INLET AND EXHAUST VALVES

- The exhaust valves open against pressure within the cylinder at the end of the working stroke. This pressure is considerably higher than against which the inlet valves have to open. Furthermore, the pressure of the exhaust gases assists, once the valve is open, in expelling the gasses through the open valve. Because of this consideration it is not unusual to find that exhaust valves are designed to be of a smaller diameter than the inlet valves. Being smaller also assists with keeping them cool which is important as exhaust valves often give rise to thermal problems.

- Both the inlet and exhaust valves may seat against the flame plate of the cylinder head. These valves seats become damaged during the operation and from time to time they have to be reconditioned by grinding-in the valves. This is required much more often in the case of the exhaust valves because they operate at higher temperatures and because the gases flowing through may contain particles of carbonaceous matter. These occasionally get trapped under the valve seat and cause pitting. The life of an exhaust valve between reconditioning can be extended if the thermal loads to which it is subjected can be evenly distributed around the valve. This is accomplished by the rotating the valves slowly as the engine is working.

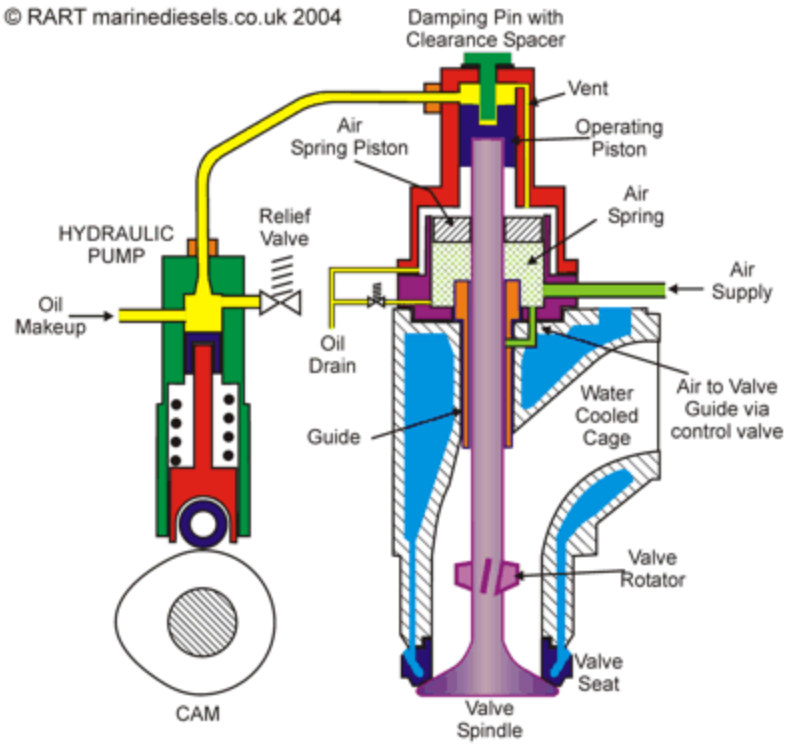
- Valve rotators which carry out this movement have a type of ratcheting mechanism (the best known is the “Rotocap” type as in Fig.7.3.) which indexes the valve round a small amount every time it is operated by the rocker gear. In more recent designs the exhaust valves are rotated by the vanes fitted to the stem and driven by the gases expelled from the cylinder (see Fig.7.2.) The main advantage of this rotator is that the valve has still sufficient momentum to turn as the head comes to touch the seat, thus scraping off the deposit formed particularly in heavy oil fuel operation. Valves may be assembled in cages which are removable from the cylinder head as separate units. Each valve cage, in addition of the valve itself, carries the seat ring, stem guide, and spring.

- When the seat ring wears, it may be renewed at low cost. The condition of the exhaust valve is influenced greatly by the temperature at which it operates. To reduce its temperature the cage is cooled in the upper part near the guide and round the seat region aswell. Fig. 3. shows how water is conducted down an annular passage immediately behind the valve seat and back again. Cylinder heads are fitted with relief valves in order to draw attention to any abnormally high firing pressure. The setting of the spring is such that the pressure required to open the valve is 10% to 20% above the maximum combustion pressure. Provision is also made in the cylinder head to connect an indicator for measurement of cylinder pressures. Frequently this passage is combined with that of the relief valve. The starting air valve is also accomodated in the cylinder head. This is a non-return valve which will admit the compressed air required for starting purposes. It also prevents the high pressures which occur inside the cylinder during the normal operation getting back into the starting air system.

QUESTIONS AND DISCUSSION

- Why are exhaust valves sometimes of a smaller diameter then the inlet ones ?
- What should be done when the valves are damaged ?
- What causes pitting and where does it occur ?
- How can the life of an exhaust valve be prolonged ?
- Describe the two system commonly used today for rotating the valve.
- What is a valve cage and what is the advantage of using it ?
- Describe the cooling of the valve following Fig.7.3..
- What is the cylinder cover relief valve provided for ?
- How does pressure refief valve operate ?
- What are two functions of the starting air valve ?
- What other devices are generally fitted on to the cylinder head ?

I. Fig.below illustrates an exhaust valve. Provide Croatian your language labels.



II Say which of the statemants below are TRUE and which are FALSE . If FALSE state why.

1. Both types of diesel engines, two – and four – cycle, employ air inlet and exhaust valve.
2. The exhaust valves are arranged to open outwards (i.e. towards the outside of the cylinder) in order to avoid opening against the high pressure within the cylinder at the end of the power stroke.
3. In order to facilitate overhaul of the valves without removing the cylinder cover, valves together with their springs, stems, etc. may be fitted in separate casings.
4. The air inlet valves are fitted with an automatic rotating device causing the valve to rotate slowly, thereby avoiding local overheating.
5. The air inlet valves operate under less difficult condition than the exhaust valves and the period between their maintenance is longer.
6. In larger engines, owing to the larger dimensions of the exhaust valves and the consequent slower rate of cooloing by conduction, arrangements have to be made to conduct the heat rapidly away from them.
7. Compressed air is admitted to the cylinder through the relief valve and the engine is made to rotate by this means until sufficient momentum is attained to obtain the necessary compression to fire the fuel.

III Replace the boldface word in the sentences with the expressions similar in meaning from the list below using the correct form of the verbs.

ACCOMMODATE, ADMIT, DEPOSIT, EXPELL FROM, EXTEND, REMOVE, ROTATE, SCRAPE, STEM, VANES, FIT, FLOW, GIVE RISE TO, PITTING, MAINTAIN, RECONDITION.

