

## PISTON MACHINES AND PISTON COMPRESSORS

### 1. *Piston machines*

**Piston machines** are classified as machines working with volume changes. It means that the working medium is closed by a **piston** in a certain **compartment**, which periodically changes its volume. It leads to a change in pressure at the same time. A characteristic **feature** of **piston machines** is a regularly repeated process in a working **compartment**.

#### 1.1 *Driving machine*

A machine can be the source of mechanical energy. It is most often in the form of a rotating shaft. In this case we call it a **driving machine**. A typical representative is a **combustion engine**.

#### 1.2 *Driven machine*

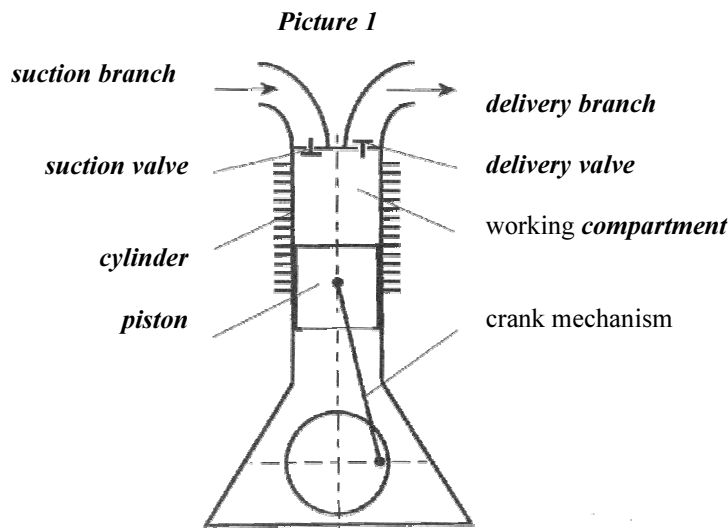
A machine can change mechanical energy into pressure, into the movement of gases or liquids. In this case we call it a **driven machine**. Among this group are **compressors** and **pumps**.

#### 1.3 *Working compartments*

Almost all working **compartments** are **cylindrical**. A **cylinder** is closed at one end by a **cylinder head**. This head has an opening with **valves**, which control input and output media. A **piston** closes the working **compartment** from the other side and its motion most often **ensures** crank mechanisms.

### 2. *Piston compressors*

They are used for **compressing** and transporting gases. The transferred mechanical energy is then **partially** transferred also into heat, which is necessary to remove by cooling. For a basic description of a piston compressor see Picture 1.



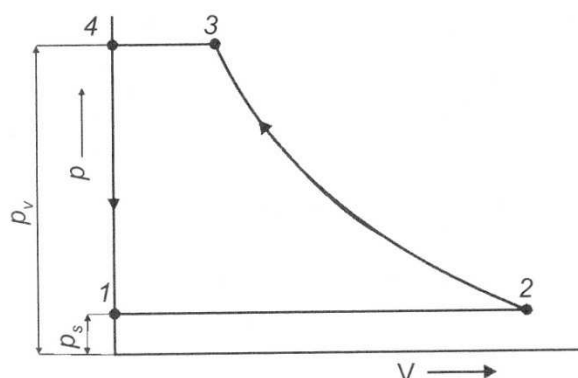
## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### 2.1 Diagram p-V

The working *circuit* of a *piston compressor* is given by return *piston* motion in which gas is *sucked*, compressed and delivered. The *valves* are mostly opening and closing automatically, depending on pressure changes in the working *compartments*.

2.1.1 It is possible to clearly illustrate the occurrences in Diagram p-V (pressure-volume). An ideal kind of this diagram (without *clearance of compartment*) you can see in Picture 2.

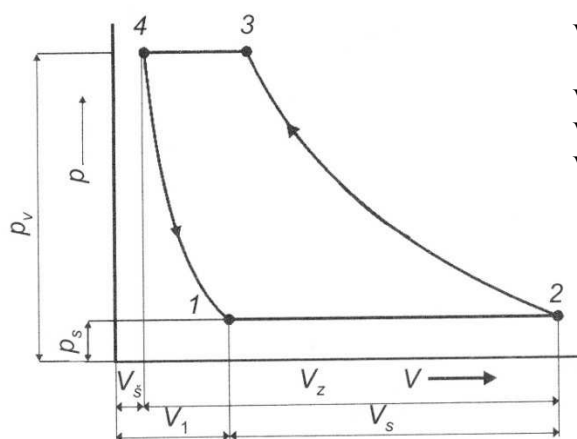
Picture 2



1 to 4 working *circuit* phase  
 $p_s$  *suction* pressure  
 $p_v$  pressure at output

