ΑΕΝ ΑΣΠΡΟΥΡΓΟΥ

ΣΧΟΛΗ ΜΗΧΑΝΙΚΩΝ

MARITIME ENGLISH
6th- ΣΤ' SEMESTER

ΑΚΑΔΗΜΑΙΚΟ ΕΤΟΣ 2014-15

IOANNA CHARCHANDI
BA (Hons), MSc, MEd, PhD Cand., LL.B St.

Piston Cooling and Crosshead Lubrication

The working pistons are cooled by bearing lubricating oil. The crosshead is lubricated by bearing oil which has been boosted to a higher pressure. Both oil systems are led to the crosshead via a double articulated lever with separate oil supplies.

Crosshead lubrication

The crosshead lubricating oil 'KE' reaches the connecting piece 8, which is fitted to the connecting rod shank 10, by-passing through the support 4, the lower lever 6 and the upper lever 7. The oil enters the ring space 'RR' through bore 'BA'. The crosshead pin is lubricated through drillings in the crosshead bearing shell 9 (see Fig. 'A'). A drilling 'OB' through the connecting rod shank 10 leads the oil to the crankpin bearing.

Piston cooling

Bearing oil 'KO' passes through the support 4, the lower lever 6 and the upper lever 7 to the connecting piece 8, which is fitted to the connecting rod shank 10. The cooling oil is led to the working piston through the bore 'BB', the ring space 'OR', drillings in the crosshead bearing shell 9 and the bores 'BC', then outside the oil pipe 3 through the piston rod 1. The oil then flows through the oil pipe 3 to the central bore in the crosshead pin 11 and returns to the crankcase. Part of the piston cooling oil is used to lubricate the guide shoes 2 and the guide shoe pins as shown in Fig. 'C' (see also group 3326–1).

Attention

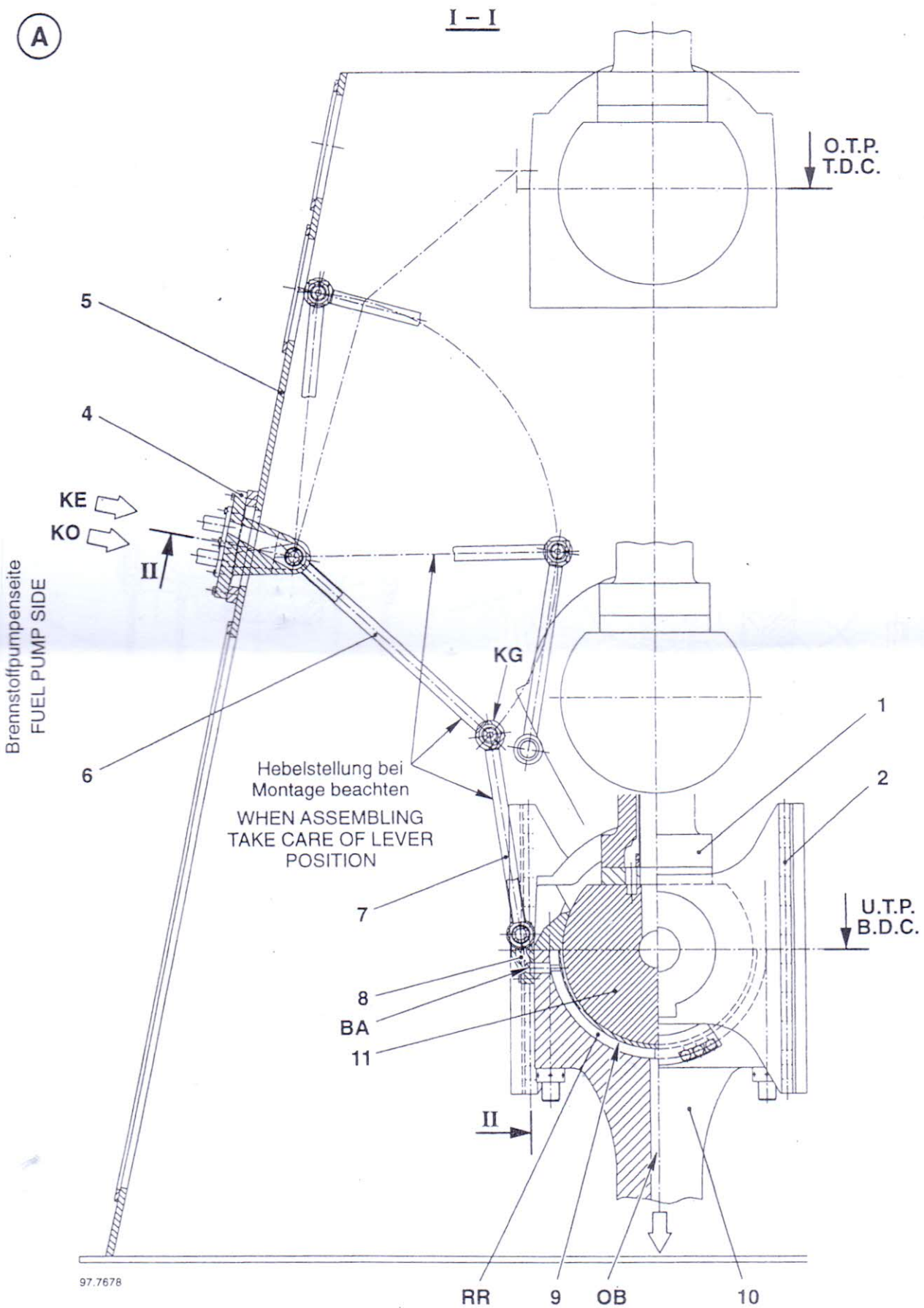
When fitting the upper lever 7 to connecting piece 8 great care must be taken that the toggle lever **(knee) 'KG' buckles upwards as per Fig. 'A'.** Wrongly fitted, this would certainly lead to very grave damage to the toggle lever, the crosshead and the column. Besides **this it will cause interruption of the lubricating oil supply with further heavy damage resulting.**

Key to Illustrations:

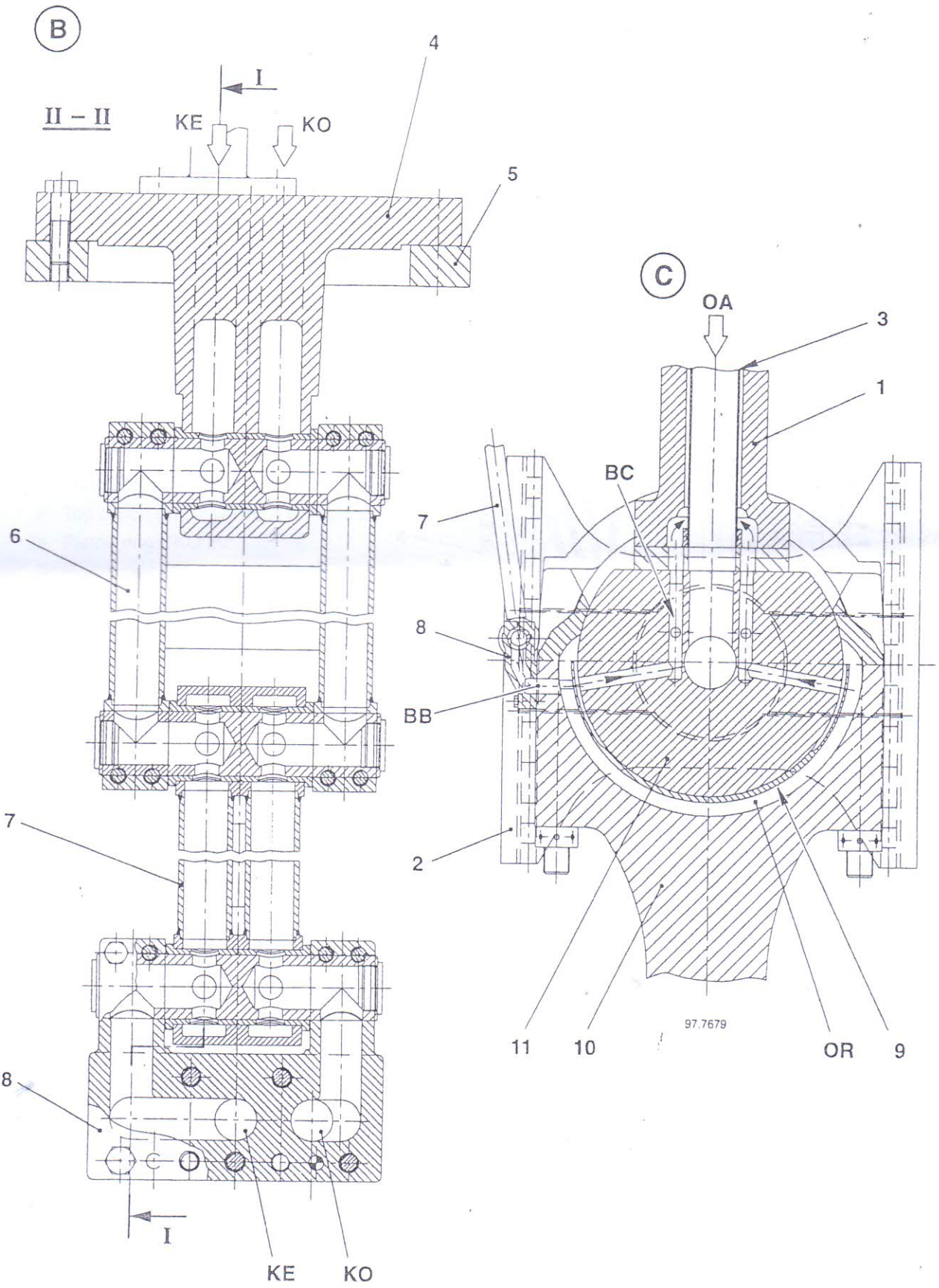
'A' Articulated lever arrangement
'B' Longitudinal section through articulated lever
'C' Cross section through crosshead

