

# PROPORTIONAL VALUE OF FUNCTIONAL GROUPS IN FORMING MACHINES

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## NOTE

This article was prepared for the purpose of solving problems in assessing the technical condition of forming machines (e.g., presses, bending machines, etc.) and determining their total value. It is related to the article entitled *Comparative Analysis of Pricing Parameters* published in Volume 67, Book 1, 2023 of *Canadian Property Valuation*.

### EXPERIMENTAL DERIVATION OF FUNCTIONAL GROUPS OF FORMING MACHINES AND THEIR PROPORTION TO THE WHOLE

Forming machines differ in their use, design, and essential parameters. The design of a given forming machine depends on the type of forming operation it undertakes and the product it subsequently produces.

That stated, forming machines consist of different structural groups, which, at lower hierarchical levels, are made up of components and parts. Quantification is the process of determining the value of the components of a machine as a percentage of the total value. To give a fictional example, if the total value of a machine is \$1,000, and the drive makes up 10% of that amount, the drive would be valued at \$100.

In view of the variability of forming machines, and for the purposes of valuation, it seems appropriate for appraisers to follow a uniform breakdown of their structure and quantification. We can do this by considering the components of forming machines according to their functionality and thus subdivide them

into 'functional groups' using four categories: mechanics (stand), mechanics (components), hydraulics, and electrical.

The structural breakdown of two typical press forming machines with hydraulic and mechanical drives is shown in Table 1.

To author this article, the leading manufacturers of forming machines

FUNCTION GROUP	HYDRAULIC PRESS	MECHANICAL PRESS
Drive	Hydraulic	Electromechanical or servo electric
<b>Properties of functional groups</b>		
Mechanics	Mainly load-bearing	Mainly load-bearing
Hydraulics	Working	-
Electrical	Energy	Working and Energy

**TABLE 1** – Functional group properties of hydraulic and mechanical presses

in Czechia were contacted to provide information concerning the proportional value of these functional groups in relation to forming machines as a whole. Thus, the relative proportions of each functional group shown in Table 2 are based on detailed price calculations of three hydraulic presses and one mechanical press, each produced by different companies. This is proprietary information, so the production companies are not identified in relation to their products.

**IN VIEW OF THE VARIABILITY OF FORMING MACHINES, AND FOR THE PURPOSES OF VALUATION, IT SEEMS APPROPRIATE FOR APPRAISERS TO FOLLOW A UNIFORM BREAKDOWN OF THEIR STRUCTURE AND QUANTIFICATION.**

In the case of the hydraulic presses, the proportional value of the mechanical components decreases with decreasing tonnage, the proportional value of the hydraulic components increases slightly, and the proportional value of the electrical components remains the same.

In the case of the mechanical press, the working components are classified within the 'mechanical' and 'electrical' groups. It is clear from this analysis that the proportional value of the functional groups is influenced by both the type of drive of the forming machine and its tonnage.

TYPE	HYDRAULIC PRESS 1	HYDRAULIC PRESS 2	MECHANICAL PRESS 1	HYDRAULIC PRESS 3
Pressing force	1500 tons	1200 tons	-	From an average of three samples
Drive	Hydraulic	Hydraulic	Electromechanical or servo electric	Hydraulic
Mechanics	55%	50%	70%	60%
Hydraulics	34%	40%	-	20%
Electrical	11%	10%	30%	20%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

TABLE 2 – Proportional value of components in various hydraulic and mechanical presses

TYPE	HYDRAULIC PRESS 1	HYDRAULIC PRESS 2	MECHANICAL PRESS	HYDRAULIC PRESS 3
Pressing force	1500 tons	1200 tons	-	From an average of three samples
Drive	Hydraulic	Hydraulic	Electromechanical or servo electric	Hydraulic
Mechanics (stand)	40%	30%	50%	40%
Mechanics (components)	15%	20%	20%	20%
Hydraulics	34%	40%	-	20%
Electrical	11%	10%	30%	20%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

TABLE 3 – Proportional value of components in various hydraulic and mechanical presses considering the stand/frame

**OTHER VALUATION CONSIDERATIONS FOR FORMING MACHINES**

The lifespan of a forming machine depends on the service life of its components. Thus, in appraising a machine, it is important to consider the service life of the supporting parts such as the machine stand or frame. This component usually has a long service life and can typically be renovated with simple surface treatments like welding. However, in making repairs to machine

stands/frames, the dynamic stability of the machine must not be disturbed.