2.1.2 In an ideal cycle gas would be completely pressed out from the working *compartment*.

Picture 3



$V_1$  volume, at which residual gas expands in the working chamber  
 $V_s$  actual sucked-in volume of gas  
 $V_z$  clearance (residual) volume  
 $V_s$  *lifting volume*

with a clearance of compartment

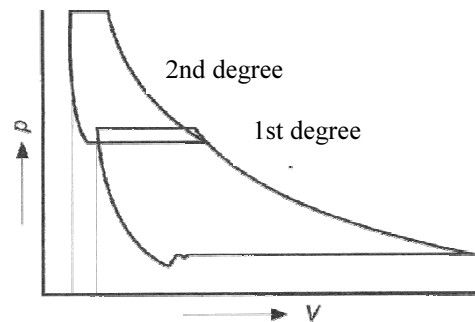
### 2.2 Real diagram p-V

A real machine, however, has a certain “clearance space” (see Picture 3). The residual gas expands in it when there is return *piston* motion. It causes the reduction of the voluminous performance of a *compressor*. This phenomenon is more *significant* the greater the

## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

pressure rate is in the discharge and in the **suction** (the **compressor** ratio). That is why the distribution of compression for compressors is used at different degrees (see Picture 4). The **exhaust gas** cooler is classified in the degrees.

**Picture 4**



### 3. **Piston compressor classification**

**Pistons** are classified according to the following criteria:

#### **According to compression size:**

- low-pressure
- medium-pressure
- high-pressure

#### **According to number of *cylinders***

- single- *cylindrical*
- multi-*cylindrical*

#### **According to *cylinder* arrangement**

- with *cylinders* in a *row*
- with *cylinders* in a V-shape
- with opposite position *cylinders*

#### **According to compression course**

- single-degree
- multi-degree

## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### VOCABULARY

circuit	oběh
clearance of compartment	škodlivý prostor
combustion engine	spalovací motor
compartment	prostor
compressing	stlačování
cylinder	válec
cylinder head	hlava válce
cylindrical	válcový
delivery branch	výtlačné hrdlo
driven machine	hnaný stroj
driving machine	hnací stroj
ensure	zajišťovat
exhaust gas	vytlačovaný plyn
feature	znak
lifting volume	zdvihový objem
partially	částečně
piston	píst
piston compressor	pístový kompresor
piston machine	pístový stroj
pump	čerpadlo
remove	odstranit, odvést
row	řada
significant	výrazný
suck	sát, nasávat
suction	sání, odsávání
suction branch	sací hrdlo
valve	ventil