1	Piston rod
2	Guide shoe
3	Oil pipe
4	Support
5	Column
6	Lower lever
7	Upper lever
8	Connecting piece
9	Crosshead bearing shell
10	Connecting rod shank
11	Crosshead pin

BA	Bore for crosshead lubricating oil
BB	Bore for piston cooling oil
BC	Bore in crosshead pin
KE	Inlet for crosshead bearing oil
KO	Inlet for piston cooling oil
KG	Toggle lever (knee)
OA	Piston cooling oil return
OB	Bore for crosshead lubricating oil to the crankpin bearing
OR	Ring space for piston cooling oil
RR	Ring space for crosshead lubricating oil


A
I – I
O.T.P.
T.D.C.
5
4
KE
KO
II
Brennstoffpumpenseite
FUEL PUMP SIDE
KG
6
Hebelstellung bei
Montage beachten
WHEN ASSEMBLING
TAKE CARE OF LEVER
POSITION
1
2
7
U.T.P.
B.D.C.
8
BA
11
II
RR
9
OB
10
97.7678

Piston Cooling and Crosshead Lubrication



Working Piston

The working piston consists basically of: Piston crown 1, piston skirt 3, piston rod 5, the oil cooling components and piston rings 2 and 2a. Piston crown and piston rod are joined by ten elastic bolts 9. Piston skirt 3 is directly screw fastened to the piston rod 5.

Piston rod 5 is fastened to crosshead pin 8 in a particular position. A compression shim 7 is fitted between them, its thickness being adapted to the compression ratio.

Only for running-in a new cylinder liner, a piston ring designated with 'KOPPL 20' and having plasma coating should be fitted in the uppermost ring groove. When replacing the uppermost piston ring 2 for an used and run-in cylinder liner, the piston ring 2 with designation 'KOP 20' is to be mounted in the uppermost piston ring groove. All piston rings have to be fitted with the marking 'TOP' upwards.

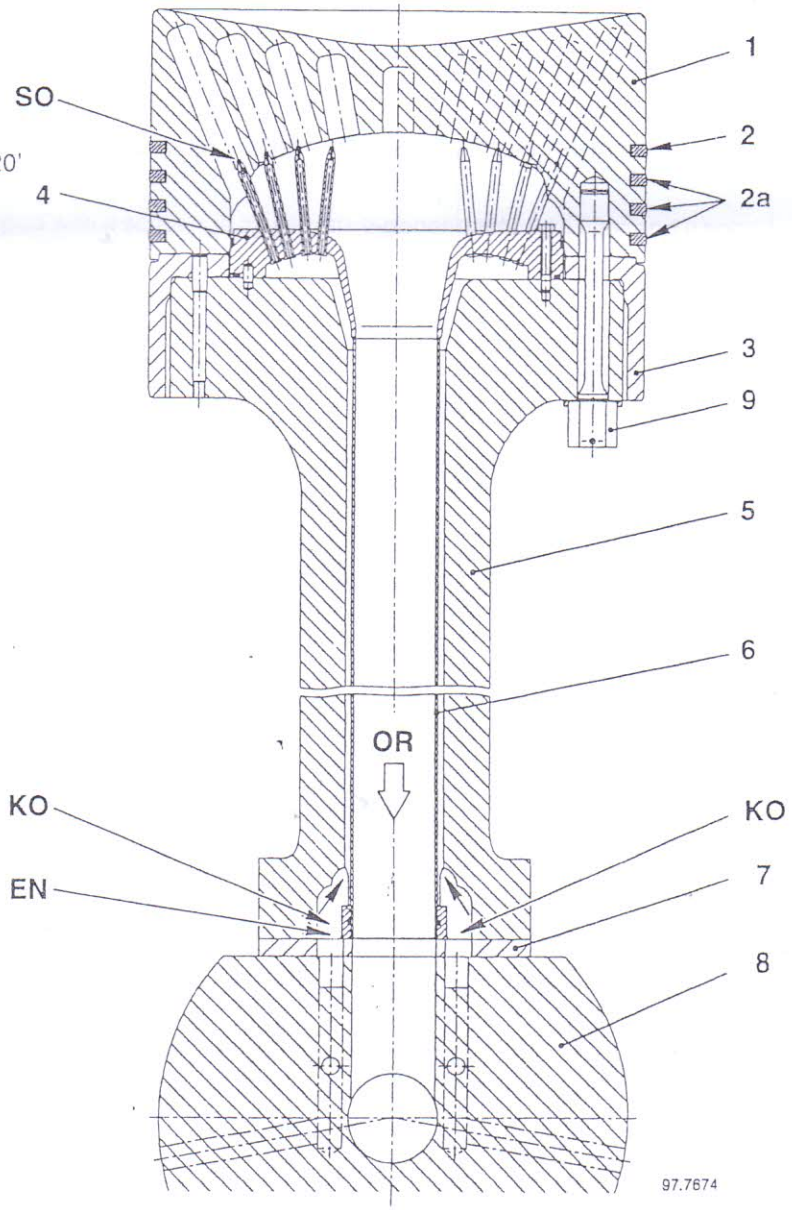
Piston cooling

The piston crown 1 is cooled by bearing lubricating oil. The piston cooling oil 'KO' is fed from crosshead pin 8 into the two inlet slots 'EN'. From here it flows outside the oil pipe 6 (arranged in the piston rod 5) till spray plate 4. The cooling oil is sprayed into the cooling bores of the piston crown through nozzles in the spray plate. From there the oil 'OR' flows through oil pipe 6 into the crosshead pin from where it emerges sideways.

Key to Illustration:

1 Piston crown
2 Top piston ring 'KOPPL 20' / 'KOP 20'
2a Piston rings 'KO 20'
3 Piston skirt
4 Spray plate
5 Piston rod
6 Oil pipe to spray plate
7 Compression shim
8 Crosshead pin
9 Elastic bolt

EN Inlet slot (groove)
KO Piston cooling oil
OR Oil return from working piston
SO Spray oil



Speed Governor

Speed Control System (Electronic) NORCONTROL DGS-8800e

1. General

The function of the speed governor is to maintain the engine speed constant, at a given rated value, i.e. the speed governor controls the amount of fuel injected into the cylinder via the fuel pump regulating linkage in accordance with the required load.

A further function of the governor is to protect the engine from unexpected operating conditions, or overload, by built-in fuel limiters.

The NORCONTROL DGS-8800e speed control system consists of the following components:

- DGU-8800e .... Regulating unit.
- ELACT-001 .... Actuator (final control element) for the setting of the fuel pump regulating linkage.
- DSU-001 ..... Digital servo unit = power amplifier to ELACT-001.
- TRAFO-001 ... Transformer (current supply for digital servo unit).

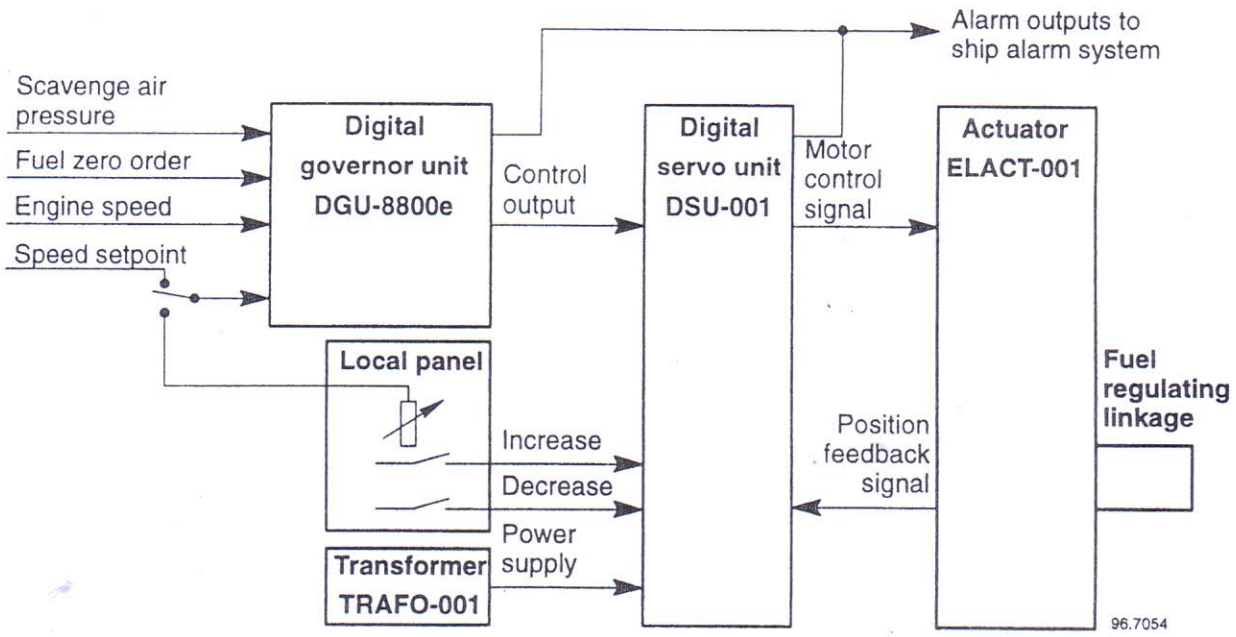
The DGU-8800e governor is a digital electronic governor. The speed detection takes place electrically via pick-ups on a gear wheel of the camshaft drive.