1. When the maneuvering handle is moved to the “start” position, compressed air is let in to turn the engine in the disered direction.
2. Improper on board fuel treatment may cause troubles to the combustion chamber components.
3. The valve plate of the exhaust valve is turned by means of the propeller fitted to the valve shaft acted upon by the outgoing exhaust gases stream.
4. The gas rotator is simple an efficient since it provide sufficient rotating torque when the valve seats down the rub of the thin layer accumulated mainly in heavy oil operation.
5. The cylinder head is equipped by the inlet and exhaust valves designed for the cross flow gas exchange principle, i.e. air intake is opposite to exhaust gas outlet.
6. The inspection of the valves revealed clean seats with only shallow indentation from carbon deposits.
7. With modern grinding equipment valves can be quickly restored.
8. For engines of larger size, valve cages for the inlet exhaust valves are considered an advantage as they can be replaced without dismantling the cylinder head.
9. The aplication of new maintenance methods may increase service life of the engines components by 30%.
10. The pressure of the exhaust gases assists, when the valves open, to drive the gases out of the cylinder.

IV. Complete the passage using the information from Fig.7.5. which shows an engine indicator.

- The power developed within the engine cylinder can be measured by an _____ . It is fastened onto the indicator cock provided in the cylinder head by a _____ . The engine indicator consists of a small _____ of known size which operates in a cylinder against a specially _____ . A magnifying _____ transfers the piston movement to a _____ on which is mounted a card. The drum moves backwards and forewards under the pull of a _____ . The cord is moved by a reciprocating mechanism which is proportional to the engine movement in the cylinder. A diagram which represents the gas pressure on the engine piston at different points of the stroke is drawn by means of the _____ .

UZROK, RAZLOG (Cause, Reason) I

U tehničkom su jeziku vrlo česti primjeri kazivanja uzroka ili razloga, te uzročno posljedičnih veza unutar rečenica ili među više rečenica. Evo primjera iz VII lekcije.

- This is required much more often in the case of the exhaust valves because they operate at higher temperatures and beacause gases flowing through may contain particles of carbonaceous matter.
- Because of these considerations it is not unusual to find that the exhaust valves are designed to be of smaller diameter than the inlet valves.
- Being smaller also assists with keeping them cool which is important as exhaust valves often give rise to thermal problems.

- Uzrok (Razlog) izrečen je istaknutim dijelovima gornjih rečenica. U prvoj rečenici uzrok je izračem dvjema zavisnim uzročnim rečenicama, (cause) u drugoj predloženom grupom ("Because of …"), u utrećoj putem glagola sa nastavkom -ing , ("Being smaller …") i zavisnom rečenicom ("… as exhaust valves often give rise to thermal problems.").
- Evo još nekoliko primjera izricanja uzroka ili razloga čitavom nezavisnom uzročnom rečenicom:

1. Because the castings are not so big and heavy, the column and cylinder block may be made in one piece.
2. As no repair was possible, the auxiliary pump had to be replaced.
3. For installation intended to burn only Diesel oil, only a simple supply system is used since the fuel will flow under gravity at all times.
4. Since new system of chocking was introduced, there was no more movement or bolt breakage.

- Uzrok (razlog) se najčešće izražava zavisnim rečenicama **because, since** i **as** a njihovi su ekvivalent u Hrvatskom **jer, budući da, zbog toga što, stoga što, zato što,** itd….
- Kada se zavisne rečenice uvode sa **since** i **as** onda one najčešće prethode glavnoj rečenici (5), (7), dok uzročna navedena sa **because** obično slijed iza glavne rečenice (1). No to ne mora biti i čvrsto pravilo što potvrđuju primjeri (2), (4), za because, te (3) i (6). za as i since. U primjeru (3) upotrebljen je oblik na **–ing** (Particip sadašnji) glagola "be" (being) umjesto svršenog oblika "be" u rečenici koja bi glasila:

- 3a. *As (since) exhaust valves are smaller, this also assists in keeping them cool*.

I . Connect the following sentences by establishing CAUSE – RESULT relationship

Ex. a. The damage to the hull appeared to be serious. The ship was drydocked in the shipyard.

As (since) the damage to the hull appeared to be serious, the ship was drydocked in the nearest shipyard.

Ex b. In oil burns the bunker space is reduced. Fuel oil is stored in double bottom tanks.

In oil burns the bunker space is reduced, because oil is stored in double bottom tanks.

Connect the following sentences by establishing CAUSE – RESULT relationship

1. The bolts have not been accurately tightened . The flange leaks.
2. The friction in bearing surfaces increases. The wrong lubricant was chosen.
3. The pipe in the main feed line had burst. Steam was lost in both boilers.
4. This type of liner is called the "wet liner". The cooling water is in direct contact with the outer surface of the liner.
5. The temperature rose. The cooling of the engine was poor.
6. The Engine Cadet had very little training. His work was not quite satisfactory.
7. The needle lifts of its seat. The upward force on the needle exceeds the force of the compressed ring.
8. The aperture in the frame for the water jacket is much larger than the cylinder bore. The connecting rod large end has much more room to pass.

II. Retain the CAUSE – RESULT relationship expressed in the sentences given below using the -ing form (Present Participle) instead of the AS/SINCE/BECAUSE – clauses.

•

Ex. Last night the Second Engineer did not join in the conversation, because he was angry with us.

Last night the Second Engineer did not join in the conversation, being angry with us.

Note the omission of the subject and the position of the -ING form: the very beginning, preceding all other words. This occurs when the subject of both clauses –ING form must follow its noun / pronoun as in the example:

As the pressure was too low, we could not start the engine

The pressure being too low, we could not start the engine

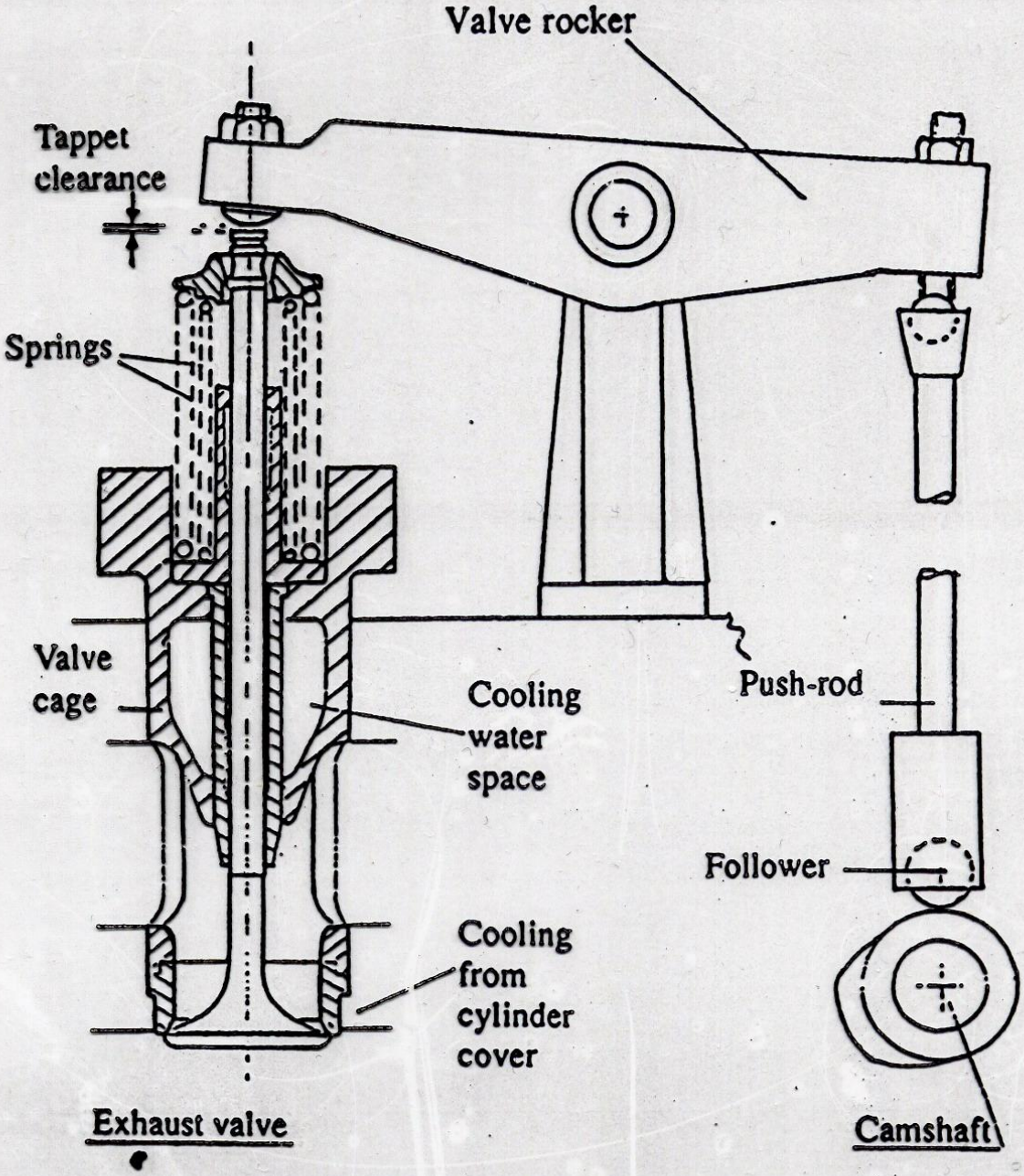
II. Retain the CAUSE – RESULT relationship expressed in the sentences given below using the -ing form (Present Participle) instead of the AS/SINCE/BECAUSE – clauses

- The greaser cannot talk with you now, because he is busy.
- As Saturday was a holliday, all shops were closed.
- Because the fixing studs were loosely tightened, the safety of operations was not guaranteed.
- As they saw that they could not fight the fire the left the engineroom.
- The fuel is being atomised properly, because it has been preheated at the correct temperature.
- As the last bus has gone we had to walk home.
- Since the temperature has risen too high, it will be impossible for the lube oil to maintain its viscosity.
- As none of those present had any questions to ask, Master closed the meeting.
- The Engine Cadet applied to the Donkeyman for advice, because did not know what to do.
- The large end bolts withstand any load since they are strongly made.

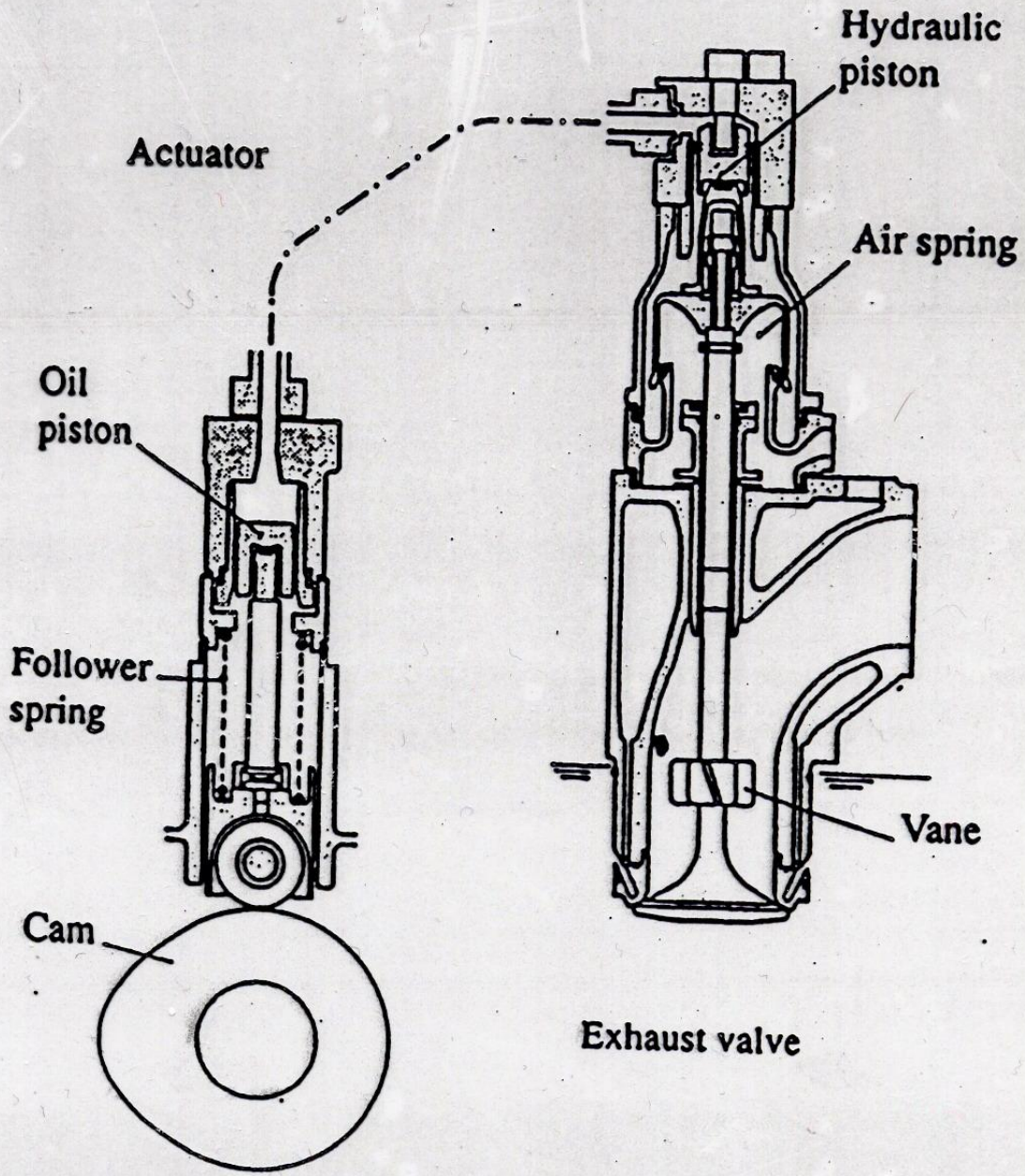
V . Translate into English choosing from the following VERB + NOUN COLLOCATIONS.

