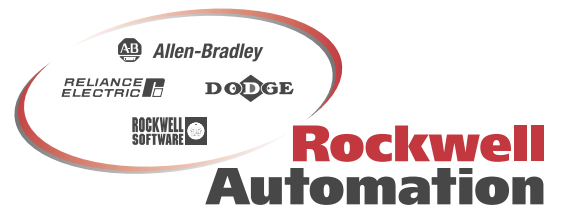




Drive Fundamentals

# Load Characteristics



Bringing Together Leading Brands in Industrial Automation

## Motor Load Groups

*Constant Torque Load*

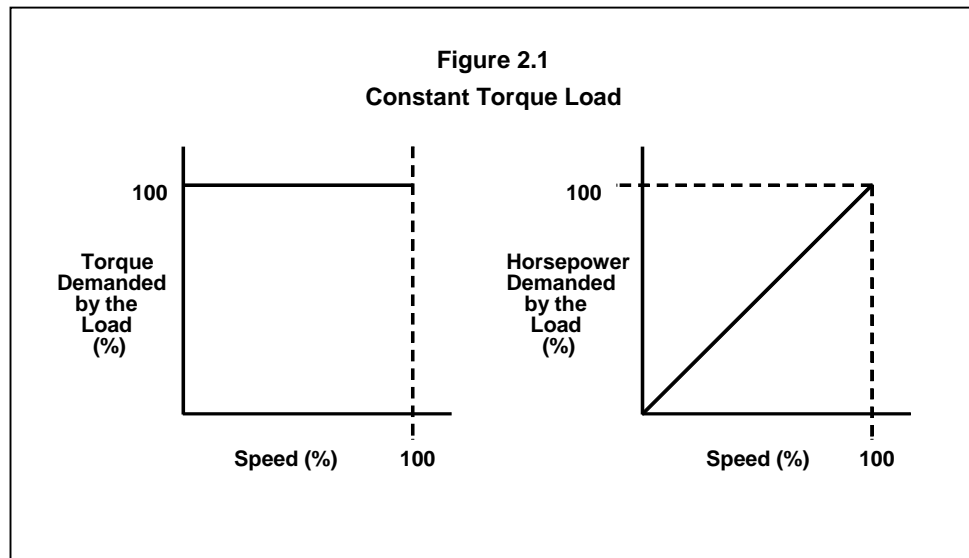
*Variable Torque Load*

## Introduction

Motor loads are classified into two main groups depending on how their torque requirement varies with operating speed. The following paragraphs deal with the various load types found in the industry.

## Constant Torque Load

The torque demanded by the load is constant throughout the speed range. Loads of these types are essentially friction loads. Figure 2.1 shows the constant torque and its effect on horsepower demanded by the load.



Since horsepower is a product of torque times speed, and torque remains constant in this type of load, horsepower is a function of speed.

$$HP = \frac{\text{Torque} \times \text{Speed}}{5250}$$

Where:

Torque = lb-ft.

Speed = RPM

5250 = a proportionality constant

Examples of this type of load are conveyors and extruders. Constant torque is also required when shock loads, overloads, or high inertia loads are encountered.