The actuator ELACT-001 is a final control element for the electronic governor, which moves the fuel pump regulating linkage to the position pre-given by the electronic governor.

The setting of the rated value for the engine speed is normally carried out ellectrically by the engine remote control to the electronic governor.

The DGU-8800e electronic governor is equipped with a scavenge air pressure-dependent fuel limiter and a speed-dependent fuel limiter (torque limiter).

Simplified schematic diagram of the speed control system



The correlation with the engine control is shown on the schematic diagram in group 4003–2.

2. Description

The following bulletin describes the construction and the function of the governor and its ancillary devices by the manufacturer, KONGSBERG NORCONTROL.

Documentation: – Digital Governor System DGS-8800e for Sulzer RTA engines.

2.1. The most important functions are:

Regulating unit DGU-8800e:

- Speed regulation
- Scavenge air pressure-dependent fuel limiter
- Speed-dependent fuel limiter (torque limiter)
- Start fuel limiter
- Engine shut-down (Fuel zero signal)
- Alarms (governor condition, signal monitoring)

Digital servo unit DSU-001:

- Controls the current to the actuator
- Regulates the actuator position according to the value pre-given by the regulating unit
- Permits manual positioning of the actuator by INCREASE / DECREASE knobs
- Alarms

Actuator ELACT-001:

- Final control element (actuator) to electronic governor:
  Sets the fuel pump regulating linkage acc. to the value pre-given by the electronic governor.

Transformer TRAFO-001:

- Current supply for digital servo unit

3. Settings

The necessary settings in the electronic governor are made by the engine manufacturer during the engine test run, either on the test bed, or during the sea trials of the ship. The exact settings are recorded, and are then part and parcel of the acceptance documents of the engine.

Setting and repair of the electronic governor, as well as on the PGA-EG 200 governor / actuator, should be made **only by specially instructed personnel**. Alterations of the governor settings may only be undertaken with the written agreement of the engine manufacturer.

4. Troubles

If troubles occur the manufacturing documentation gives advice on possible causes and the measures to be taken.

5. Emergency operation

5.1. Failure of the electronic governor

The fuel quantity remains constant if the regulating unit DGU-8800e or the digital servo unit DSU-001 fail.
The actuator can be positioned manually from the local panel by INCREASE / DECREASE knobs, if the digital servo unit still functions.

5.2. Failure of the digital servo unit DSU-001 and of the ELACT-001 actuator

The engine can also be controlled provisionally in EMERGENCY OPERATION without governor, if the digital servo unit and/or the actuator have also failed and if they cannot be immediately replaced (see group 0570–1).

Reversing Servomotor

The duty of the reversing servomotor is to move the fuel cams on the camshaft for forward or reverse engine rotation. Normally, one fuel cam is arranged on either side of the reversing servomotor for each pair of engine cylinders.

In engines with an uneven number of cylinders the servomotor at the free end is fitted with a single fuel cam 5. The camshaft rotation is opposite to the direction of rotation of the crankshaft.

The cams can be reversed (turned relative to the camshaft) corresponding to the desired direction of rotation of the engine, to the position where the fuel injection is actuated at the right moment.

Function

The fuel cam 5 and the tapered bushes 14 are fitted to the sleeves 13 by pressure bond. The sleeves 13 and the segments 7 are screwed together. Fuel cams 5, tapered bushes 14, sleeves 13, segments 7 and bushes 8 thus form individual units which can execute a turning movement limited by the wing 11.

AHEAD for right hand engine rotating clockwise:

When the camshaft 1 rotates in direction of the arrow 'DR' the segments 7 are pushed by the wings 11 in the direction of the arrow. The connecting piece 'VA' is subjected to control oil pressure. It fills the spaces 'RA' through drillings in the bush 8 and ensures that the segments 7 lie firmly pressed against the wings 11. The correct end position of the reversing servomotor is transmitted to the valve group [G] in the pneumatic logic unit via the connecting piece 'VR'.

Reversing:

When reversing the connecting piece 'VA' has zero pressure, and the spaces 'RB' are filled with control oil through the connecting piece 'VB'. The segments 7 and therefore also the fuel cams 5 are turned on the camshaft, until they again rest against the wings 11. As soon as the correct reversal indicated by the connecting piece 'VR' and the correct direction of rotation is attained, then fuel is injected at the correct timing for the new direction of rotation.

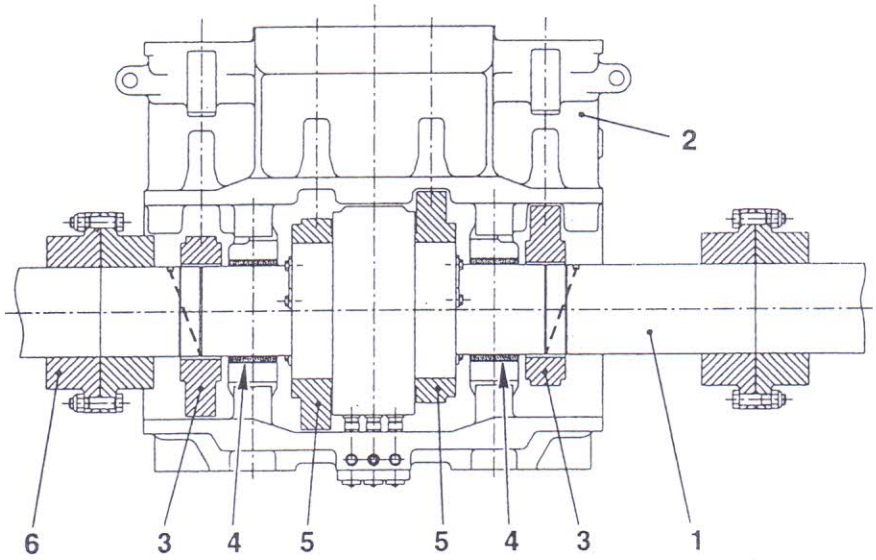
The control diagram of group 4003–2 shows how the reversing servomotors are controlled and how the monitoring functions.

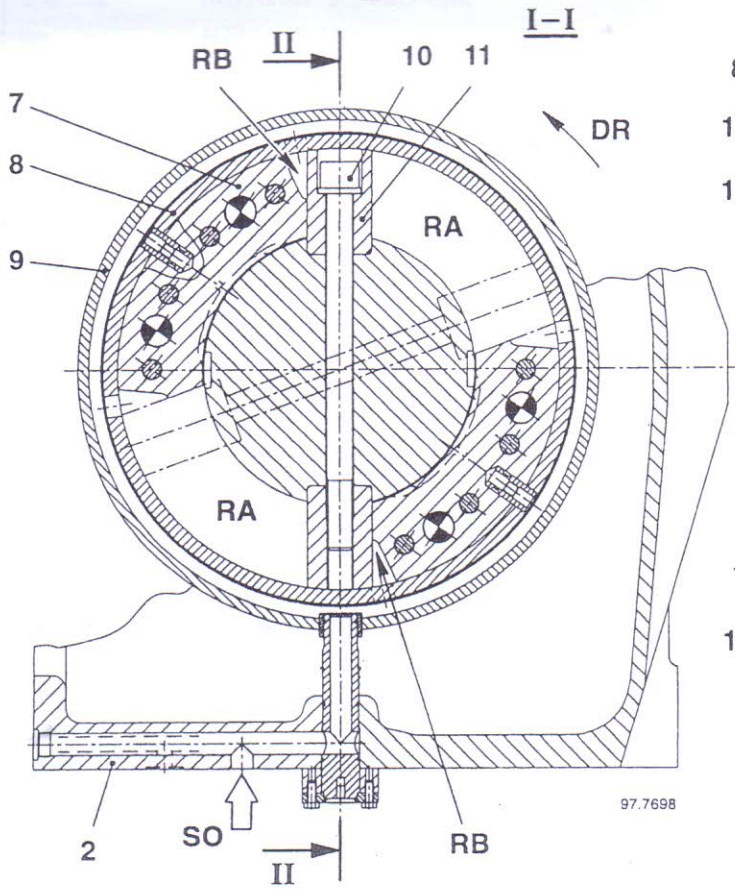
Key to Illustration:

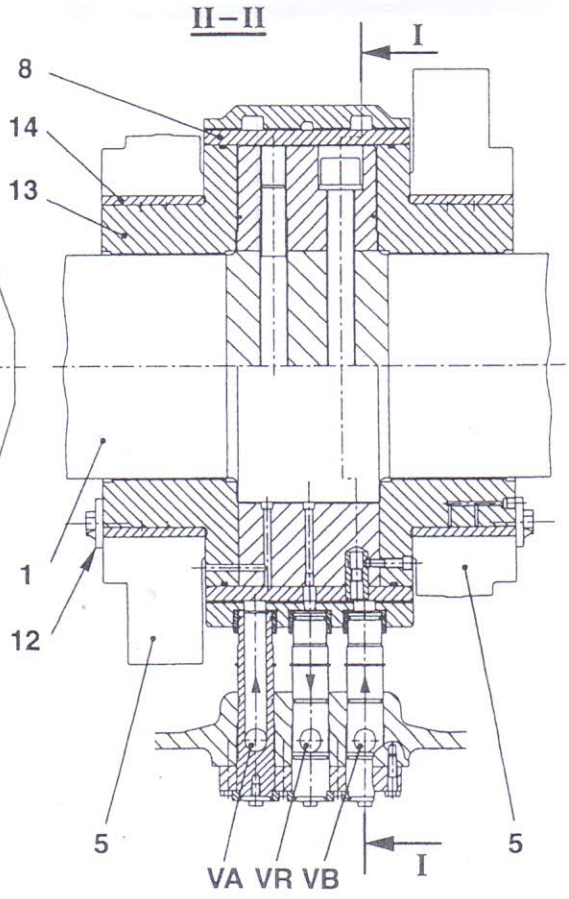
1 Camshaft
2 Fuel injection pump casing
3 Actuator cam
4 Camshaft bearing
5 Fuel cam
6 Flange coupling
7 Segment
8 Bush
9 Sliding ring
10 Waisted screw
11 Wing
12 Locking plate
13 Sleeve
14 Tapered bush

DR Direction of rotation
SO Control oil connection
VA Connecting piece for camshaft rotating anticlockwise
VB Connecting piece for camshaft rotating clockwise
VR Connecting piece for reversing end position signal
RA Space for camshaft rotating anticlockwise
RB Space for camshaft rotating clockwise

Reversing Servomotor







Req. Date: 06/11/2014
Req. No: **SP.KL.099.14/R**

Component	HFO Purifier No.1 (Complete)
Maker	ALFA LAVAL LTD
Model/Type	FOPX613 TFD-20
Serial No	

HFO Purifier No.1 (Complete) — FOPX613 TFD-20 hfo-pur-maintenance-manual

No	Part No	Description	Maker	Req	Appr	OnBrd	Supply Info	DWG No
1	1761482-04	Flow indicator -O- ring	ALFA LAVAL LTD	2	0	0		Flow Indicatc Book:181801 V2
2	1762181-01	Flow indicator protection glass	ALFA LAVAL LTD	1	0	0		Flow Indicatc Book:181801 V2
3	260104-69	Flow indicator -O- ring	ALFA LAVAL LTD	2	0	0		Flow Indicatc Book:181801 V2

Component	HFO Purifier: Separator Bowl
Maker	ALFA LAVAL LTD
Model/Type	FOPX613 TFD-20
Serial No	

HFO Purifier: Separator Bowl — FOPX613 TFD-20 hfo-pur-545006-04

No	Part No	Description	Maker	Req	Appr	OnBrd	Supply Info	DWG No
4	537864 02	Valve plug	ALFA LAVAL LTD	9	0	0		hfo-pur-5450 4
5	543049 07	Sliding bowl bottom	ALFA LAVAL LTD	1	0	0		hfo-pur-5450 4
6	545156 02	Top disc	ALFA LAVAL LTD	1	0	0		hfo-pur-5450 4
7	65133	O-ring	ALFA LAVAL LTD	6	0	0		hfo-pur-5450 4
8	73180	O-ring	ALFA LAVAL LTD	2	0	1		hfo-pur-5450 4
9	74722	Rectangular ring	ALFA LAVAL LTD	2	0	1		hfo-pur-5450 4
10	74736	Seal ring	ALFA LAVAL LTD	3	0	0		hfo-pur-5450 4

Component	HFO Purifier: Machine Bottom Part
Maker	ALFA LAVAL LTD
Model/Type	FOPX613 TFD-20
Serial No	

HFO Purifier: Machine Bottom Part — FOPX613 TFD-20 hfo-pur-543048-16-17

No	Part No	Description	Maker	Req	Appr	OnBrd	Supply Info	DWG No

SHIP'S MACHINERY AND ENGINEER'S RESPONSIBILITIES

The reliability of any marine engine depends on the technical staff of the ship-owner and in particular on the engineers.

Engine builders, pump makers and all the constructors of the equipment in ships supply instructions about the regular care and maintenance that should be given to their equipment.

The Chief Engineer knowing what the survey requires will plan the voyage maintenance work and will make the engineers responsible for the efficient running and maintenance of the machinery.

The Chief Engineer sets the watches after "full away" is rung and gives instructions about the gradual working up of the main engine to full power to the senior watch-keeping engineer officer on duty.

The Chief Engineer will allocate the duties of his engineer officers according to the size and type of the machinery.

Watch keeping engineer officers will be on duty in the engine room for 4 hours and off duty 8 hours during every 12 hours. As soon as the main engine on full power has settled down, indicator diagrams must be taken to check the compression and the setting of the fuel pumps and the injection valves. The builders supply a copy of the indicator diagrams taken on the test bed. These should be used for comparison with the diagrams taken.
The compression pressure, firing or maximum pressure and the mean indicated pressure should be same for all cylinders.

The Port Engineer gets the engine Log Book from the chief engineer as soon as the voyage is completed and reads the entries.
He wants to get all information regarding the efficiency of the main engines and particulars of the operation of all machinery, boilers and appliances with pressure and temperatures, fuel consumption, the miles run, the ship factor, draft, average r.p.m., weather conditions and any failures.

He then briefs his company whether the repairs or renewals suggested by the chief engineer and necessary also regarding the economical situation of the ship.

For this reason the chief engineer must complete the abstract properly and regularly because it is the evidence of the correct execution of the duties by all engineers.

Every engineer likes to be relieved of his watch promptly and it is the duty of the engineer who is taking over to be punctual.
Fifteen minutes before the end of a watch, one bell is always rung as a warning.

The engineer going on watch should then be ready to go below to have a look round and assures himself that the machinery is all in order before taking over that is he should examine all the main parts.

In the steering engine is aft and he must see that all bearings and moving parts are in order and that no wastage of steam is at the glands. He should also examine the control valve gear, the bolts of the brackets and the engine bedplate.

MERCHANT MARINE ACADEMY OF ASPROPYRGOS
COURSE: ENGLISH

CONDENSERS

Read the text carefully and fill in its gaps with the following words:

a. efficiency b. exhaust c. deflectors d. deaerator e. insulates
f. velocity g. hot h. regenerative i. non-condensable j. condensate

Single Pass Auxiliary Condenser

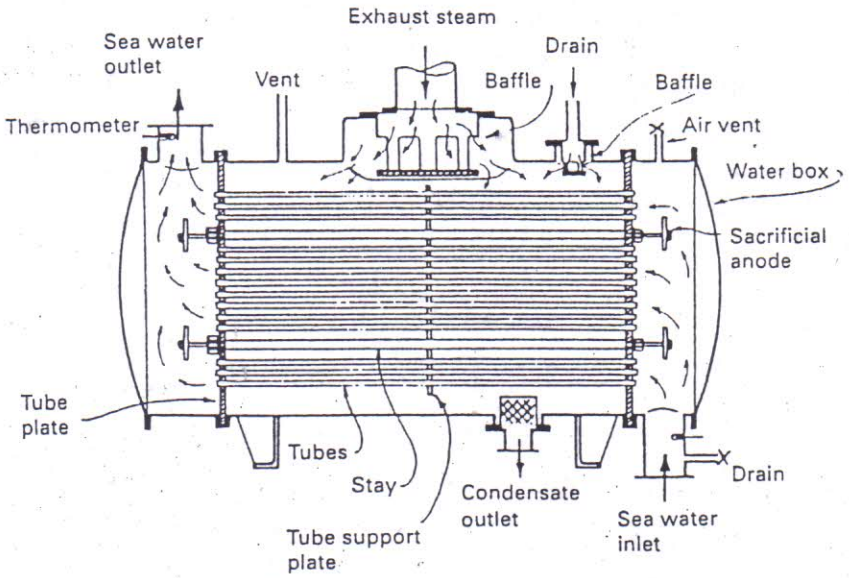


Figure 1.

The basic function of the condenser in a feed system is to remove the latent heat from the exhaust system so that the resulting 1. _____ can be pumped back into the boiler, thus conserving the distilled water feed. For optimum thermal efficiency only latent heat should be removed, so that the condensate is removed from the condenser at the same temperature as that of the incoming 2. _____ steam. The reason for this is that any energy given to the condenser cooling water is discharged at the ships side and so lost to the system, the energy then having to be restored by the combustion of fuel for evaporation back into steam to take place. The process which can cause an additional energy loss is that referred to as undercooling. This means that the condensate has been cooled below its corresponding evaporation temperature, and this energy has to be restored before evaporation can again begin to take place. This loss is not of great importance in simple auxiliary condensers, but can lead to severe losses in condensers associated with turbine plant.

Another important function of the condenser is connected with the fact that when the exhaust steam is condensed, its volume is enormously reduced, by a factor in the order of 20.000 to 1. This enables a constant low pressure to be maintained in the condenser into which the exhaust steam will flow. If the process is carried out rapidly, while at the same time any 3. _____ gases such as air are removed, pressures will below atmospheric pressure, referred to as vacuum conditions, can be produced. This low pressure enables the exhaust steam to be expanded down to a

corresponding low saturation temperature, thus increasing the thermal efficiency of the plant.