accommodate the valves, admit the air, cause pitting, conduct water, cool the cage, distribute the load, expell the gases, extent the life, fit the head with valves, grind the valves, set the spring, measure the pressure

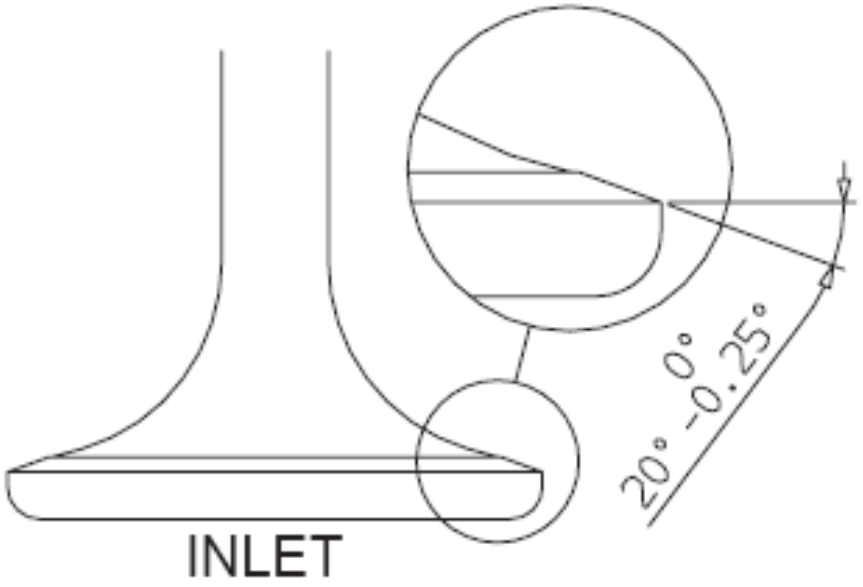
1. Nakon sagorijevanja goriva u cilindru dio ispušnih plinova se tjera u zrak kroz dimnjak.
2. Bojim se da ćemo u slijedećoj luci morati brusiti ventile.
3. Budući da je podmazivanje bilo slabo, to je uzrokovalo ljuštenje zupčanika u reduktoru.
4. Kako da produžimo vijek trajanja ventila ?
5. Morat ćemo osigurati bolje hlađenje sjedišta ventila.
6. Voda se cijevima odvodi u izmjenjivače topline.
7. Ventili nisu bili dobro podešeni, jer nismo obratili pažnju na knjigu sa uputstvima.
8. Nakon što se regulira pritisak zrak se pušta u cilindar.

