

## COMPARISON OF APPROACHES TO PREVENTION OF INJURIES, ACCIDENTS AND INCIDENTS BETWEEN THE CZECH REPUBLIC AND RUSSIA

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**Abstract:** *Important aspects of the design of machinery are estimation of their risks and assessment of operator safety. This article compares legislation in the field of industrial safety, and prevention of injuries, accidents and incidents in the Czech Republic and Russia. Information from the article could be beneficial especially for Czech (or European) enterprises, which try to enter the Russian region markets.*

**Keywords:** *Machinery, safety of machinery, risk assessment, prevention of accidents, pressing and forging.*

### Introduction

The development of legislation is important for industrial safety which regulates the minimum requirements for industrial processes. Currently, the safety of employees and nearby residents is considered one of the most important factors to be taken into account in any activities.

Legislative requirements vary from state to state; in advanced countries they are based on the fundamental principle - the employer is responsible for health of workers.

Industrial risks can be divided into several basic categories: physical hazards (employee is exposed to physical factors - temperature, pressure, forces, etc.), chemical hazards (effects of chemicals and chemical products) and ergonomic hazards resulting from the inappropriate interaction between the machinery equipment and human, or the impact of the working environment.

Safety in industry is a broad term that can be applied in the following areas:

- operation of machinery,
- operation of equipment containing hazardous chemical substances and products,
- operation of lifting equipment,
- operation of pressure equipment,
- operation of equipment for mining and processing of ores.

Important trading partner of the Czech Republic and the EU (European Union) is Russia. According to data given on the website BusinessInfo.cz, import to Russia in 2010 increased by 47.4% to 140.0 billion U.S. dollars compared to the same period of 2009. A considerable part of the import consists of machinery, equipment and vehicles. Therefore it is important for both countries to know the requirements concerning safety in the industry.

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## 1. Legislation

Prevention of accidents in the Czech Republic is regulated by legislation of European Union, as well as the specific legislation of the Czech Republic. In Russia there are federal laws that are in accordance with international laws (international treaties and conventions in particular with the European Union). In the Czech Republic there are the following laws and decrees relating to safety in industry:

- Government Decree No. 176/2008 Coll. «On technical requirements for machinery (Revised European engineering direction 2006/42/ES) [1];
- Decree No. 48/1982 Coll. of Czech Agency for work's safety, which contains the basic requirements to ensure safety of work and technical equipment [2];
- Law No. 59/2006 Coll. - The prevention of major accidents (Directive of European Parliament and the Council 2003/105/ED on the control of hazards of major accidents involving dangerous substances);
- Decree No. 19/1979 Coll. - which determines some requirements for ensuring safety of the particular lifting equipment;
- Government Decree No. 26/2003 Coll. – which determines technical requirements for pressure equipment;
- Law No. 44/1988 Coll. – on mining and Law No. 61/1988 Coll. On mining, explosives and state mining administration;

In Russia, these are the following laws and decrees:

- Technical regulation on safety of machinery and equipment TR TC 010/2011 [3];
- Regulations on safety of machining equipment. POT RO-14000-002-98 [4];
- Federal Law of 30 November 2011 No. 366-FZ "About ratification of the Convention of Prevention of Major Industrial Accidents (Convention No 174)";
- Federal Law of 21 July 1997 No. 116-FZ "On work safety of hazardous machining equipment ";
- Federal Law of 21 November 1995 No. 170-FZ "On the use of nuclear energy";
- Federal Law of 21 July 1997 No. 117-FZ "On safety of hydrostructures";
- Instructions for risk analysis of hazardous machining equipment (RC 03-418-01).

Approaches to prevention of accidents for each industry are specific. This article will describe legislative requirements of the Czech Republic and Russia in the field of prevention of accident in the operation of machinery.

## 2. Ensuring safety of machinery in the Czech Republic and Russia

### 2.1 Ensuring safety of machinery relating to the design of machinery

As early as a manufacturer designs machinery he has to define the parameters that ensure workers safety during assembling, dismantling, commissioning, as well as for self-dependent operation, and as part of technological systems in accordance with the requirements of operational documentation.