It also follows that where high vacuum conditions are to be maintained it becomes an important consideration that the condenser also acts as a 4. _____ to give increased efficiency to the removal of the air and non-condensable gases. There are a number of reasons why this must be done, the most critical being that the specific volume of these gases remains relatively large and if not removed would cause a back pressure to build up in the condenser leading to an increased exhaust steam temperature, so reducing the thermal efficiency of the plant. Air is also a very poor conductor of heat, and pockets and films of air forming around the tubes greatly reduce the rate of heat transfer between the exhaust steam and the cooling water.

REGENERATIVE CONDENSERS

When used for the main engines or for large electric generating sets, the condenser must be carefully designed to enable a high thermal efficiency to be obtained for the plant. A regenerative type condenser attempts to do this by using a number of special features to meet the design factors for maximum 5. _____.

A cross section through a typical regenerative condenser is shown in Figure 2.

Regenerative Condenser

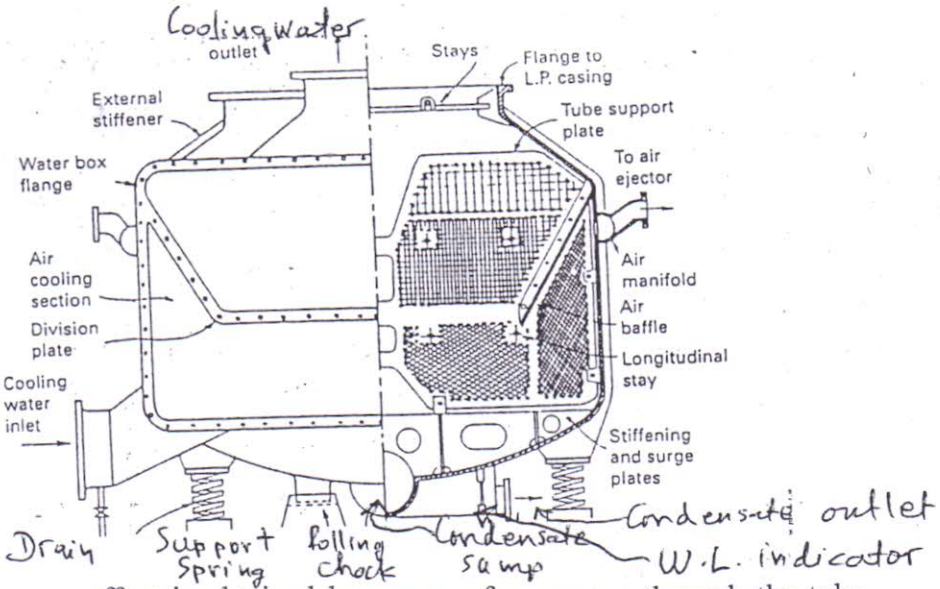


Figure 2.

The 6. _____ effect is obtained by means of a passage through the tube bank which allows a proportion of the exhaust steam to reach the lower parts of the condenser. Droplets of condensate dripping from the tubes then mix with this relatively 7. _____ steam, which gives up its latent heat to reheat these water droplets by direct contact, thus reducing the amount of undercooling to within 1° C of the exhaust temperature. This reheating also provides a deaerating effect; as when the water droplets are raised to their corresponding saturation temperature, dissolved gases in the water will be driven out. Suitable buffles then direct these gases to an air cooling section, from whence they can be drawn off by the air ejector. This arrangement can reduce the normal dissolved oxygen content of the condensate leaving the condenser at less than 0.02 ml/litre.

A manifold is fitted, to ensure these released gases, are drawn off evenly along the full length of the air baffle. It should be noted that the air take off points are placed a few tube rows below the top of the air cooling space, so allowing an air

pocket to form which 8. _____ the outgoing gases from the relatively hot baffle. This prevents them from being reexpanded as they leave the condenser.

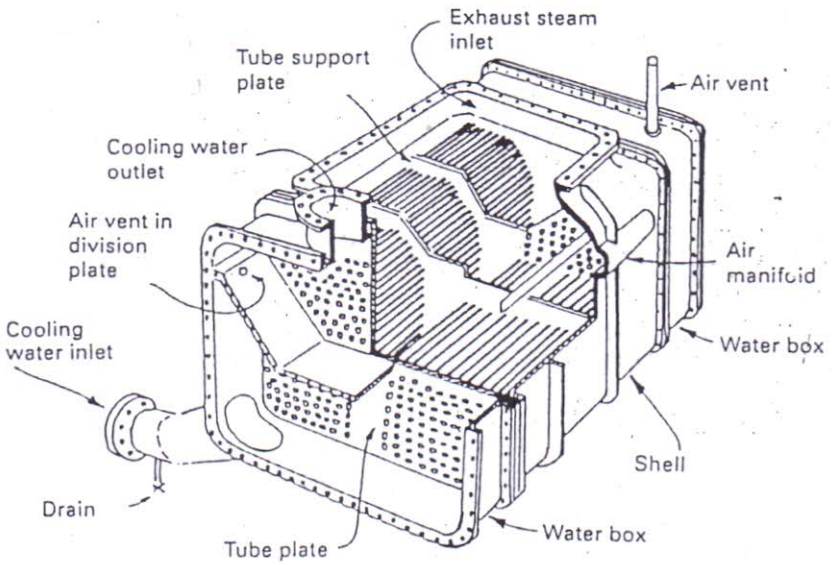
The various return drains should be introduced into the upper part of the condenser to ensure the hot water entering also undergoes this deaerating procedure. Where these drains enter the condenser, 9. _____ should be fitted to prevent direct impingement of water onto the tubes causing erosion.

The first rows of tubes are often arranged with a coarse vertical pitch so as to offer as little resistance as possible to the incoming exhaust steam. The tube pitch is then progressively reduced and eventually staggered to reduce the available flow area. This is done to maintain a steady steam 10. _____ through the tube bank. However this variation of tube pitch increases production costs and so in many cases a constant tube pitch is used. In some cylindrical condensers a similar result is achieved to some extent by mounting the tube nest eccentric to the shell, although this is mainly to obtain the regenerative effect.

The condenser illustrated in figure 3 below, allows the cooling water to make two passes, the division plate following the line of the air baffle, so that water on its first pass is circulated through the close pitched tubes in the air cooling section below the baffle, thus obtaining maximum possible cooling effect. There is however an increasing use of single pass condensers, this being due to the greater use of scoop circulation where it is important to offer as little resistance as possible to the flow of cooling water through the condenser.

Two-Pass Regenerative Condenser

Figure 3



The cooling water should flow through the numerous thin walled tubes with as high a velocity as practicable for the operating conditions. This normally entails water speeds in the order of 2 to 4m/s. The ability of the tube material to withstand erosion finally limits the speed. Cupro nickel tubes offer the best resistance and can operate at water speeds of over 10 m/s as compared to about 5 m/s for aluminium brass. However, cupro nickel is both more expensive and offers greater resistance to heat transfer than the aluminium brass, and so is not generally fitted in merchant ship condensers unless exceptionally high water speeds are to be used or long periods of operation in highly polluted water are expected.

The water speed through the condenser tubes should not be allowed to fall below 1m/s otherwise undue build up of deposits may occur leading to poor rates of heat transfer, and to possible corrosion of the tubes.

Technical Exercises

Exercise 1:
Answer the following comprehension questions based on the previous text:

1. Which is the basic function of the condenser?

_____
_____
_____

2. Explain the role of the condenser as deaerator.

_____
_____
_____

3. How is the regenerative effect accomplished in a related condenser?

_____
_____
_____

4.In what way is the steady steam velocity maintained through the tube bank?

_____
_____
_____

5. Explain the behavior of the cooling water in a two pass condenser.

_____
_____
_____

Technical Exercises

Exercise 2:

Match the words from list A with their synonyms in list B:

List A	List B
1. condenser	a. speed, proportion
2. combustion	b. erosion
3. exhaust	c. to fall in very small drops
4. evaporation	d. to protect something so that electricity, heat or sound cannot get in or out
5. expand	e. lessen, lower
6. rate	f. heat exchanger
7. drip	g. steam produced when engine is working
8. insulate	h. the change of a liquid into steam
9. reduce	i. become larger in size
10. corrosion	j. process of burning

Exercise 3:

1) Explain and 2) make sentences with the following technical words derived from the text:

1.function:

2.distill:

3.condense:

4.pressure:

5.deaerate:

6.volume:

7.efficiency:

8.tubes:

9.sea water inlet:

10.water box:

Now read the following pages 7-11 about repair work on the heat exchange system (condenser) of the HAVFROST ship and do the exercises on page 12:

Vessel: **Havfrost**

Item: Dirty Drains Condenser tubestack renewal.

Date:	1 March, 2002	*Owner's job no.:*	755-001
Owner:	Bergesen d.y. ASA	*Yard's job no.:*	
Reported by:	J.McFarland	*Owner's acc. no.:*	4510-755-001
Contact person:	2Engr	*Parts order no.:*	
Location of job:	ER bottom plates port side	*Drawing no.:*	
Access:	Good	*Sketch enclosed:*	Yes
Scaffolding/staging:	No	*Testing:*	Yes
Ventilation:	No	*Class survey:*	
Local cleaning:	No		
Hot work cleaning:	No		
Gas freeing:	No		
Local lighting:	No		

Job progress :	☐ *Started*	☐ *Finished*	☐ *Cancelled*	
Job completed by :	☐ *Yard*	☐ *Service engineer*	☐ *Travelling fitters*	☐ *Crew*
Test approved by :	☐ *Superintendent*	☐ *Chief officer*	☐ *Chief engineer*	☐ *Class*

Parts required: (Y) = YARD supply (O) = Owner supply

User Note: Use ENTER to make a new line.

