

## IDENTIFICATION OF THE FORMING MACHINE

### – FOR THE NEEDS OF AN EXPERT

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**Abstract:** *This article describes expert's approach to identifying of the forming machine. Expertise is a structured object with elements of expert, expert object, expert problem, expert activity, and expert opinion. Thorough identification of the machine by a local expert investigation is an essential part of an expert's assessment. The identification is carried out as part of a technical inspection of the forming machine. Forming machines are known for their variability. They are described by a few of characteristics. These characteristics are presented in ČSN 21 0200 (Czech state standard; Terminology of forming machines). Some are important in terms of valuation needs; some are less so. It is therefore important to examine their significance. Accurate identification is important to achieve credible results of expert examination. The issue of identification is addressed on the forming machine – the press brake.*

**Keywords:** *Forming machine, Expert object, Identification, Valuation, Utility value.*

**JEL klasifikace:** C10

## 1 INTRODUCTION

The forming machine is a technical and production system designed to implement technological forming processes. The energy to reshape from an energy machine (e.g., an electric motor) is transferred into the work process by a tool and is converted into deformation work and other forms of energy. Czech state standard ČSN 21 0200 (ČSN 21 0200, 1992) defines the forming machine as a production machine with a pressure or shock effect for the processing of material by forming, straightforward or rotating the working parts.

The basic classification of forming machines is regulated by the standard ČSN 21 0200 (ČSN 21 0200, 1992). This standard divides machines into basic groups, and these are presses, hammers, automatic metal forming machines, shears,

bending machines, roll bending machines, straightening machines, rolling machines, rotary swaging machines, curling machines, spinning lathes, metal forming complexes and mechanization and automation means. Beyond explaining the basic concepts, the standard divides forming machines according to various aspects. The forming machines are categorized according to a type of drive, according to a motion conversion system, according to a number of working parts, according to a construction of a stand, according to an arrangement of a drive, according to a version of a table and according to a technological purpose.

Abroad, property valuation standards are dealt with by International Valuation Standards (IVS) (IVSC, 2018). IVS can be considered as a kind of general basis for various valuation activities around the world. These standards are described at a general level and define the main types of values, i.e., define possible valuation results, which they refer to as IVS. According to IVS, the most common way of valuing machinery and equipment is on a market-based basis. The value is determined by comparing the asset with identical or comparable assets for which price information is available. The market approach should be applied in cases where the market is large enough and there is a sufficient frequency of sales of assets, they are publicly traded and where the subject of the transaction is substantially similar assets. If comparable market information does not relate exactly or substantially to the same asset, the valuer shall perform a comparative analysis of qualitative and quantitative similarities and differences between comparable assets and the asset being valued.

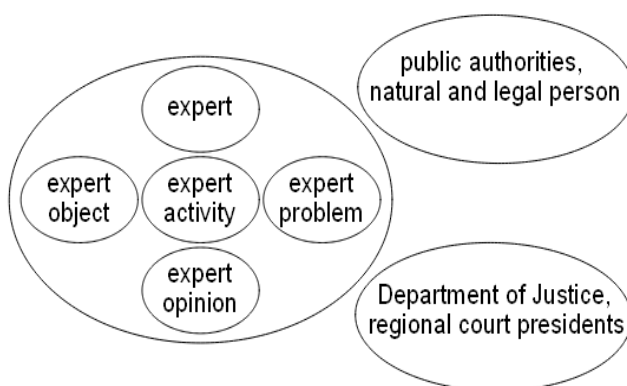
In the Czech Republic, the method of valuing property is regulated by Act No 151/1997 Sb., property valuation law (Act no. 151/1997 Sb.). In the Czech Republic, the cost and comparative valuation method is combined under the market approach. A suitable combination is described for example in Commentary on the valuation of movables (Bradáč et al., 2017).

The procedures for valuing machines are well known. They are based on the identification of the valued machine, the determination of the price of a new one, the determination of the technical value of the machine and the expression of its usual (normal) price based on a market analysis. However, the application of these activities as part of the implementation of valuation procedures is difficult. For forming machines, this difficulty depends on the number of types of machines that fall into this group, the large variability in

production and the resulting differences in product characteristics, the number of factors that influence the technical condition of the machines, etc. The valuation itself always requires an analysis of the object of the valuation itself and the state of the surroundings including the state of the market for the given type of property.

The solution to valuation problems is realized through a system of expertise (Janiček, 2013) and (Bradáč et al, 1999). This system is defined as a system with the following essential elements expert, expert object, expert problem, expert activity, and expert opinion (Figure 1). There are links between the various elements, determined by temporal and causal connections.

