

Friction Hinges/Friction Clutches

By Douglas Collins and Ed Rude

The terms friction hinges or friction clutches refer to hinges that resist rotary motion with constant force. This resistance value is expressed as a **MOMENT** (inch-pounds or Kg-cm of torque) when specifying a hinge.

A typical use of these hinges is the attachment of a laptop computer screen to its base.

In this type of application the hinge(s) serve two functions.

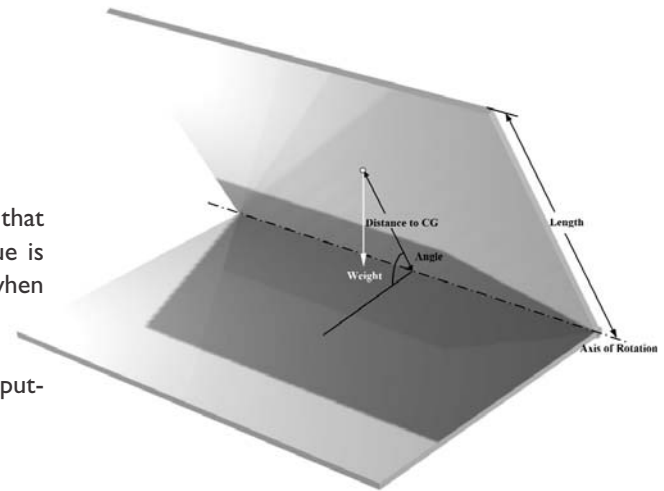
1. Hold the laptop together throughout its useful life, inclusive of the functional range of motion and inevitable bumps, bangs and bruises.
2. Maintain a force resisting motion to allow proper positioning of the screen for comfortable viewing and use of the laptop.

Other functions and attributes can be incorporated into the hinge design to enhance the ergonomics and functionality of the laptop unit. The available options and characteristics of those functions and attributes are topics for another article. This article will address only “constant force friction hinges” as they may be known.

When considering the hinge(s) required for a laptop application several basic parameters must be defined to properly outline the characteristics and the physical constraints of the design.

These are:

- What is the weight of the screen and the length of the lever arm from the axis of rotation to the center of gravity(Cg)?
- What is the weight and Cg distance for the base of the laptop in all conditions/configurations? Do feet on the unit impact this value?
- At what angles must the display be positioned (working range)?
- What ergonomic feel will your customer be satisfied with? (How hard or easy must it be to move the screen?)
- Is it allowable or preferable for the screen to gently fall closed from some angle?
- Would your customer prefer balanced or unbalanced torque? (Often unbalanced with opening torque 30% less than closing torque offers users a more natural feel in operation.)
- Is it acceptable for the user to use two hands to position the screen? (Hold the base in place as the screen is moved.)
- What type of vibrational loading will the laptop be subject to in use?



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The torque exerted by the display on the hinge at a particular angle is given by:

Torque = Weight x Distance from the Axis of Rotation to Center of Gravity x Cos of the Angle

If the weight of the display is evenly distributed, the distance from the axis of rotation to the center of gravity is equal to half the length of the display. (Example shown below)

Example:

The Angle of the Display = 45°

Weight of the Display = 2 lb.

Length of the Display = 10 in.

Distance to the Center of Gravity = 5 in. (Assuming weight is evenly distributed).

Hence the torque exerted by the display on the hinge at a 45° angle is:

Torque = (2 lb.)(5 in.)(Cos 45°) = 7.07 lb.in



- What type of drop loading will the laptop be expected to survive?
- How much room do I have? (X,Y,Z constraints)
- What am I attaching the hinge to and how am I fastening it?

Note: Mounting constraints should play a large part in developing or considering the initial hinge design and specification as they impact the ability of the hinge to perform its two primary functions. This often can impact the user experience as much as proper designation of the hinge torque specification.

Additional parameters may include:

- Appropriate level of resistance to corrosion.
- Cosmetic requirements.
- Life cycle requirements.
- Tolerancing specifications.
- Serviceability (disassembly) requirements for the Laptop.
- Integration into your assembly process.
- Suitable (appropriate) level of quality inspection.
- Any of your defined special needs not listed here...

The customer teams at TorqMaster International can assist you in specifying a hinge for your application.

We offer many standard products that are available in small and large volumes. These hinges are fully tooled and available immediately for development, prototyping, and production. Configurations (iges models and .pdf prints) are available online www.torqmaster.com for downloading and importing into your software for you to instantly fit our hinge into your design. Please contact us if your import requirements specify another file type and we will be happy to send you a compatible file.

We often can re-configure existing hinge components into new hinge geometry that is a better fit for your application than the selections showcased in our online catalog. Some of these hinges are already designed and documented but simply not showcased on our web site. These reconfigured

hinges are available in a flash for design and prototyping efforts. IGES and .pdf's can quickly be created for design integration and confirmation.

Additionally, we have a library of many additional components that are not showcased on our web site. These components may offer solutions to suit your needs if reconfiguring the showcased components does not.

Further augmenting the ability to reconfigure components that are readily available, we often design and configure one or two custom components (new geometry) in conjunction with components from our library to suit your particular design and/or mounting constraints.

These "semi-custom hinges" are readily designed and available for nominal fees as the design complexity and prototyping requirements dictate.

Looking past these quick time solutions, TorqMaster's product development teams can create and tool the ideal new design or replacement hinge for your OEM application. Our customer satisfaction team will gladly define a development, production and quality program for your specific OEM requirements. Pricing is based on a sliding scale that weighs the difficulty and complexity of the design, the anticipated production volume, schedule and run requirements, as well as your specific prototyping requirements and development schedule. Please contact sales@torqmaster.com to be assigned your customer satisfaction representative and be introduced to your project development team. ■

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