(O) Tubestack , seals & joints.

Job description:

Removal of condenser for inspection, renewal of tubestack and testing prior to refitting.

Allow:- Removal of 70kg condenser 1220mm,x 130mm,Ø retained by 4x150 flanges two with 4xM15 bolts and two with 8xM15 bolts including two foot brackets each with 2xM15 bolts.

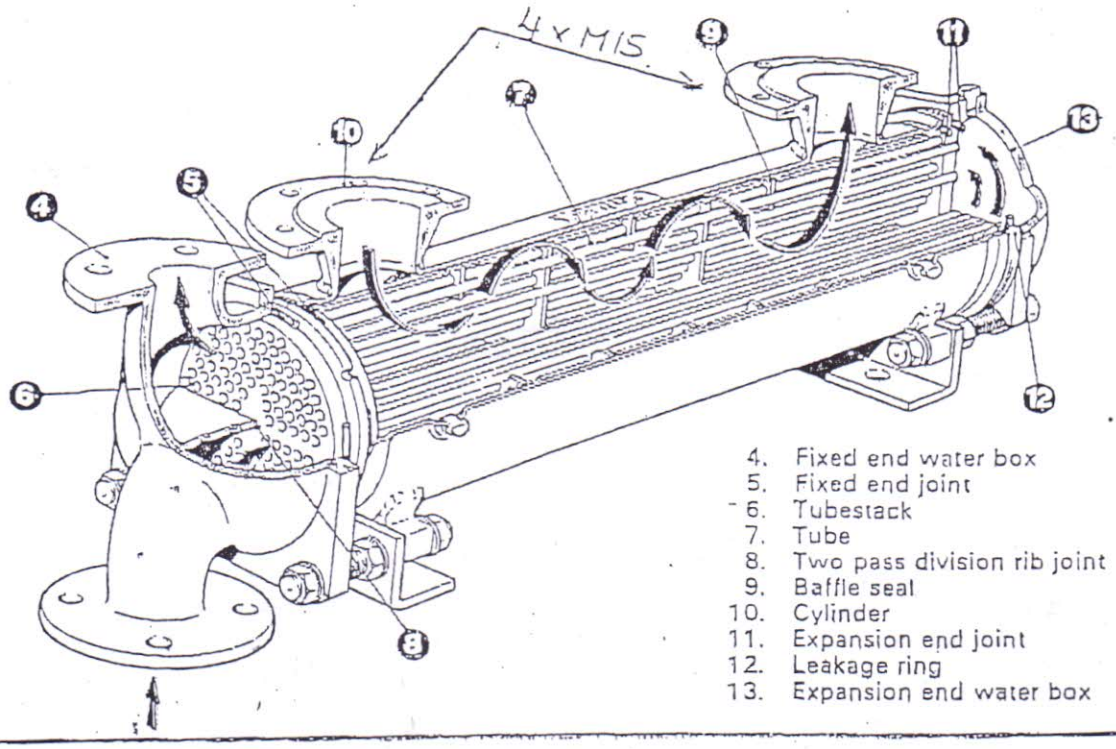
Stripdown of condenser and removal of old tubestack.
Cleaning and inspection of casing and covers.
Fitting of new tubestack and rebuild and reinstalling of condenser.
Transport to yard workshop

Prior to reinstalling casing to be pressure tested to 10 bar with tube stack fitted. Tube stack to be pressure tested to 7 bar. All joints and seals to be renewed.

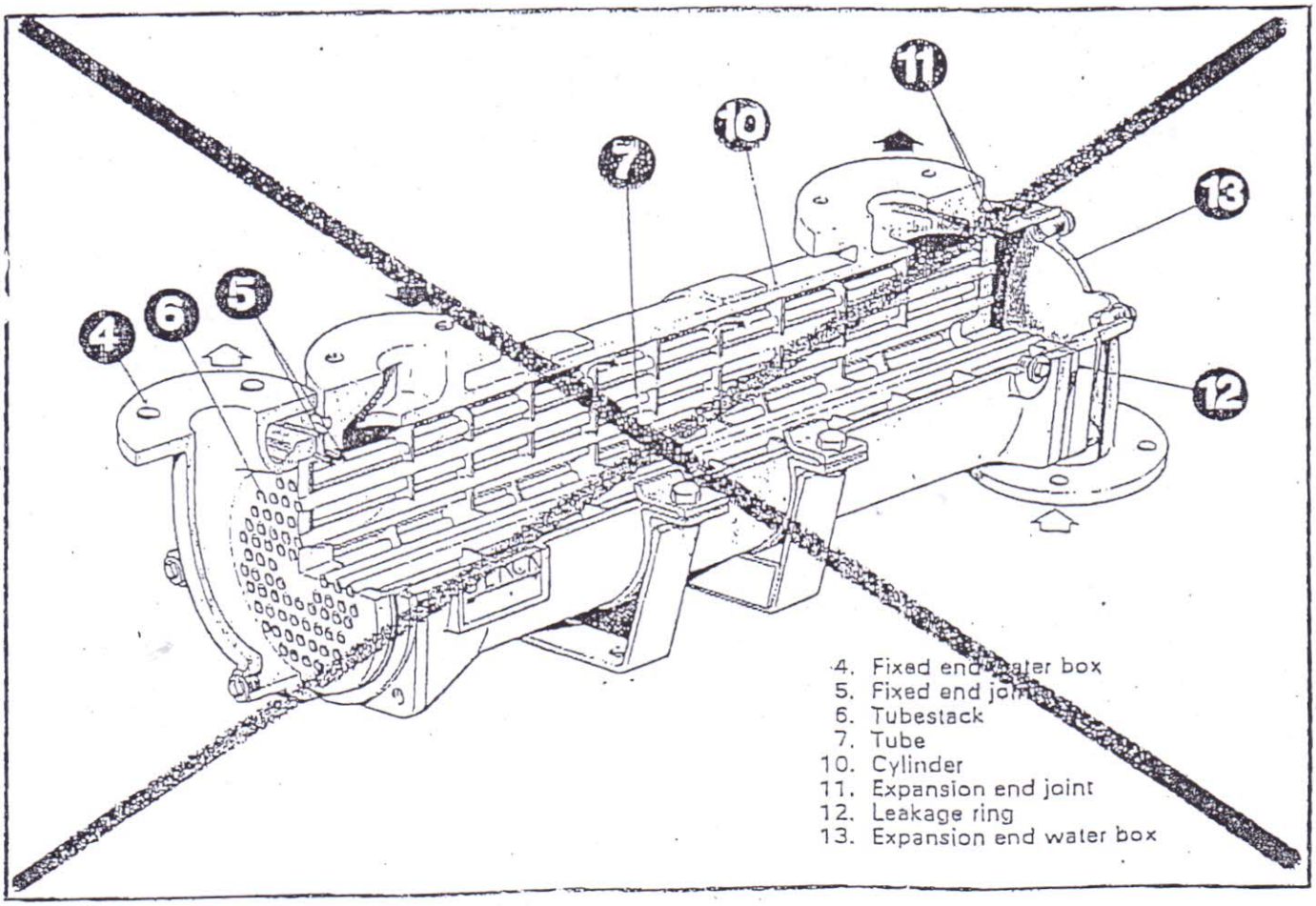
Manufacturer:- Serck Heat Transfer
Serial No:- 221916-01

171 | 755.001

JOB 755-001



4. Fixed end water box
5. Fixed end joint
6. Tubestack
7. Tube
8. Two pass division rib joint
9. Baffle seal
10. Cylinder
11. Expansion end joint
12. Leakage ring
13. Expansion end water box



4. Fixed end water box
5. Fixed end joint
6. Tubestack
7. Tube
10. Cylinder
11. Expansion end joint
12. Leakage ring
13. Expansion end water box

Vessel: **Havfrost**

Item: Main Dump Condenser Inspection

Date:	2 March, 2002	*Owner's job no.:*	755-002 / 172
Owner:	Bergesen d.y. ASA	*Yard's job no.:*	
Reported by:	J.McFarland	*Owner's acc. no.:*	4510-755-002

Contact person:	2Engr	*Parts order no.:*	
Location of job:	ER bottom plates port side.	*Drawing no.:*	2-1661 & 3-2143
Access:	Good	*Sketch enclosed:*	
Scaffolding/staging:	No	*Testing:*	Yes
Ventilation:	No	*Class survey:*	
Local cleaning:	No	:	
Hot work cleaning:	No	:	
Gas freeing:	No	:	
Local lighting:	No	:	

Job progress :	☐ *Started*	☐ *Finished*	☐ *Cancelled*	
Job completed by :	☐ *Yard*	☐ *Service engineer*	☐ *Travelling fitters*	☐ *Crew*
Test approved by :	☐ *Superintendent*	☐ *Chief officer*	☐ *Chief engineer*	☐ *Class*

Parts required: (Y) = YARD supply (O) = Owner supply

User Note: Use ENTER to make a new line.

