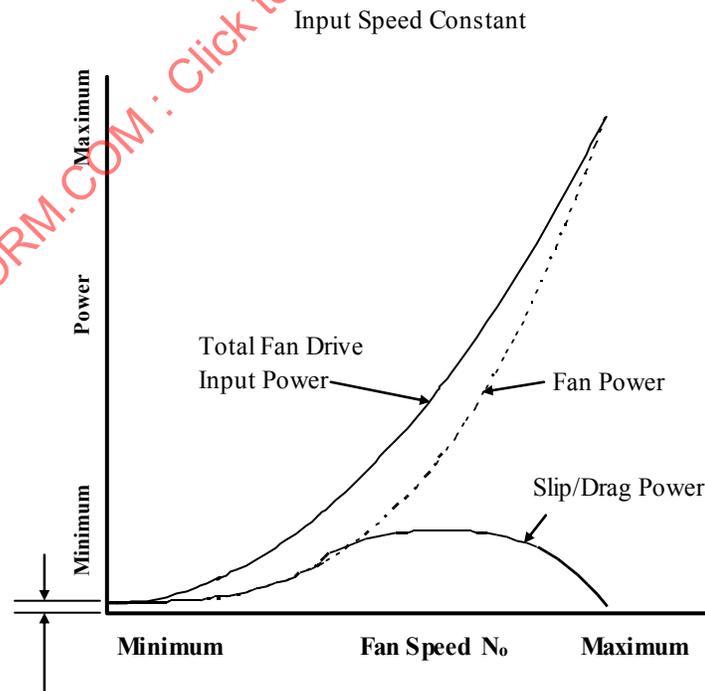


FIGURE 1 - POWER VERSUS FAN SPEED

Fan output speed (N_o) can be determined from curves such as those presented in Figures 2 and 3. Curves as shown in Figure 2 can be provided by the fan drive manufacturer. Curves as shown in Figure 3 would normally be derived by the fan drive user.

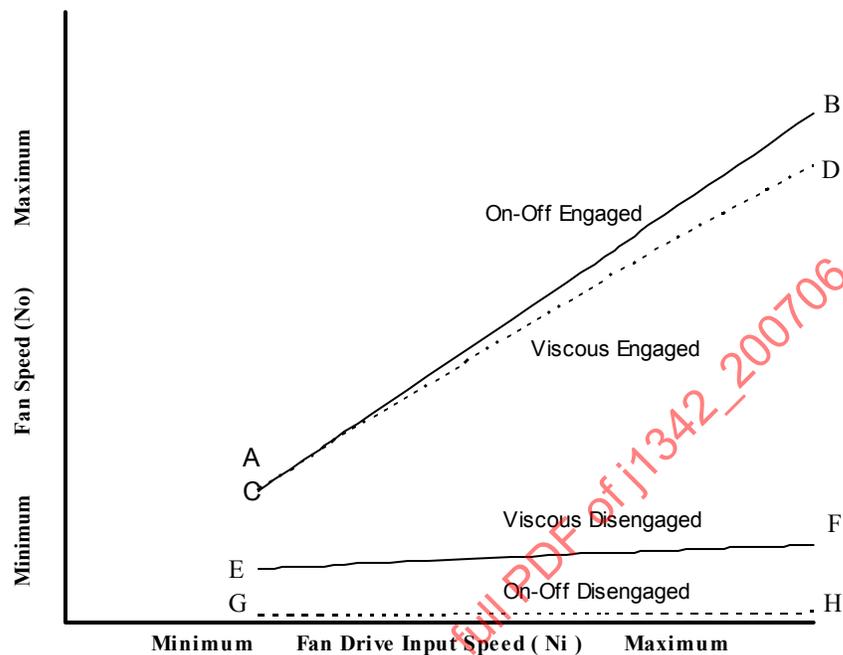


FIGURE 2 - FAN SPEED VERSUS FAN-DRIVE INPUT SPEED

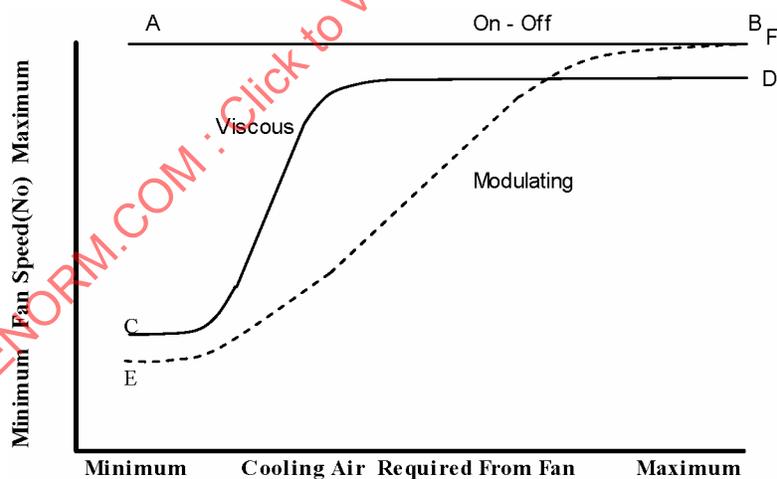


FIGURE 3 - FAN SPEED VERSUS COOLING AIR REQUIRED

4. PROCEDURE FOR ANALYZING VARIOUS TYPES OF FAN DRIVE SYSTEMS

4.1 The Section 3 method applied to the on/off drive is as follows:

When operating conditions do not require fan drive actuation, fan speed (N_o) will fall on line G – H (Figure 2), or may be zero (0) rpm ($N_o = 0$), depending on the particular fan clutch being analyzed.

When operating conditions require fan drive actuation, fan output speed (N_o) will fall along line A – B of Figure 2. Given a specific input speed (N_i), the output speed (N_o) can be determined from line A – B of Figure 3.