In many cases, a forming machine can be completely modernized simply by replacing some structural components. This extends the overall service life of the machine.

The proposed breakdown of the forming machines and the proportions of their functional groups considering the service life of the supporting frame is given in Table 3.

“ IN APPRAISING A MACHINE, IT IS IMPORTANT TO CONSIDER THE SERVICE LIFE OF THE SUPPORTING PARTS SUCH AS THE MACHINE STAND OR FRAME. ”

**FUNCTIONAL GROUPS FOR SELECTED FORMING MACHINES**

The division of forming machines into functional groups of mechanics (stand), mechanics (components), hydraulics, and electrical is shown in Figure 1 on a bending press.

The functional groups of a typical bending press (press brake) are listed in Table 4.

**CONCLUSION**

Grouped by their functionality, we can categorize forming machine components as follows: mechanics (stand), mechanics (components), hydraulics, and electrical. Such a breakdown is simple and fully corresponds to appraisers’ needs in identifying, assessing, and evaluating the residual service life of these machines.

The proportional value of each functional group is based on detailed price calculations. For example, when pricing a hydraulic press, the mechanical (stand) accounts for 30-40% of the total value, whereas the mechanical (components) account for 15-20%, the hydraulic components account for 20-40%, and the electrical components account for 10-20%. These proportional values of the functional groups may be used as a guide in valuation for all forming machines, though, in order to be accurate, they must take into consideration the tonnage and drive type of the given machine. ▣

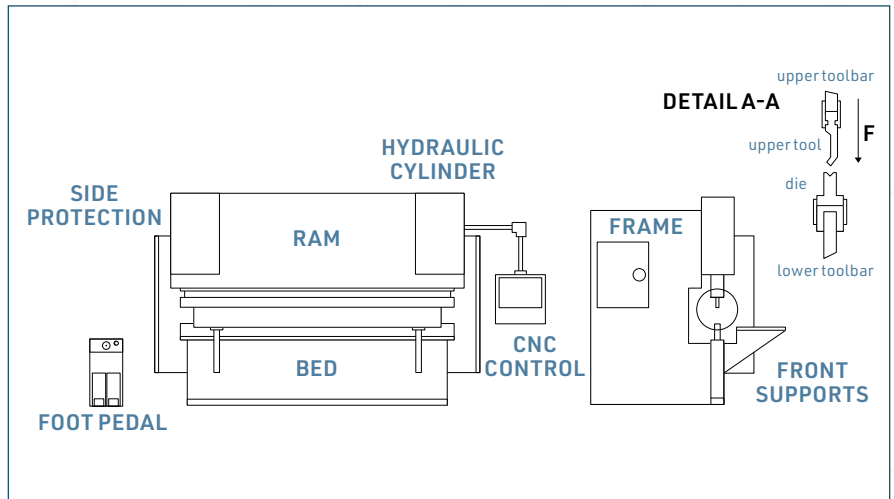


FIGURE 1 – Basic design groups of a typical bending press (press brake)

TYPE	PRESS
<b>Technological purpose</b>	Press brake
<b>Drive type</b>	Hydraulic
<b>Processed material</b>	Sheet metal
<b>Mechanics (stand)</b>	Bed (lower cross member), ram (upper cross member)
<b>Mechanics (components)</b>	Brake, clutch, safety components (light barriers, foot safety pedal), stops and shifts, linear guides
<b>Hydraulics</b>	Regulating piston pump, electric motor, hydraulic valves, servo valve, cooling and filtration unit, distribution blocks, pressure sensors, tank, etc.
<b>Electrical</b>	PLC control system, CNC control panel, switchboards, cabling

TABLE 4 – Functional groups of a typical bending press (press brake)

**NOTE**

This article is based on the author’s PhD thesis entitled *A System Approach to Valuing Forming Machines* (available from <https://www.vut.cz/en/us>). The proportional values of the different components of the hydraulic and mechanical presses were provided by the leading manufacturers of forming machines in Czechia; ŽďAS, a.s. and Dieffenbacher CZ hydraulic presses, s.r.o.