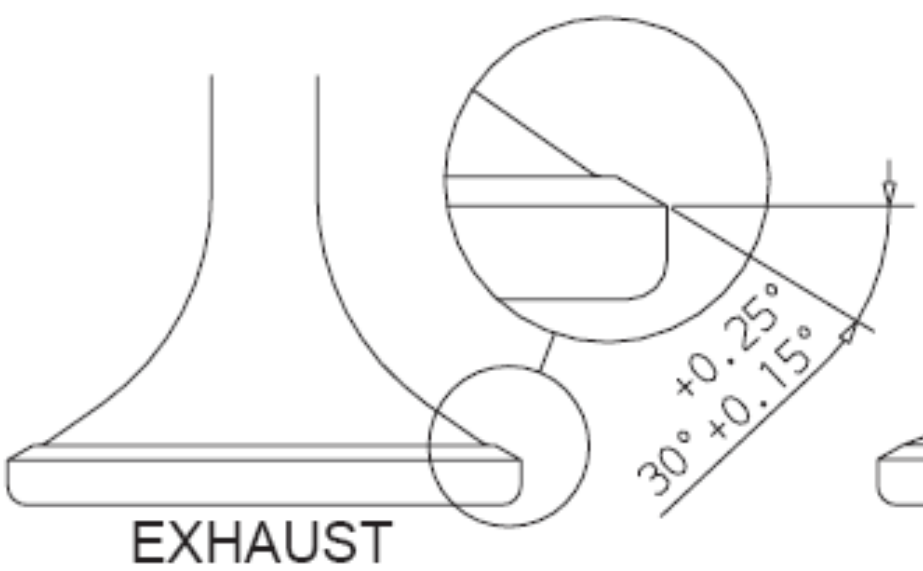


3.7 Exhaust valve with pushrod and tappet

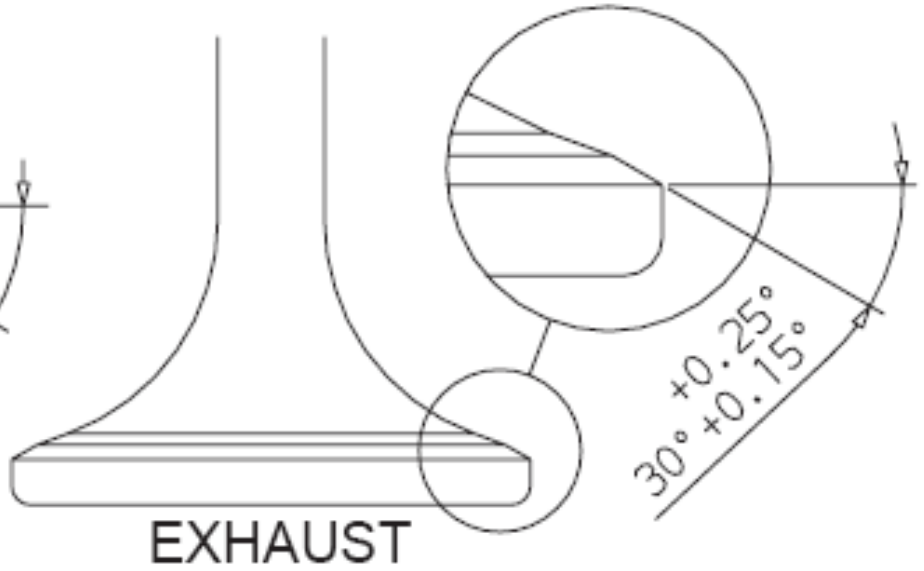


3.8 Hydraulically operated exhaust valve (Sulzer)





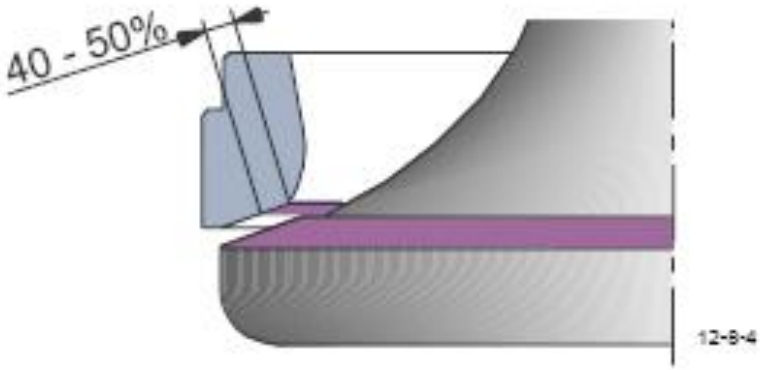
I STELLIT



II, III NIMONIC

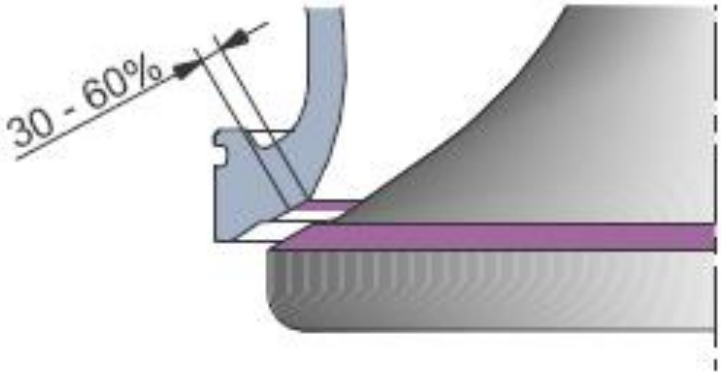
12-11-5

INLET:

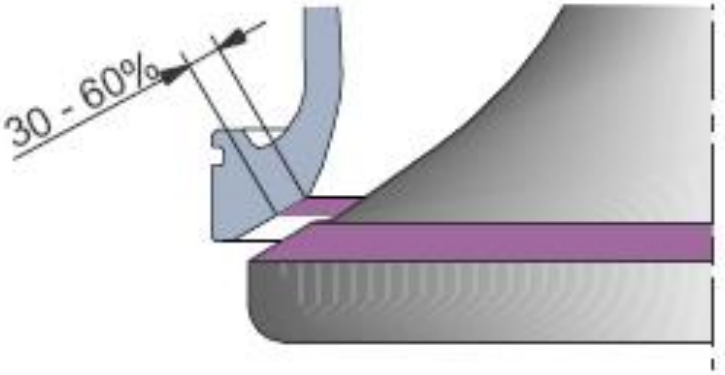


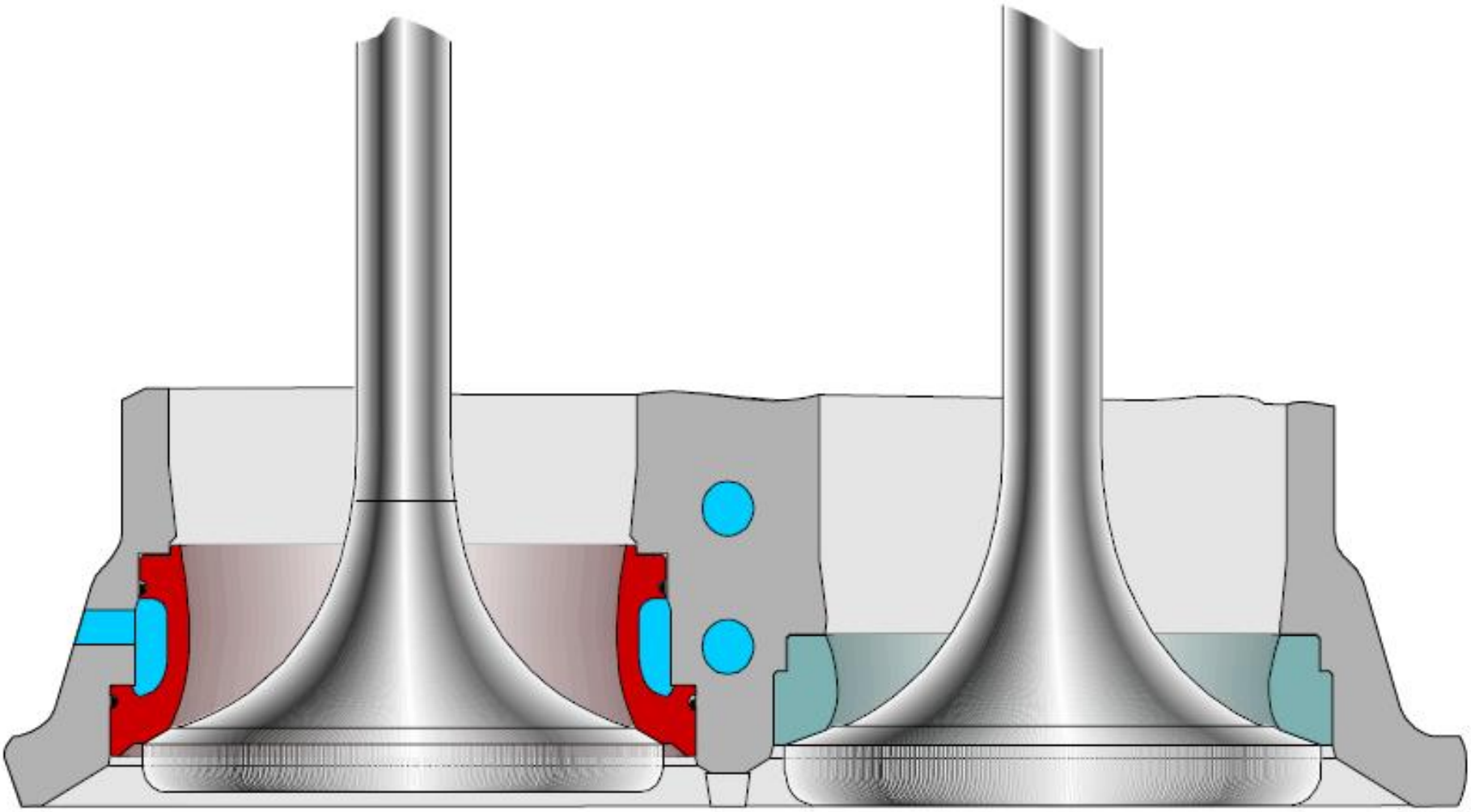
EXHAUST:

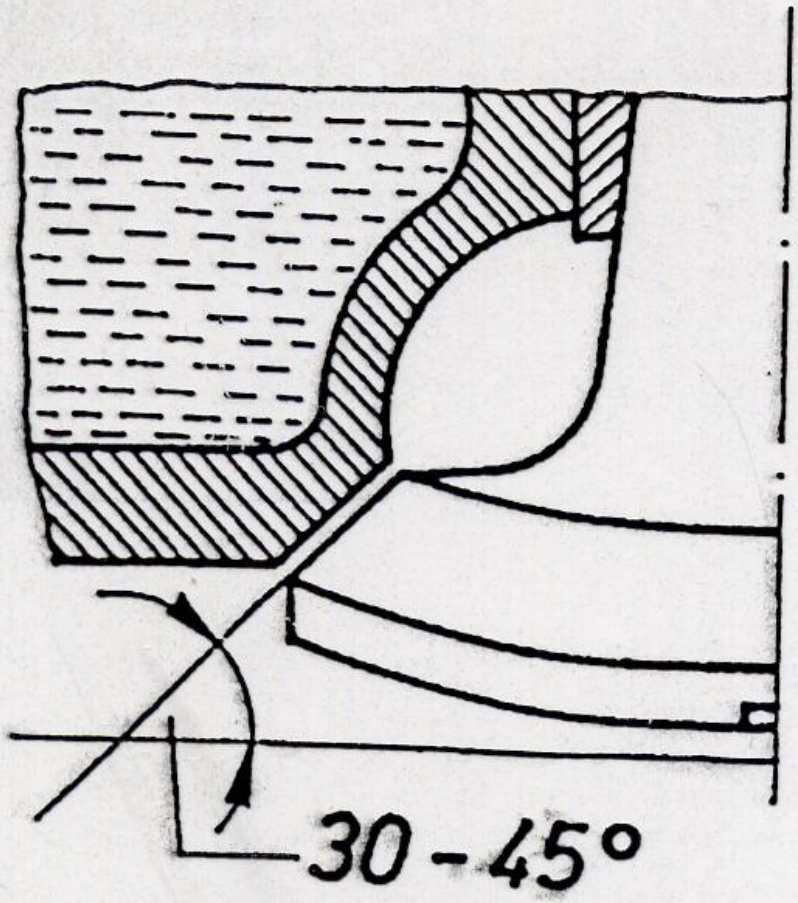
I, II



III



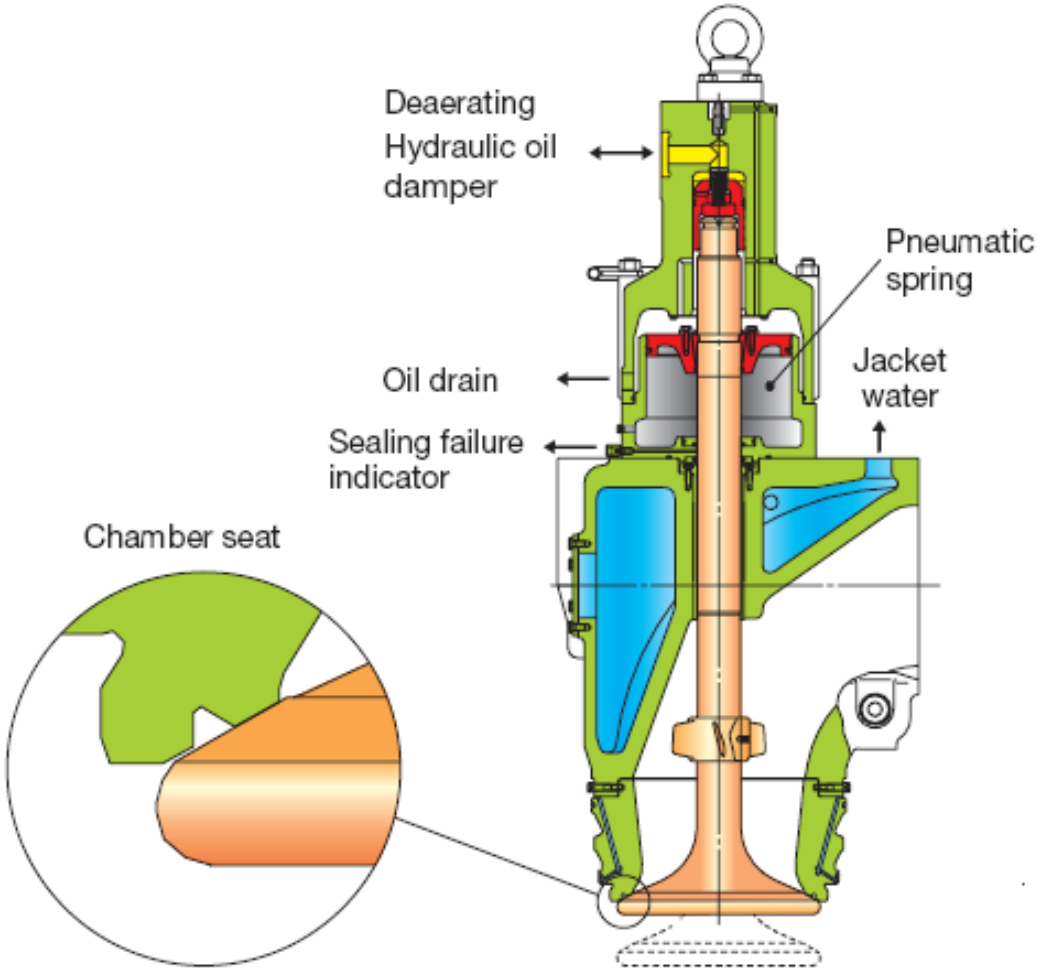


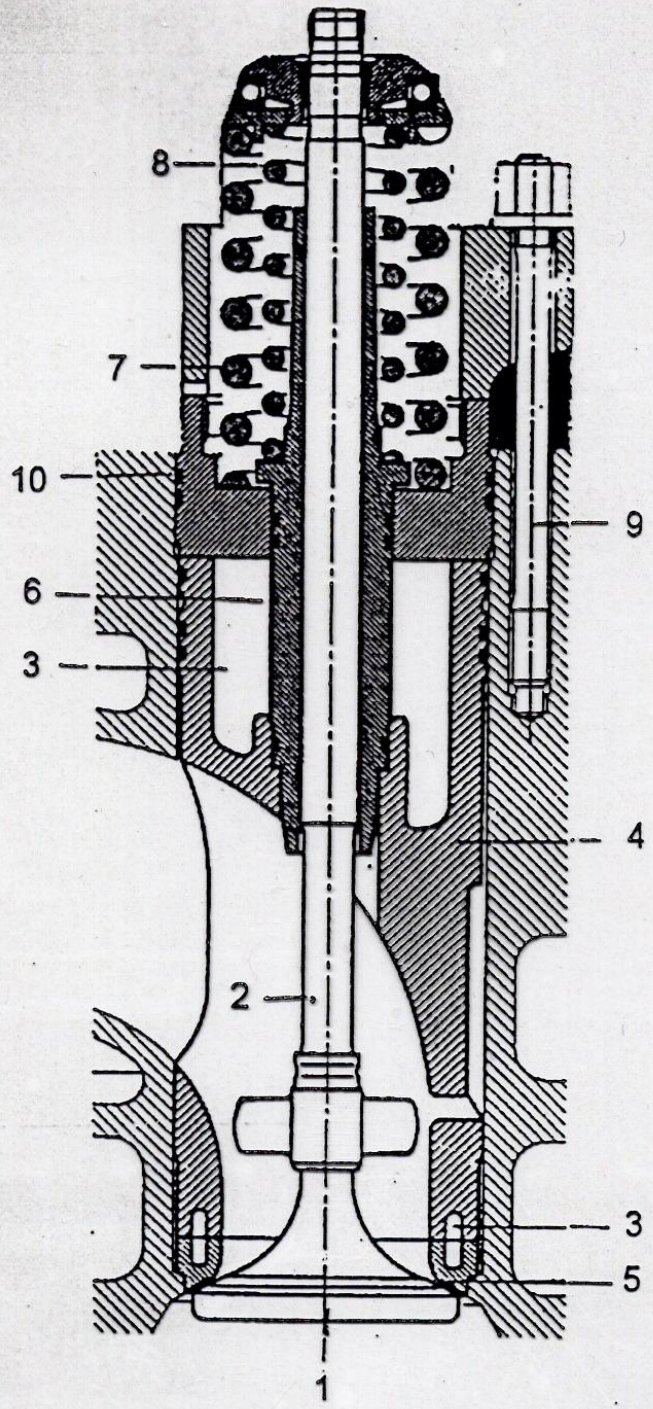


VALVE SEAT

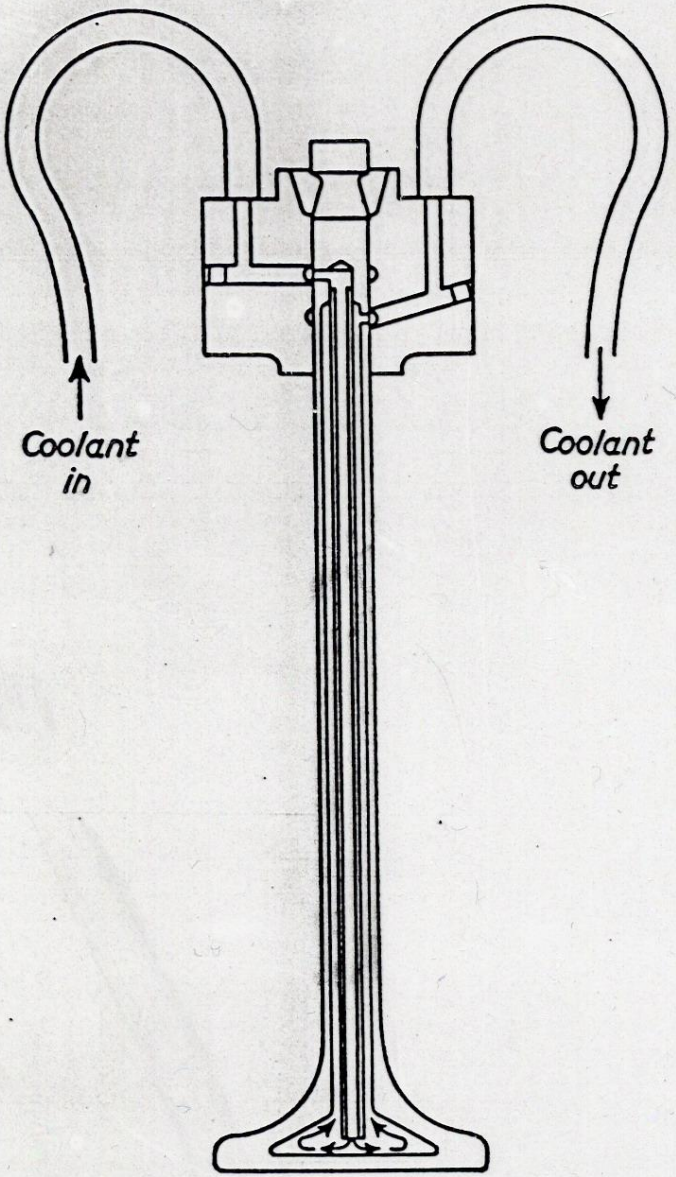
Exhaust Valve for S-MC-C

- Hydraulic activated
- "Pneumatic spring"
- Valve spindle of Nimonic (option on S50MC-C and S46MC-C)
- With vane wheel rotator
- With damped closing by an oil cushion
- Exhaust valve bottom piece of "chamber" type