**Variable Torque Load**

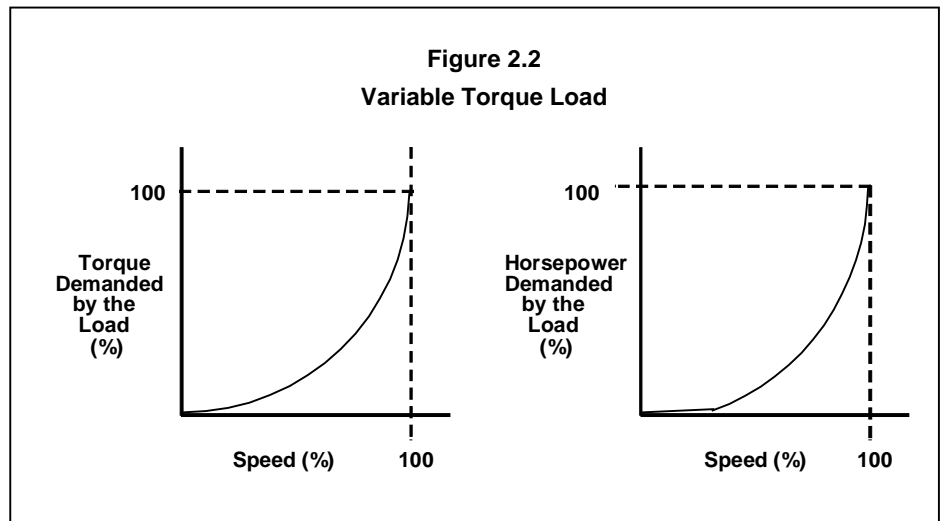
With this type of load, the torque demand increases with speed, usually speed squared (Speed<sup>2</sup>).

$$\text{Torque Constant} \times (\text{Speed})^2$$

Horsepower is typically proportional to speed cubed (Speed<sup>3</sup>).

Figure 2.2 shows the variable torque and its effect on horsepower demanded by the load.

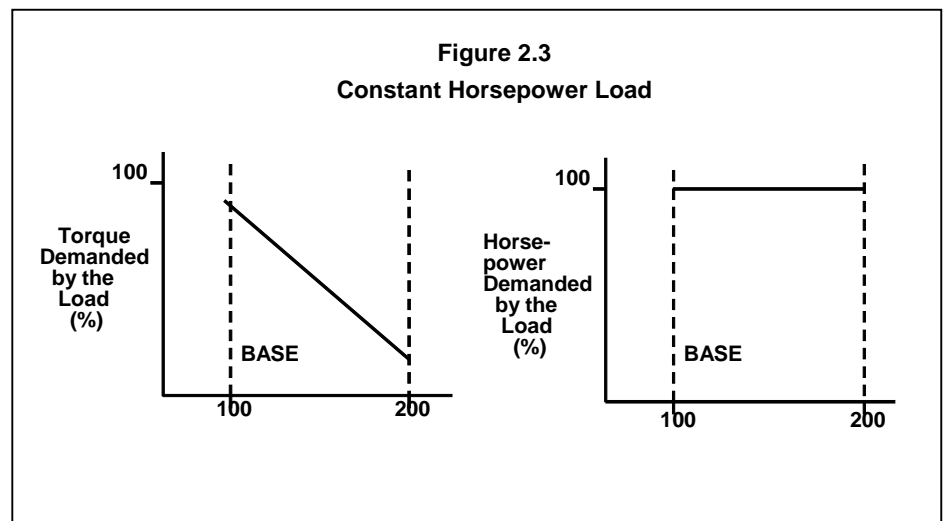
Examples of loads that exhibit variable load torque characteristics are centrifugal fans, pumps, and blowers. This type of load requires much lower torque at low speeds than at high speeds.



**Constant Horsepower Operation**

This is a function of the motor being operated above base motor speed. The horsepower demanded by the load is constant within the speed range. The speed and torque are inversely proportional to each other. Figure 2.3 shows the constant horsepower and variable torque demanded by the load.

Examples of this type of load are center driven winders and machine tool spindles.



---

**Reach us now at [www.rockwellautomation.com](http://www.rockwellautomation.com)**

Wherever you need us, Rockwell Automation brings together leading brands in industrial automation including Allen-Bradley controls, Reliance Electric power transmission products, Dodge mechanical power transmission components, and Rockwell Software. Rockwell Automation's unique, flexible approach to helping customers achieve a competitive advantage is supported by thousands of authorized partners, distributors and system integrators around the world.

**Americas Headquarters**, 1201 South Second Street, Milwaukee, WI 53204, USA, Tel: (1) 414 382-2000, Fax: (1) 414 382-4444

**European Headquarters SA/NV**, avenue Hermann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40

**Asia Pacific Headquarters**, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846



**Rockwell  
Automation**