Safety of machinery in the designing process in the Czech Republic and Russia provides:

1) Identification of potential risks, such as:

1. Risks of mechanical hazard:

- Risk of loss of stability;
- Risk of break-up during operation;
- Risks due to falling or ejected objects;
- Risks due to surfaces, edges and corners;

- Risks related to combined machinery;
- Risks related to variations in operating conditions;
- Risks related to moving parts;
- Risks of uncontrolled movements;

2. Risks associated with other hazards:

- Electricity supply;
- Static electricity;
- Energy supply other than electricity;
- Incorrect installation;
- Extreme temperatures;
- Fire;
- Explosion;
- Noise;
- Vibration;
- Radiation;
- External radiation;
- Laser radiation;
- Emissions of hazardous materials and substances;
- Risk of being trapped in a machine;
- Risk of slipping, tripping or falling;
- Lightning strike.

2) Risk assessment - the machinery must be designed and constructed to take into account the results of risk assessment;

In Russia and Czech Republic the acceptable risk for machinery is also determined. In case a degree of risk is higher than acceptable, it is necessary to adjust the machinery for reducing the risk. Provided this is not possible or not economically efficient, it is necessary to include into the instruction manual the information that restricts the conditions for using of equipment, or add a notice of additional requirement for safety measures.

3) Determination of levels of physical factors (noise, infrasound, air and contact ultrasound, local and general vibration, electromagnetic fields) and the level of emission of hazardous and toxic substances to ensure a safe operation.

4) Preparation of the instruction manual - the manufacturer has to take into account not only the expected use of machinery but also any reasonable expectable use. The instruction manual has to notify of incorrect use of machinery.

In case the machinery is intended to be used by unskilled operators, the text and adjustment of instruction manual must take into account the level of general education and the abilities to understand that can be reasonably expected from such operators.

5) Consideration of ergonomic principles to reduce discomfort, fatigue and psychological stress of operators.

## 2.2 Ensuring safety of machinery during manufacturing, storage, transportation, use and disposal of machinery

Safety of machinery in terms of manufacturing, storage, transportation, use and disposal in the Czech Republic and Russia, provides:

- 1) Ensuring compliance with requirements on design and operational documentation;
- 2) Testing of machinery according to project documentation;
- 3) Risk assessment by manufacturer that is prior to launching and after overhaul;
- 4) Produce of warning labels or marks to notify of danger;
- 5) Use of safe materials and substances;
- 6) Use of guards and protection devices;
- 7) The information in the instruction manual to avoid misuse. In Russia the instruction manual also provides recommendations for safe disposal of equipment and its components.
- 8) State control over compliance with safety requirements.

## 2.3 Classification of machinery, safety requirements

Safety requirements for specific groups, types, models of machinery are established taking into account the features of destination, productivity and operating conditions of equipment. There is machinery for:

- Metalworking
- Woodworking
- Pressing and forging
- Casting

Table 1 shows a classification of machinery in the Czech Republic and Russia.

*Tab. 1: Classification of machinery in the Czech Republic and Russia.*

Machinery	Classification group of machinery	
	Czech Republic	Russia
- Lathes		
- Drilling machines		
- Grinding machines		
- Milling Machines	Metalworking	Metalworking
- Planing and shaping machines		
- Saws machines		
- Grinding machines		
- Gear cutting machines		
- Electroerosive machines		
- Electrochemical machines	-	Metalworking
- Ultrasound machines		
- Automatic line		
- Metal Cutting Shears	Punching and shearing	Metalworking
- Bending machines	Bending and	Metalworking

- Straightening machines	straightening of the material	
- Forging hammers	Forging by hammer	Pressing and forging
- Horizontal forging machines	-	Pressing and forging
- Hydraulic presses	Punching and shearing	Pressing and forging
- Mechanical drawing presses		
- Press brakes		
- Friction Screw Presses	Punching and shearing	-
- Vulcanizing presses		
- Rotary drum curing presses		
- Platen printing, folding and slotting machines		
- Machinery for the preparation of molding materials and mixtures	-	Casting
- Machines for casting into molds in shell		
- Equipment for casting to the models		
- Casting machines	Casting	Casting
- Centrifugal casting machines		
- Casting equipment for working with ingot mold		
- Casting machines for blast furnaces		
- Complexly mechanized and automatic molding line for casting and molding	-	Casting
- Moulding machines		
- Injection and blow molding machines	Forming of material	Casting
-Sandcasting machines		
- Reversing machines		
- Machines for cleaning castings, and easing	Releasing and cleaning castings	Casting
- Band sawing machines		
- Circular sawing machines	Woodworking	Woodworking
- Planing machines		
- Vertical shapers machines		
- Thickening machines	Woodworking	-
- Lathes	-	
- Grinding machines		Woodworking
- Drilling and slotting machines		
- Tenoning machines		