(O) Joints , Seals, Anodes

Job description:

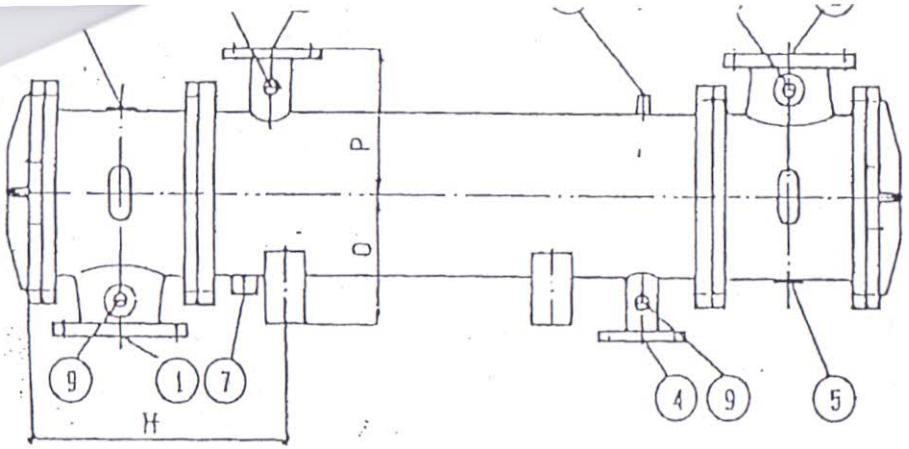
Removal of condenser for inspection, cleaning and testing.

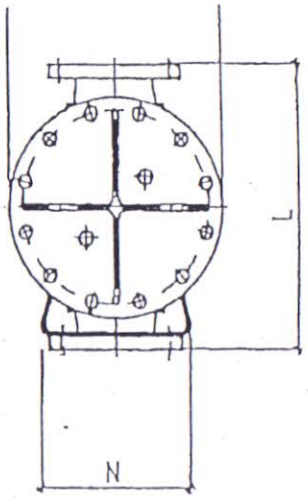
Allow:- Removal of 500kg condenser 3412mm,x 400mm,Ø (2) flanges 8xM16 bolts,
(2) flanges 4x M16 bolts, 4xM24 bolts in foot brackets and 1x3/4 BSP connector.

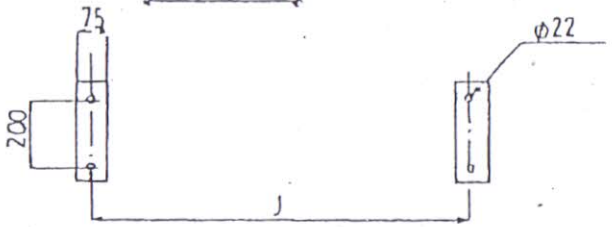
Stripdown of condenser and removal of tubestack.
Cleaning and inspection of casing and covers.
Chemical cleaning of tubestack and brushing of tubes.
Thorough cleaning of chemical detergents and refitting of tube stack.
Renewal of old anodes.
Rebuild and refitting of condenser.
Craneage and transport to yard workshop.

Prior to reinstalling casing to be pressure tested to 10 bar with tubestack fitted. Tubestack to be tested to 7 bar. All seals and joints to be renewed.

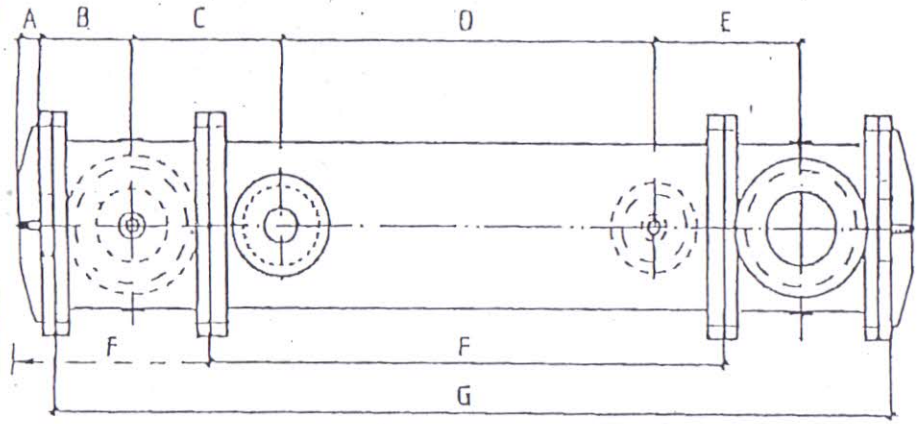
Manufacturer:- Aalborg Engineering
Type:- EV 298 Steam







F = FREE SPACE FOR REMOVAL OF TUBE BUNDLE



DIMENTION : EV298/700-2800 - STEAM

TYPE: \ DIM.	A	B	C	D	E	F	G	H	J	K	L	N	O	P	KG KILOS
EV298/700	40	169	285	400	285	700	1312	430	270	405	520	280	235	265	245
EV298/1000	"	"	"	700	"	1000	1612	480	500	"	"	"	"	"	280
EV298/1200	"	"	"	900	"	1200	1812	530	650	"	"	"	"	"	305
EV298/1500	"	"	"	1200	"	1500	2112	605	870	"	"	"	"	"	345
EV298/1800	"	"	"	1500	"	1800	2412	630	1150	"	"	"	"	"	380
EV298/2200	"	"	"	1900	"	2200	2812	730	1350	"	"	"	"	"	430
EV298/2500	"	"	"	2200	"	2500	3112	805	1500	"	"	"	"	"	465
EV298/2800	"	"	"	2500	"	2800	3412	855	1700	"	"	"	"	"	500

ASSEMBLY DRG: 2-1661

QTY	DESCRIPTION	REMARKS	POS	DRAW./STANDARD	MATERIAL
4	THERMOMETER CONN.	BSP 1/2"	9		
1	VENT SHELL SIDE	BSP 1/2"	8		
1	DRAIN SHELL SIDE	BSP 1"	7		
1	VENT. TUBE SIDE	BSP 1/2"	6		
1	DRAIN TUBE SIDE	BSP 1/2"	5		
1	SHELL SIDE OUTLET. DN50PN16 FOR EV298/700-1500		4	DN65PN16 FOR EV298/1800-2800	
1	SHELL SIDE INLET DN65PN16 FOR EV298/700-1500		3	DN80PN16 FOR EV298/1800 -2800	
1	TUBE SIDE OUTLET	DN125PN16	2		
1	TUBE SIDE INLET	DN125PN16	1		

SCALE: %

REV. NO. / DATE

DRAW. 24/6/86 LT.

TRAC.

CHECK 24/6/86 [illegible]

APPR. 17/7/86 [illegible]

