Working Energy and Energy Management in Servo Presses

A presentation hosted by:

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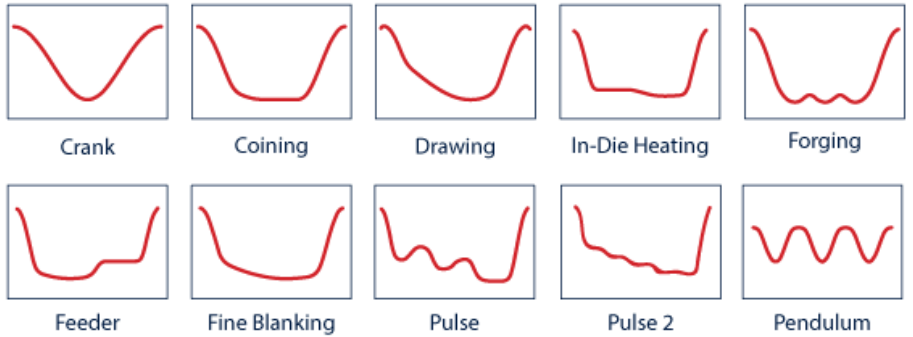
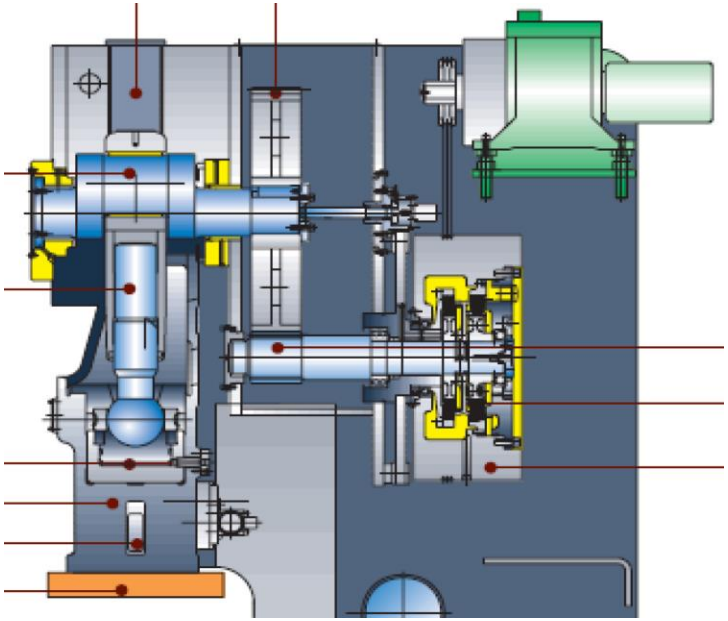
A traditional mechanical press at a given stroke length, can still achieve the highest production speeds, especially when running relatively flat parts with simple, shallow forming requirements, that typically can be processed from coil stock through a progressive die.

A mechanical servo press offers much more versatility than a traditional mechanical press, at production speeds often equaling, and frequently exceeding, traditional mechanical presses. Stroke, slide position and motion, and speed, are all programmable to allow myriad different stroke profiles that can work with a wide variety of dies, part types, automation, in-die secondary operations, etc., at optimized production speeds.



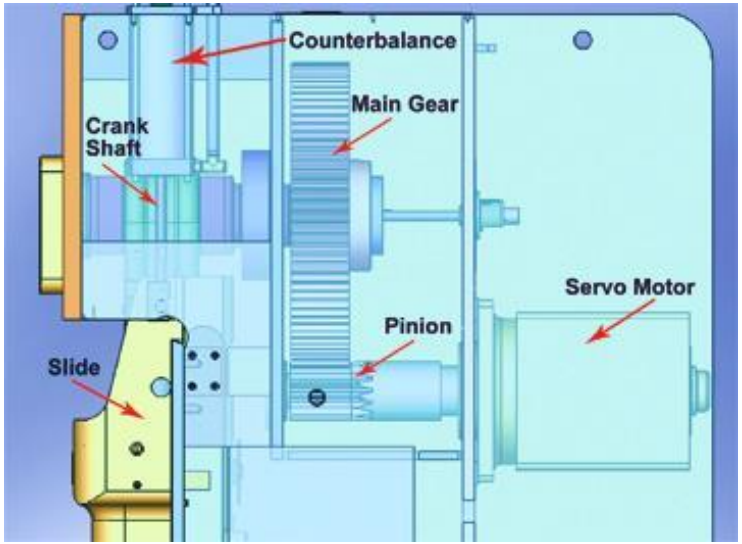
Traditional Mechanical Press

Employs a standard electric motor to power a flywheel, which stores working energy, and a clutch/brake to engage the flywheel to the gears and crankshaft, thereby transferring the working energy to the slide and, ultimately, the die and material.