**Figure 1: Expertise as a structured object**



Source: Janiček, 2013, Bradáč et al, 1999; modified

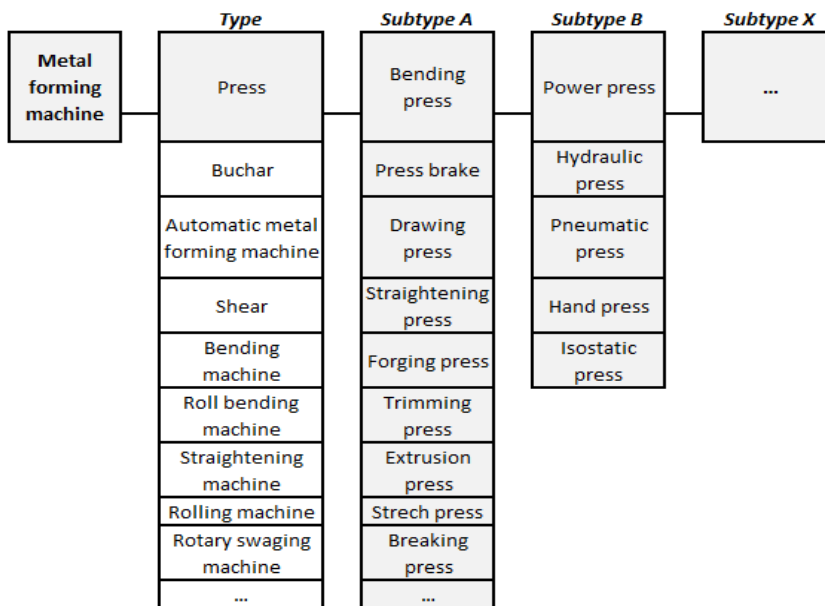
Technical-economic expertise deals with property valuation issues. Valuation problems are based on quantifying the utility of assessed objects using valuation approaches and methods. A necessary activity of an expert in solving valuation problems is to perform a technical inspection. The technical inspection consists of the identification of the forming machine, inspection of its individual groups, verification of function and evaluation of technical condition (Bradáč et al, 1999). The machine identification is done by comparing the data in the technical-economic documentation and the data found on the site itself.

The importance of identifying the valued object is also stated in the IVS. IVS, among other requirements for the object of the valuation, states: *The subject asset in the valuation assignment must be clearly identified* (IVSC, 2018).

Two major procedures in the identification and listing of machinery are macro identification and micro identification (ASA, 2000). Macro identification is the study of the entire manufacturing process by identifying major components contributing to the design capacity of the plant. Micro identification is the process of finding the individual characteristics of the equipment; it focuses on the listing of individual machines and identifies the specifics of the equipment. Of prime importance in micro identification are the brand name, model number, serial number, type of power, and dimensions (if practical).

Forming machines are typically highly variable. Standard ČSN 21 0200 (ČSN 21 0200, 1992) defines the forming machines according to different characteristics by which they can be further categorized (Figure 2).

**Figure 2: Categorization of forming machines (press) according to ČSN 21 0200; Subtype A – technological purpose, Subtype B – type of drive, Subtype X – other characteristics**



Source: ČSN 21 0200, 1992; modified

In terms of valuation needs, not all characteristics are equally relevant. The expert opinion must state all the facts influencing its result. The expert opinion must also be reviewable. Failure to state some essential facts may significantly affect the result of the expert examination.

From a valuation perspective, you can say that the value of forming machine, as well as other movable property, depends on its usefulness. In valuation, it is generally true that the higher the usefulness of the valued object, the higher the possible utility of the entity with the right to the object, the higher the value of the object for the eligible entity, and the higher the achievable price at its eventual sale. The usefulness depends on the characteristics of the valued forming machine (its design and condition), the characteristics of its surroundings (its design and condition) and the possibilities and method of handling the valued forming machine. It is clear from the above that, that the utility of a valued forming machine depends on its design. In case the expert misidentifies the forming machine, respectively its design, may negatively affect the valuation result.

## **2 METHOD**

When identifying the forming machine, it is not necessary to conduct investigations according to the above characteristics in standard ČSN 21 0200. Some characteristics are irrelevant to the needs of the expert. Others, however, are necessary to perform a comprehensive description of the forming machine. To solve this problem, descriptive data given in price offers are used. It can be concluded that the price offers contain characteristics that are decisive for the manufacturer and future user from a construction point of view. The case study will analyse the comparison of the properties of brake presses depending on the performance of the powertrain (type of drive) functional group.

## **3 COMPREHENSIVE APPROACH**

The case study is solved on forming machine – press. According to the ČSN 21 0200 standard, it is possible to categorize these forming machines according to technological purpose, type of drive, motion conversion, stand construction, drive arrangement and version table (ČSN 21 0200, 1992). The following data was found by an online survey (Table 1).