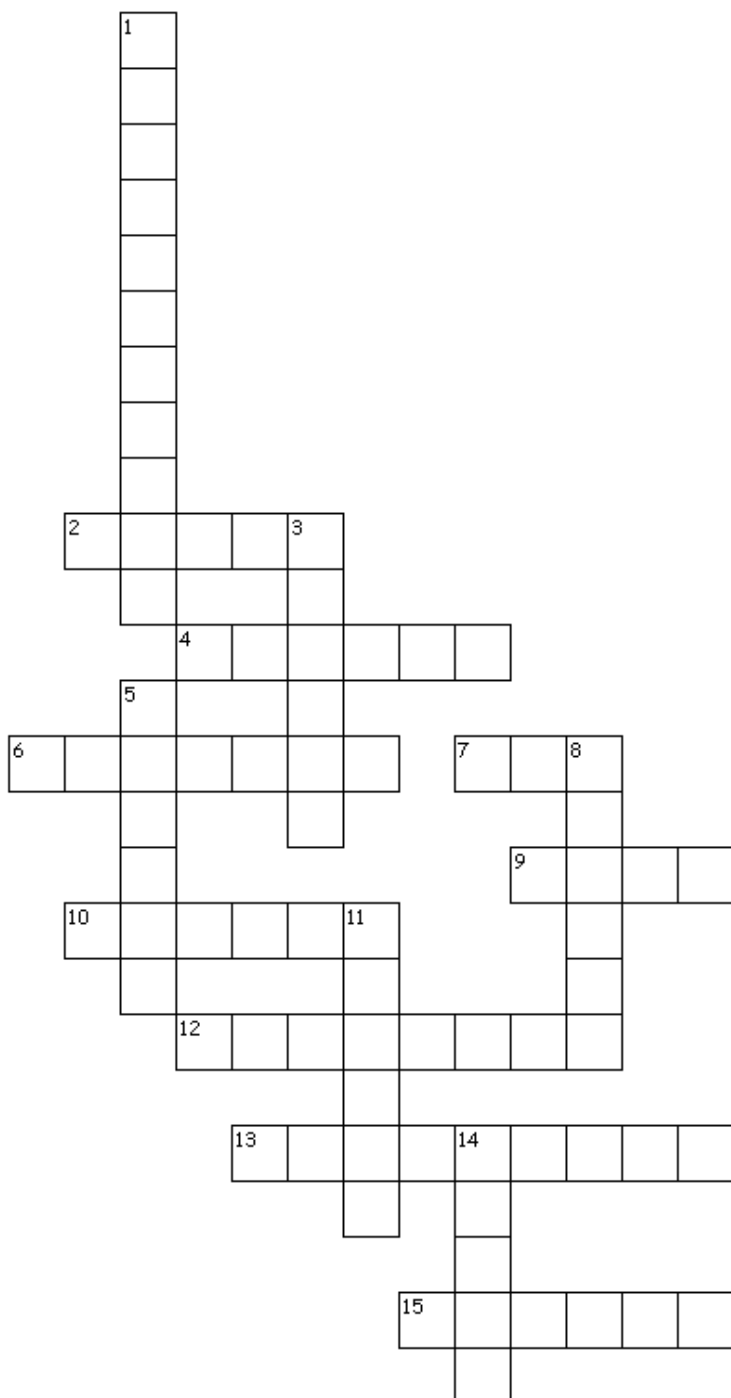
### COMPREHENSION QUESTIONS

1. How are piston machines classified?
2. What is the characteristic feature of piston machines?
3. What is the difference between driven and driving machine?
4. What do you know about piston compressors?
5. How do we classify piston compressors?

## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### EXERCISES

1. **Criss Cross Puzzle** - 15 words were placed into the puzzle.



#### Across

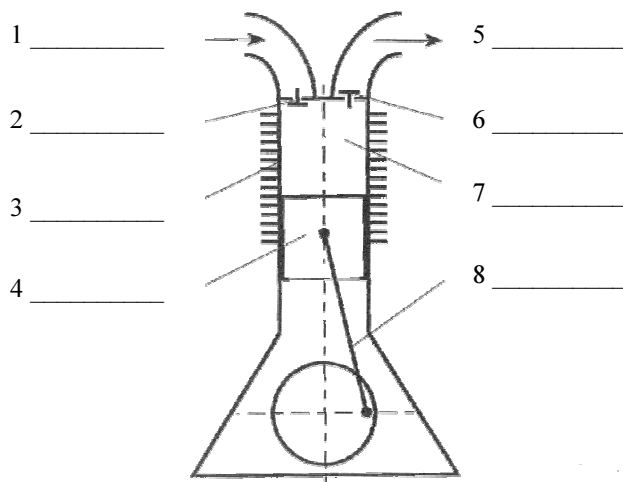
- 2. ventil
- 4. stupeň
- 6. hnací
- 7. plyn
- 9. sát, nasávat
- 10. objem
- 12. tlak
- 13. částečně
- 15. výstup

#### Down

- 1. válcový
- 3. motor
- 5. píst
- 8. zdroj
- 11. zajišťovat
- 14. vstup

## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### 2. Describe the picture.



### 3. Double Puzzle - Unscramble each of the clue words. Copy the letters in the numbered cells to other cells with the same number.

NITSOP


VEVLA


RICNYLED


RYGNEE


REERUPSS


DIVRING


TOAGIRNT


CEPSOMSORR


FAHTS


REESUN




## INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

### KEY FOR TEACHERS

#### 1. Criss Cross Puzzle

<b>piston</b>	píst
<b>valve</b>	ventil
<b>cylindrical</b>	válcový
<b>ensure</b>	zajišťovat
<b>volume</b>	objem
<b>engine</b>	motor
<b>pressure</b>	tlak
<b>degree</b>	stupeň
<b>gas</b>	plyn
<b>suck</b>	sát, nasávat
<b>input</b>	vstup
<b>output</b>	výstup
<b>partially</b>	částečně
<b>driving</b>	hnací
<b>source</b>	zdroj

#### 2. Describe the picture

- 1 suction branch
- 2 suction valve
- 3 cylinder
- 4 piston
- 5 delivery branch
- 6 delivery valve
- 7 working compartment
- 8 crank mechanism

#### 3. Double Puzzle – COMBUSTION ENGINE

piston  
valve  
cylinder  
energy  
pressure  
driving  
rotating  
compressor  
shaft  
ensure