Servo Press

Employs servo motors to replace the standard motor, flywheel and clutch/brake in an otherwise traditional crankshaft or eccentric-geared mechanical press. So, all of the working energy is supplied by the servo motors.



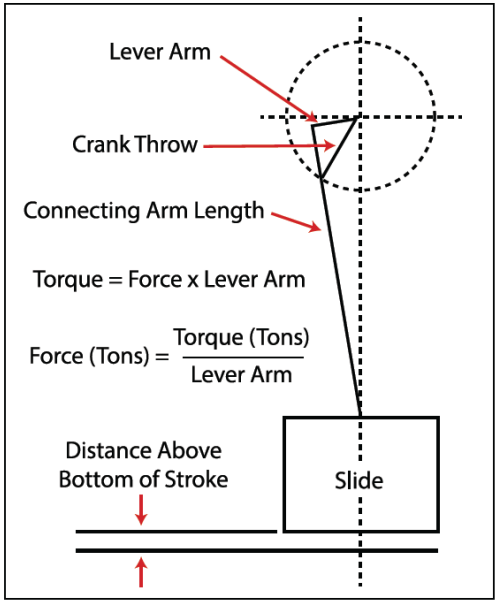
Mechanical Press vs. Servo Press

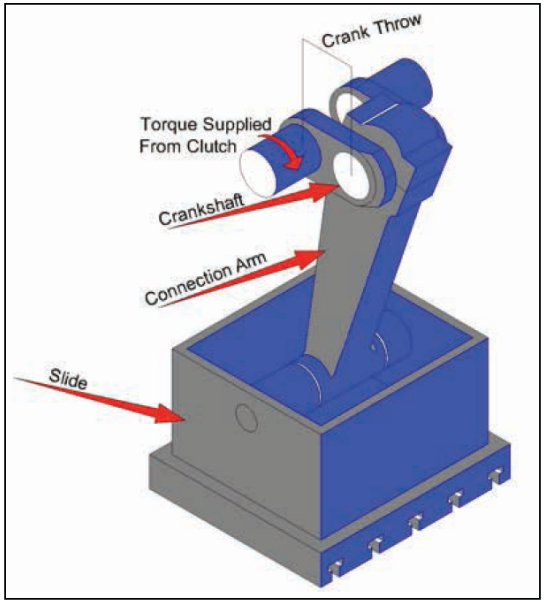
- Full press tonnage capacity (rating point) only near bottom dead center (BDC) of stroke.
- Simplicity of setup and operation.
- High accuracy and repeatability.
- Typically provides the highest stroking speeds for simple, relatively flat work.
- Fixed stroke length
- Fixed slide position and motion through the stroke length
- Stroking speed is fixed within a single cycle of the press, and slide velocity changes with crank angle as the crank rotates.
- Working energy depends on flywheel mass and speed.

- Full press tonnage capacity (rating point) only near bottom dead center (BDC) of stroke.
- Simplicity of setup and operation if applicable, but capable of very complicated set-ups as well.
- Even higher accuracy and repeatability.
- Can be configured through stroke profile programming to run complicated parts at the highest possible production rates
- Variable stroke length
- Precise control of slide position and motion throughout the stroke length.
- Completely variable stroking speed and slide velocity anywhere in the stroke, even within a single cycle of the press
- Full working energy at any speed, because all of the working energy is being supplied by servo motors

TONNAGE

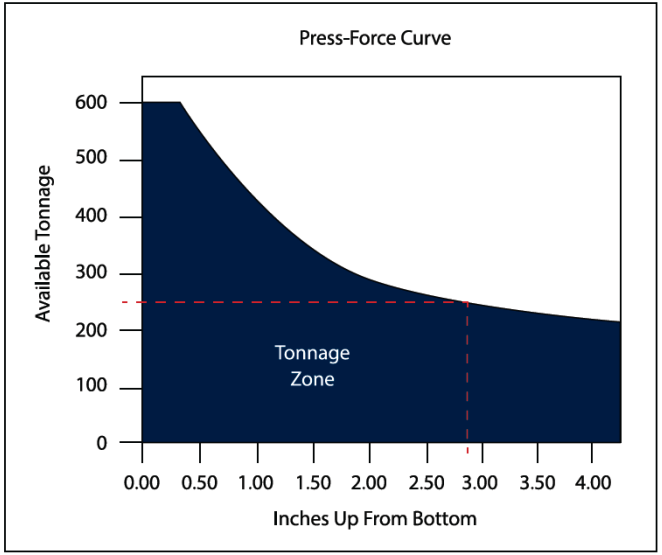
Press tonnage and press energy are not the same. Mechanical press **TONNAGE RATING** is the maximum load that can be exerted in continuous operation without causing damage to the press structure or the drive. Tonnage rating is usually determined at a slide (ram) position just above bottom-dead-center (BDC). Available working force decreases as the BDC distance increases, because the lever-arm angle has reduced mechanical advantage higher up in the stroke.