**Table 1: Internet survey results**

Technological purpose	Type of drive	Motion conversion	Number of work parts	Stand construction
bending press	hydraulic press	n/a	single action press	straight sided press
press brake	servo-electro press	n/a	single action press	open front press
drawing press	hydraulic press	n/a	triple action press	straight sided press
straightening press	hydraulic press	n/a	single action press	straight sided press
forging press	hydraulic press	n/a	single action press	column press
trimming press	hydraulic press	two-point crank	double action press	straight sided press
workshop press	pneumatic press	n/a	double action press	straight sided press
briquetting press	hydraulic press	crank press	single action press	n/a
packet press	hydraulic press	n/a	single action press	straight sided press

table continuation

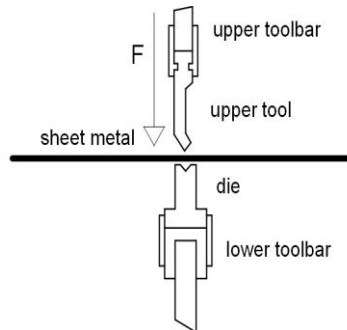
Drive arrangement	Version table	Trade name example
top drive press	press table with fixed	hydraulic bending press SICMI PDL 100
top drive press	press table with fixed	CNC servo-electro press brake APHS 125040
top drive press	n/a	hydraulic triple action press to pull moulding out of sheet metal PO 160/100
top drive press	n/a	straightening press CR-350
pull-down press	n/a	lower tensile presses CKW 6300
top drive press	n/a	trimming press LDO 315 A/S
bottom drive press	press with adj. table	workshop press pneumatic WZWP-050MPV
horizontal press	n/a	briquetting press RUF 90
top drive press	n/a	hydraulic packet press HPL 25

*Source: own processing*

The results of the survey indicate that the information sought is either stated (in the text of the description of the forming machine that is part of the price offer) or in general (by looking up in the literature, etc.). In some cases, the categorization is not given at all. The basic purpose is the technological purpose

(Figure 3). This characteristic is relevant to the purpose for which the forming machine is being procured. Technological purpose may be, for example bending, straightening, forging, coining.

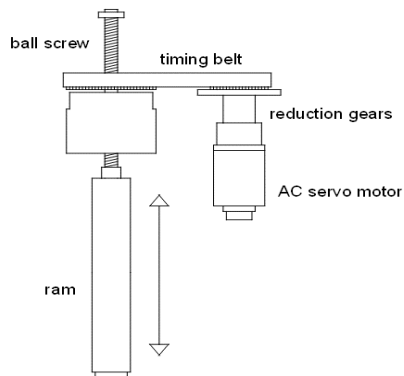
**Figure 3: Bending operation (on the press brake)**



*Source: own processing*

The type of drive characteristics categorizes the forming machine in terms of its driving unit. There may be cases where in the same type of forming machine (e.g., press brake), the conversion of movement and the transfer of force from the drive to the ram is made by applying the pressure of the liquid or via a ball screw and servomotor (Figure 4).

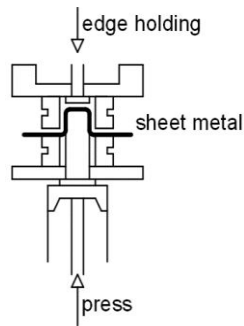
**Figure 4: Servomotor drive**



*Source: own processing*

The type of drive combined with the size of the forming force determines the production possibilities of the forming machine. The number of working parts is also an important feature. In the case of a double-action press, this characteristic means that it is a press with two independently moving rams (Figure 5).

Figure 5: Double action press



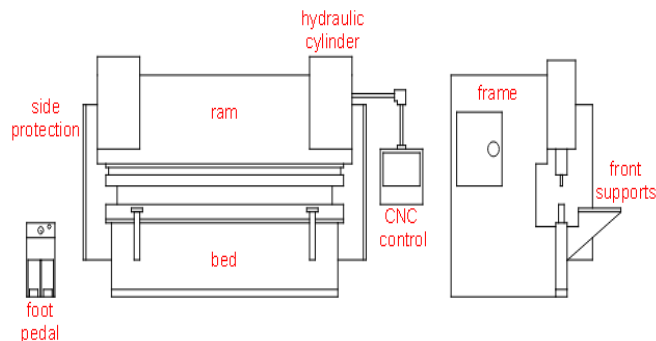
Source: own processing

These three characteristics can be considered significant and should be analysed for each forming machine – press. These three characteristics significantly influence the utility value of the machine. Inaccurate identification can therefore influence the outcome of the valuation.