In table 2 there are requirements for hydraulic presses in the Czech Republic and Russia.

Tab. 2: The requirements for hydraulic presses in the Czech Republic and Russia.

Safety requirements	Czech Republic	Russia
Pressure control	<p>1. Press should be protected in each hydraulic circuit by manometer, which allows to control operating pressure. Hydraulic circuits should be protected by relief valves for prevention excess pressure.</p> <p>2. Presses driven by pressure from the central station should be protected by equipment to prevent a rapid pressure drop.</p>	<p>1. In the accumulators, piping of each press should be manometers to control the pressure.</p> <p>2. Hydraulic equipments in all highest points should have valves to release air from fluid circuit, and in the lowest points – valves for descent of the working fluid.</p>
Movement of the piston	<p>1. Presses with vertical and horizontal movement of pressing piston should be protected by equipment to prevent undesired spontaneous movement due a leakage of pressure fluid at the reverse direction.</p> <p>2. In case of working stroke position of the pressing piston should be permitted.</p>	<p>1. To prevent a rapid dropping or lifting of pressing piston with a sudden large liquid flow rate the main valve on the pipeline should be equipped with a device that automatically shut off flow of working fluid.</p> <p>2. In the case of rapid dropping of pressing piston to eliminate the impact of piston on the foundation should be buffers, wooden pillows, etc.</p> <p>3. The pressing piston should be covered by the hood, which should be closed with the catch.</p> <p>4. For the presses, which consist of several units, the position of pressing piston should be seen on each press and pump, or about position of piston should inform alarms.</p>
Press control	<p>1. Press should be protected by device, which is possible at any time discontinue an operation, and with alarm, which notes that the press is in operation.</p> <p>2. Press should be protected by switch, which blocks press operation in case of transfer of material to the press platform.</p> <p>3. The design of the press should avoid sudden opening of the press.</p>	<p>1. The piping should have safety valves or other similar devices for the prevention of hydraulic impact.</p> <p>2. Between pump and press should be lighting and acoustic alarm, interlocked with the triggering device of presses.</p>
Pump	-	<p>1. The pump should have a safety valve and turn off device.</p> <p>2. If there are a few pumps, should be the device which disconnects each pump separately.</p>

Safety of workers	<ol style="list-style-type: none"> <li>1. Worker should be protected from burning or scalding in case of open press; heating medium inlets should be covered that their failure or other damage avoids injury.</li> <li>2. In case of press operating the person shouldn't to stay on the hopper or enter into it.</li> <li>3. The area of material immersion into the melting chamber should be protected to avoid injury done by steam blowing.</li> <li>4. Filling the hopper should eliminate putting hands into the screw and plunger injection.</li> </ol>	Manual and automatic systems shouldn't disconnect such devices in case that outage of these devices leads to injury.
Monitoring of safety	-	All parts of the press under the pressure of steam, air and liquid, periodically should be inspected and tested.

### 3. Conclusion

This article discusses legislation of the Czech Republic and Russia in the field of industrial safety. In particular, this article compares legislative requirements to ensure the safe operation of machines while their design, manufacture, storage, transportation, use and disposal. This article also deals with classification of machinery in the Czech Republic and Russia, in accordance to legislation. To describe the differences and similarities in the requirements of legislation, hydraulic press is chosen as an example. This article may be useful for Czech and European companies which wish to export their products to Russia, or move their production facilities.

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Technical regulation on safety of machinery and equipment TR TC 010/2011.

Regulations on safety of machining equipment. POT RO-14000-002-98.