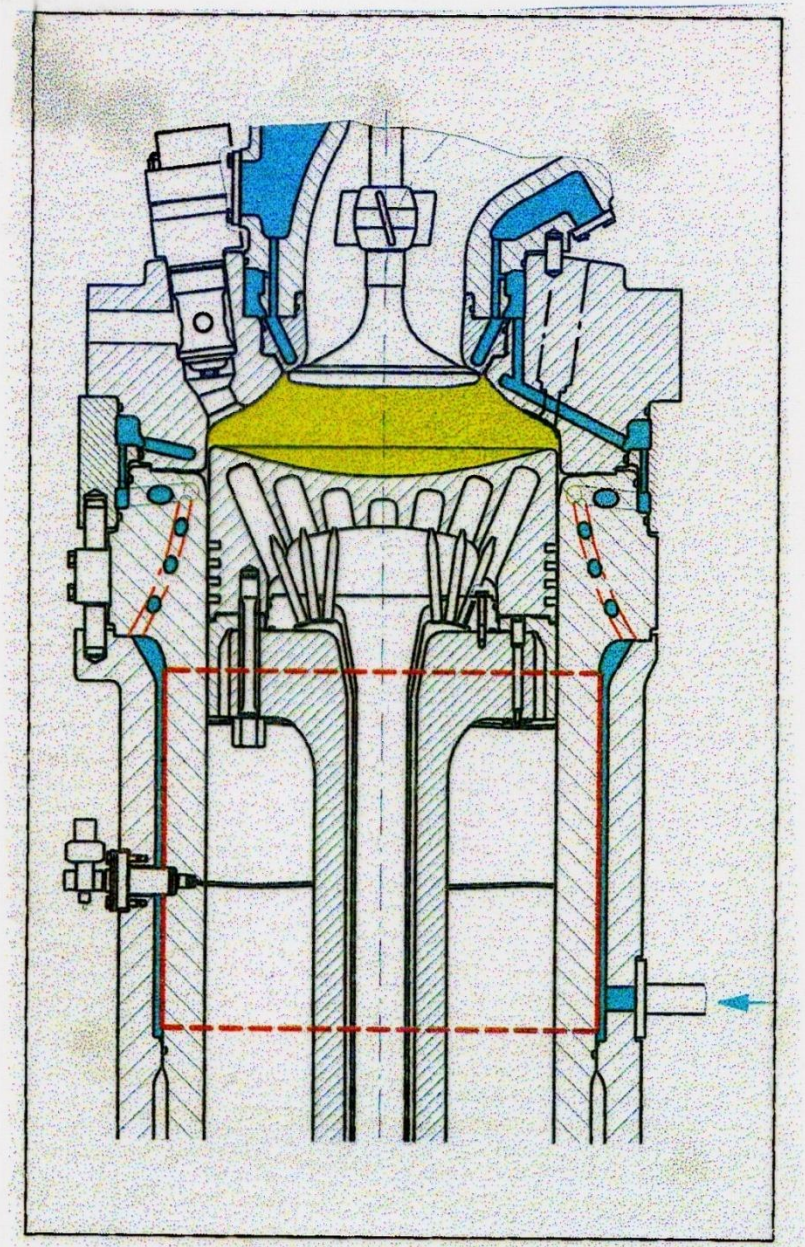


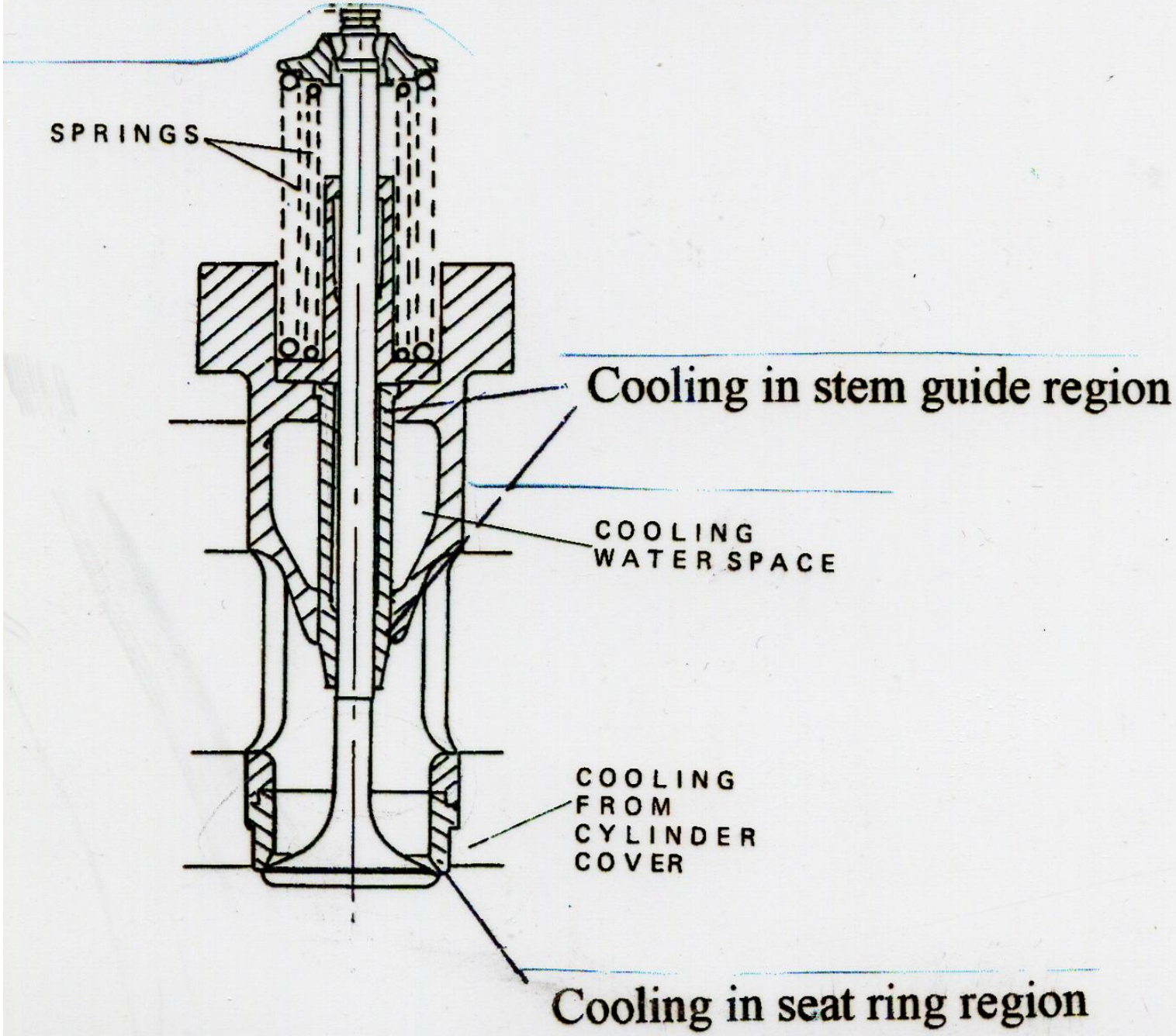
1. valve head
2. stem
3. cooling water space
4. cage
5. seat
6. stem guide
7. spring
8. safety spring
9. valve stud
10. sealing rings



COOLING OF VALVE STEM BY
WATER CIRCULATION IN IT

COOLING IN LARGE ENGINES




SPRINGS
Cooling in stem guide region
COOLING
WATER SPACE
COOLING
FROM
CYLINDER
COVER
Cooling in seat ring region