#### 4 ANALYZING PROPERTIES RELATIVE TO UTILITY VALUE

Characteristics of technological purpose, type of drive and number of work parts describe and determine how and what kind of product can be produced on a forming machine. Thus, it can be said that the subject's benefit from using a forming machine is contingent on these very characteristics. The case study will analyse the effect of the type of drive on the benefit, which is expressed in terms of properties – functionality, economy, life, and ecology. Study subject – press brake (Figure 6).

Figure 6: Basic design groups of the brake press (hydraulic)



Source: own processing



The type of drive may be hydraulic or servo electric. These types of drives have a few advantages and disadvantages and affect the utility value accordingly (its quality). The advantages and disadvantages are shown in the Table 2.

**Table 2: Comparison of presses properties depending on design of powertrain functional group**

		Type of drive	
		Servo electric	Hydraulic
<b>Functionality</b>	<b>Power</b>	(-) small (up to about 2,200 kN)	(+) large (up to tens of MN)
	<b>Production</b>	(-) minor parts	(+) more robust parts
	<b>Bending speed</b>	(+) large (up to 2 times larger than a hydraulic)	(-) small
<b>Economy</b>	<b>Maintenance</b>	(+) easy (access to the drive system mostly from the side of the press)	(-) worse (drive aggregate tends to be placed at the top of the frame)
	<b>Operating costs</b>	(+) low (replacing damaged drive train parts not costly)	(-) high (costly exchanges of hydraulic filters, oils, seals, valves, etc.)
	<b>Economy</b>	(+) smaller cost (energy consumption only when the machine is deployed i.e., in its own bend)	(-) higher costs (pump works regardless of current requirements, hydraulic fluid cooling requirements)
<b>Life</b>	<b>Life</b>	(+) longer (significantly dependent on environment, mechanical impurities, etc.)	(-) shorter (significantly dependent on temperature, pressure and purity of hydraulic fluid, system tightness)
<b>Ecology</b>	<b>Noise</b>	(+) low (the engine is only running at its own bend)	(-) larger (machine is noisy even in non-working mode)
	<b>Disposal</b>	(+) does not require (absence of hydraulic system eliminates risk of pollution of the working environment and consequently of nature)	(-) is required (hydraulic fluid disposal required)

*Source: own processing*

## 5 CONCLUSION

This study describes the issue of identifying the forming machine. Identification of the forming machine is an important activity of the expert, in solving expert problems. Properly made identification is an important step towards achieving credible and reviewable results of expert examination.

The identification is carried out as part of the technical inspection of the forming machine. Standard ČSN 21 0200 lists the characteristics that categorize forming machines according to various aspects. Some characteristics are also important for valuation needs. To solve the significance of the characteristics, an internet survey of forming machines - presses was conducted. The essential characteristics are given in the text of the description of the forming machine, which is part of the price offer. Some are detailed, some merely superficial. The most significant characteristic is – technological purpose. Furthermore, the type of drive and number of work parts can be included among the important characteristics that are relevant for valuation purposes.

Identification is also important for determining the value of the forming machine (marketability coefficient) when compared to the forming machines used.

From this can be inferred, that the way the drive system of the forming presses is carried out fundamentally affects the quality of the brake press. The way it is dealt with translates into functional characteristics (power, character of production, speed of bending), life, economy (maintenance, running costs, economy) and ecology (noise, disposal of operating fluids).

## CITATION LIST

- [1] ČSN 21 0200 (1992). *Terminology of forming machines*. Praha: Czech Standards institute.
- [2] IVSC (2018). *International Valuation Standards 2017*. London: International Valuation Standards Council.
- [3] Act no. 151/1997 Sb., property valuation law. [online]. 2014 [accessed 2020-11-22]. Available from WWW: [www.mfcr.cz/assets/cs/media/Cenovy-vestnik\\_2014-c-01.pdf](http://www.mfcr.cz/assets/cs/media/Cenovy-vestnik_2014-c-01.pdf)

- [4] BRADÁČ, A.; SCHOLZOVÁ, V.; KREJČÍŘ, P. (2017). *Commentary on the valuation of movables*. In: Official valuation of assets 2016. Brno: CERM. ISBN 978-80-7204-927-1.
- [5] JANÍČEK, P. (2013). *Expert engineering in systems concepts*. Praha: Grada Publishing. ISBN 978-80-247-4127-7.
- [6] BRADÁČ, A.; KREJČÍŘ, P.; LUKAŠÍK, L.; OŠLEJŠEK, J.; PLCH, J.; KLEDUS, M.; VÉMOLA, A. (1999). *Forensic engineering*. Brno: CERM. ISBN 80-7204-133-9.
- [7] ASA (2000). *Valuing Machinery and Equipment: The Fundamentals of Appraising Machinery and Technical Assets*. Washington, D. C.: Machinery and Technical Specialties Committee of the American Society of Appraisers. ISBN 0-937828-07-6.

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