A mechanical presses working capacity is a function of the structural strength of the frame and its drive members. The presses maximum working capacity (tonnage) is a fixed value. When a working distance increases (deep-drawing), the available force higher up in the press stroke will be less.

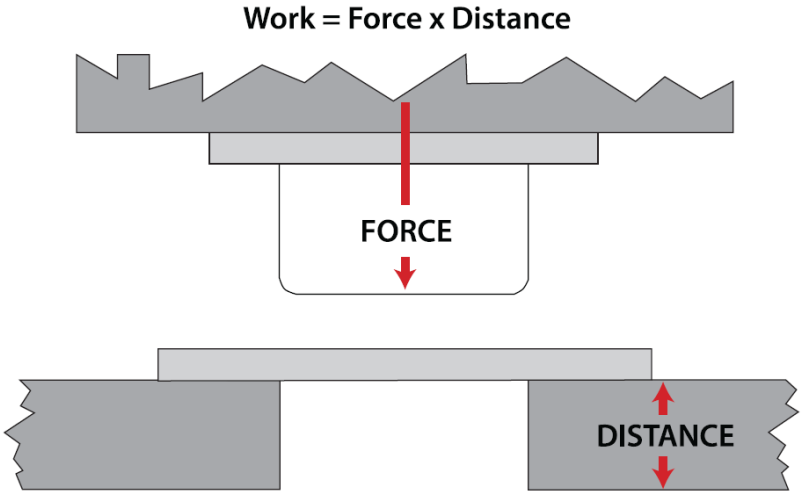
The crankshaft in a mechanical press rotates, causing the mechanical advantage of the connection arm to change constantly. This means that the relationship between force and distance will not be linear. To demonstrate this effect, press force curves can show available force compared to the distance of the slide from the bottom of the stroke.



Press-force curve showing available force compared to the distance of the slide from the bottom of the stroke.

ENERGY

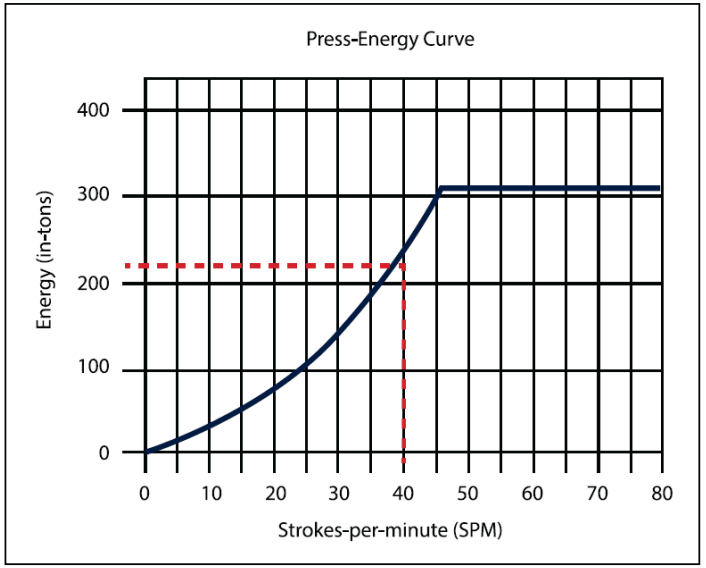
Where tonnage rating is largest load a press can withstand, the **ENERY RATING** is a function of applied press loads and the distance through which the loads are applied. Deep-drawing operations consume large amounts of press energy due to their long working distances, sometimes beginning several inches from BDC.



Depending on the type of work being performed, each stroke of the press will expend a certain amount of energy. This requires the size of the main drive motor (horsepower) and the rotational speed of the flywheel to be considered.

The main motor and its electrical connections are the only source of energy for a mechanical press and must generate eough horsepower to supply the stamping operation requirements. The motor is used to restore the energy to the flywheel during the non-working portion of the stroke.

The flywheel mass and rotation speed is the energy storage device. The flywheel stores and delivers work energy while the electrical motor restores energy by maintaining flywheel speed and avoiding slowdown. If the flywheel slows down too much, motor damage can occur, or the press will wind down to a stop.



Press energy rated capacity diminishes to when speed is reduced.

Summary Characteristics of a Mechanical Servo Press

- Full press tonnage capacity (rating point) only near bottom dead center (BDC) of stroke.
- Variable programmable stroke profiles, with:
  * Precise control of slide position and motion throughout the range of the stroke.
  * Variable, precise control of slide velocity, even within a single cycle of the press stroke.
  * Full working energy at any speed.

Link to servo video

Thank you for attending!!

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