

Sizing of Drivers and Transmissions for Compressors, Fans, and Pumps

(This practice is appropriate for attachment to Inquiry or Purchase Document)

IP 10-11-1

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Rev. 0

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Changes shown by

SCOPE

- I 1.1 This practice covers the sizing of drivers and transmissions for compressors, fans, and pumps.
- I 1.2 **An asterisk (*)** indicates that a decision by the purchaser is required or that additional information is furnished by the purchaser.

SUMMARY OF ADDITIONAL REQUIREMENTS

- I * 2.1 **Table 1** lists the standards which shall be used with this practice as specified by the purchaser.

TABLE 1

STANDARD
RMA (Rubber Manufacturers Association) Bulletin No. 3 Ed. 2 Static Conductive V-Belts

DEFINITIONS

- I 3.1 Normal operating conditions refer to pressure, specific gravity, capacity, and other conditions for which a single item of driven equipment is guaranteed. When a service is shared by several units of equipment, the total capacity for the service is the sum of the normal capacities of each unit.
- I 3.2 **Normal power.** Power required by the driven equipment at **normal operating conditions** and includes all mechanical losses within the driven equipment, except power transmission losses.
- I 3.3 **Driver power rating** is defined as follows:
 - a. **For electric motors:** the nameplate power at 1.0 service factor or the nameplate power times a continuous overload capability/service factor multiplier for those standards of manufacture which recognize continuous overload capability/service factor ratings.
 - b. **For internal combustion engines:** the power available at the engine coupling after any derating for type of service, altitude, summer ambient temperature, fuel quality, and after subtracting engine power absorbed by auxiliary equipment driven from the engine shaft.
 - c. **For steam turbines:** the power available at minimum steam conditions (minimum temperature and pressure and maximum back pressure) at the turbine coupling after deducting power absorbed by auxiliary equipment driven from the turbine shaft. However, turbine efficiency shall be optimized for delivering **normal power and speed with normal steam conditions**.
 - d. **For gas turbines:** the power available at the turbine drive coupling when operating at the rated turbine speed, and after any derating of the turbine for the specified altitude, summer ambient temperature, inlet and exhaust duct losses, and power deduction for any auxiliary equipment driven from the turbine shaft.
 - e. **For drivers with integral power transmission:** the power available at the output shaft of such integral power transmissions.
- I 3.4 **Power transmissions** are defined as any equipment, imposed between the driver and the driven equipment, which may transmit or alter the developed driver speed or torque, including couplings.

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SIZING OF DRIVERS

O,R 4.1 **Driver power rating** shall be calculated per the following:

DRIVER TYPE	DRIVEN EQUIPMENT	DRIVER POWER RATING SIZING BASES
Electric Motor, Steam Turbine, Internal Combustion Engine	Compressors, Centrifugal Flow Fans, ⁽²⁾ Pumps ⁽²⁾	The larger value of subpar. a. and b., below: a. Minimum Required Driver Power: $\frac{\left(\text{Driven Equipment Normal Power Requirement} \right) \times \text{Load Factor}^{(1)}}{\left(\text{Mechanical Efficiency of Separate Power Transmission} \right)}$ b. Driver Power Required at Alternate Operating Condition: $\frac{\left(\text{Driven Equipment Power Requirement of Specified Alternate Operating Condition} \right) \times \text{Load Factor}^{(1)}}{\left(\text{Mechanical Efficiency of Separate Power Transmission} \right)}$
Gas Turbine	Compressors, Pumps ⁽²⁾	Per subpar. a. & b., above and the following: - Power rating including any helper turbines, shall be equal to or greater than the Minimum Required Driver Power. - Power rating including any starter or helper turbines, shall exceed the driven equipment (including gear) power by at least 5% over the range from zero to rated speed and at any specified alternate operating conditions. *3. Selection of gas turbine power ratings shall be approved by the Owner's Engineer.
Electric Motor, Steam Turbine	Axial Flow Fans	$\frac{\left(\text{Fan power required at specified minimum design dry bulb temperature with blade angle set for specified max. design dry bulb temperature} \right) \times \text{Load Factor}^{(1)}}{\left(\text{Mechanical Efficiency of Separate Power Transmission} \right)}$

Notes:

- (1) Factors to be applied as multipliers in calculating power rating requirements for drivers shall be per [Table 2](#).
- (2) Alternate conditions for sizing drivers of Pumps and Centrifugal Flow Fans are given in [Par. 4.3](#).

O,R 4.2 **When an alternate operating condition is specified** for the driven equipment, the condition requiring the greatest power and corresponding speed shall be selected for **sizing the driver**.

O,R 4.3 **Alternate conditions for selecting the driver power rating** are specified in the following for the equipment types indicated:

- Centrifugal Flow Fans:** The fan power shall be selected for the normal flow capacity, but with minimum ambient temperature at the site.
- Centrifugal Flow Fans in parallel operation:** Motors shall be sized for operation over the entire head-capacity curve.
- Centrifugal Pumps, 0 to 5 hp or 5 kW:** The pump hp (kW) at the normal operating condition shall be increased by 0.5 hp (0.5 kW).
- Centrifugal Pumps in parallel and auto start operation, Firewater and Boiler Feed Water Pumps.** Motors shall be sized for operation over the entire head-capacity curve.
- Positive Displacement Pumps.** The pump power shall be selected for normal capacity, but with a discharge pressure equal to setting of the pressure relief valve.
- Vacuum Service Pump.** The pump power shall be the peak power required during the vacuum pull-down period.