SHELL AND TUBE HEAT EXCHANGER

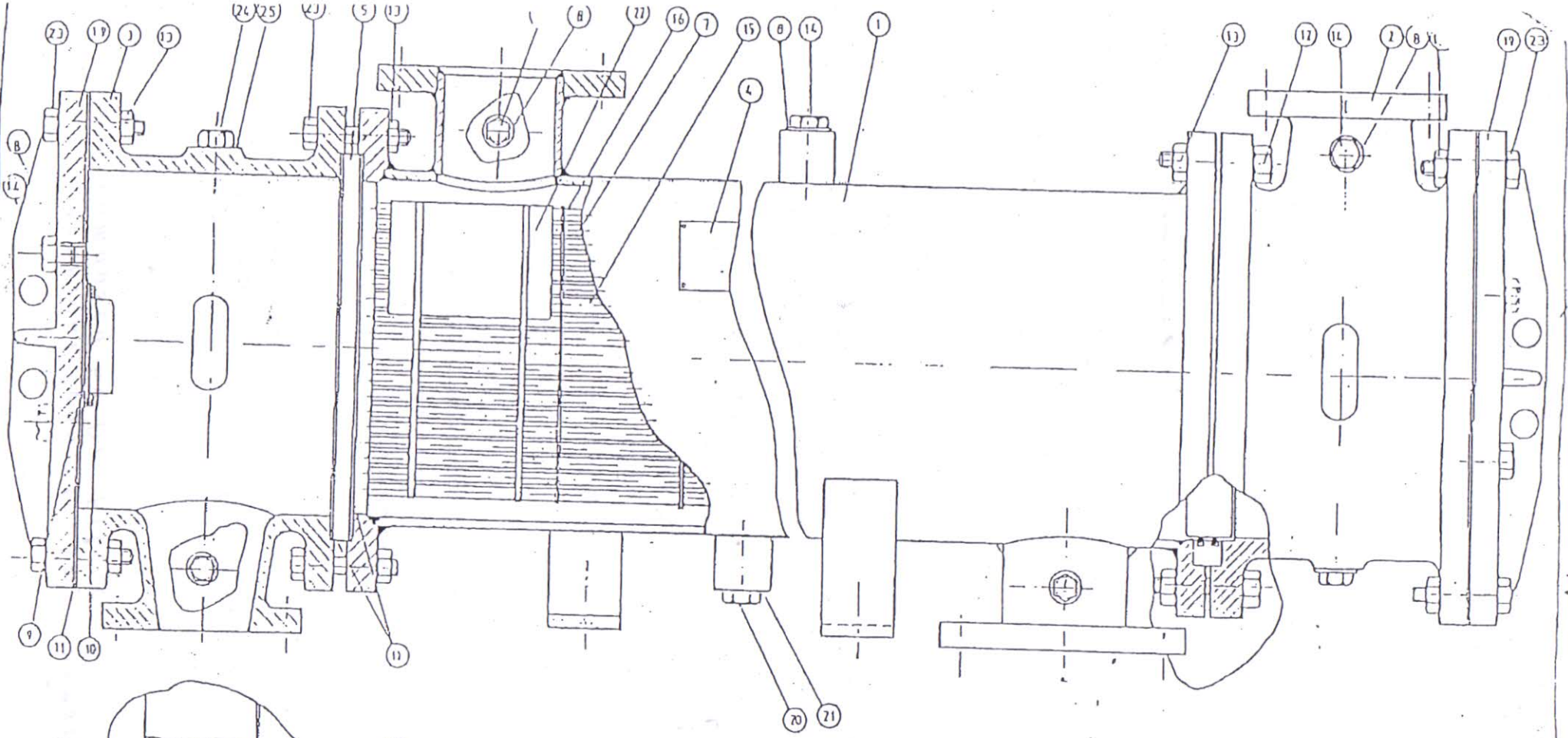
TYPE : EV298 - STEAM

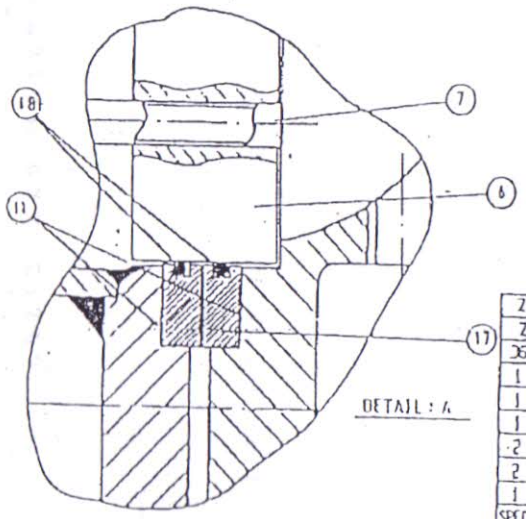
EAR. DRAW. | NEW DRAW.

3-2143

JOB 755-002

JOB 755.002 - 1





12	BOLT	4640	M24 × 100	12					8.8 DIN931
6	GASKET	4565		11	ORG.3-2165				
1	ANODE	4694	1 KILOS	10	ZINK				
1	SCREW	4610	M8 × 16	9					
11	COPPER WASHER	3929		8					DIN 7603
195	TUBE		Ø 12,7 x 1	7					
1	TUBE SHEET	5160		6	ORG. 7-1614				ACC. TO SPEC.
1	TUBE SHEET	5156		5	ORG. 7-1614				ACC. TO SPEC.
1	NAMEPLATE			4					
1	WATER BOX	1594		3	ORG. 2 1128				
1	WATER BOX	1594		2	ORG 2 1128				
1	SHELL			1	ORG. 2-1599				
QTY.	DESCRIPTION		REMARKS	POS.	ORS./STD./REF./NOTE(S)				

2	COPPER WASHER	3930		25					
2	PLUG	4297	3/4" BSP	24	ORG. 4-1572				CuZn39Pb3 DIN17660
36	BOLT	4639	M24 × 90	23					8.8 DIN931
1	IMPINGEMENT SHEET (B+L)		2mm sheet	22					CuZn37 DIN17660
1	COPPER WASHER	3937		21					
1	PLUG	4298	1/1" BSP	20					CuZn39Pb3 DIN17660
2	BLIND FLANGE	1685		19	ORG. J-1083				
2	O-RING	3986		18					ACC. TO SPEC.
1	STUFFING RING	5075		17	ORG. 4-1609				
SPEC	BAFFLE	5055		16	ORG. 4-1645				ACC. TO SPEC.
SPEC	DISTANCE PIECE		Ø 16 x 1,5	15					ACC. TO SPEC.
11	PLUG	4296	1/1" BSP	14	ORG. 4-1641				CuZn39Pb3 DIN
48	NUT	4744	M24	13					8.8 DIN

SCALE: % REV. no. date

DRAW. TRAC. CHECK APPR.

ASSEMBLY DRAWING

EV 298 STEAM

EXP. DRAW. NEW DRAW.

2-1661

2 - 200,55 / 2741

Exercises

Exercise 5:
Answer the following comprehension questions based on the previous texts and diagrams (pages 7-11):

1. (on page 7): Why is the condenser of HAVFROST ship removed?
_____
_____

2. (on pages 7-8): Where are the tubes of the condenser fitted?
_____
_____

3. (on page 8): What is the role of the two pass division rib joint?
_____
_____
_____

4. (on page 7): What takes place before tubestack removal? Why?
_____
_____

5. (on page 8): Which side of the condenser is the water box fitted on?
_____
_____
_____

6. (on page 9): How is the cleaning of the tubestack accomplished?
_____
_____
_____

Exercise 6:
Translate the following words from pages 7-11 into Greek:

1. tubestack (page 7: _____

2. foot brackets (page 7): _____

3. stripdown (page 7): _____

4. casing (page 7): _____

5. fitting (page 7): _____

6. installing (page 7): _____

7. leakage ring (page 8): _____

8. water box (page 8): _____

9. expansion end joint (page 8): _____

10. flanges (page 9): _____

11. bolts (page 9): _____

12. chemical detergents (page 9): _____

13. anodes (page 9): _____

14. yard workshop (page 9): _____

15. vent shell side(page 10): _____

16. drain tube side (page 10): _____

17. shell side outlet (page 10): _____

18. tube side inlet (page 10): _____

19. shell and tube heat exchanger (page 10): _____

20. copper washer (page 11): _____

21. stuffing ring (page 11): _____

22. gasket (page 11): _____

A. Understanding a printed text (1)

This text will describe the **cylinder head** in a diesel engine, and will give instructions on how to remove it.

Read the passage through and find the answers to these questions. Remember, you do not have to understand every word to answer the questions.

1. What is a cylinder head made of?
2. What is its function?
3. What are the parts of a cylinder head called?
4. What part of the engine can you see when the cylinder head is removed?

The Cylinder Head

The cylinder head is cast as one ____. It is the upper sealing surface of the combustion chamber. It may serve one, two, three, four or six cylinders. The valve guides, which guide the valve stem during the opening and closing of the valve, are pressed into the cylinder head. All cylinder heads are made of a special iron alloy casting ____ carbon, silicon, and copper. This alloy mixture ____ elasticity and good thermal conductivity, and has a low thermal expansion rate. The size of the cylinder head is not ____ by the number of cylinders but rather by such factors as the overall cost of the engine, the cylinder block design, the number of main bearings, the expected thermal stress, and the anticipated cooling and sealing difficulties (of the cylinder head).

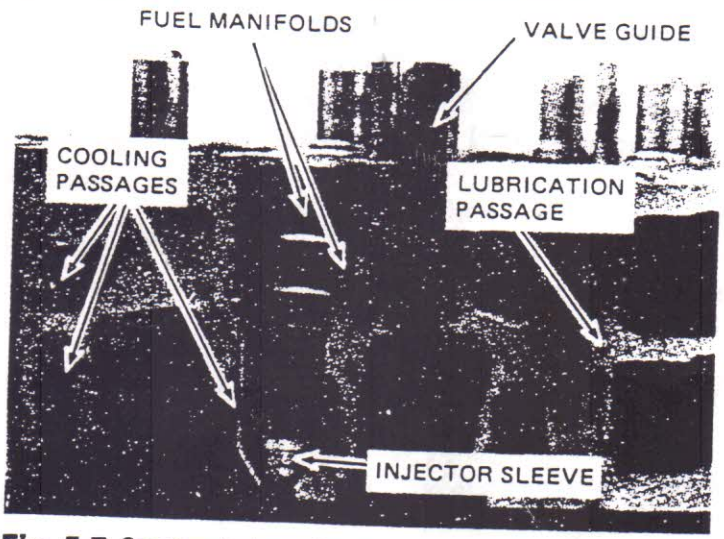


Fig. 5-7 Sectional view of a cylinder head.

Whether an individual cylinder head is ____ for each cylinder (Fig. 5–7) or whether the cylinder head covers two, three, four or six cylinders, it must nevertheless have adequate strength and stiffness. It must ____ as a sealing surface between the cylinder sleeve, cylinder-block top deck, and oil and cooling passages, without distorting the sleeve or valves. The cylinder head must be sufficiently strong so that it does not ____ between the cylinder-head bolts (studs), between the intake and exhaust valve, or between the valves and injector (sleeve or bore).

The internal cooling passages must be located to ensure that the coolant flow has a high velocity at and around the valves and injector tubes. It must remove heat (steam bubbles) and prevent the accumulation of deposit or scale. The passages should have no dead ends. The external openings must _____ turbulence and permit unrestricted circulation from the cylinder block to the cylinder head and from the cylinder head to the radiator.

The valves must be located so that the fuel spray can _____ the total combustion area, but they must be far enough apart so that the coolant can circulate freely between them, thereby preventing the cylinder head from cracking between the valve seats.

Removal of Cylinder Head

Care should be taken when removing the cylinder-head bolts or nuts.

Caution Never remove the cylinder head when it is hot because it will become distorted (warped).

If the cylinder head is very heavy, use a hoist to____ it from the cylinder block. If it is small, screw the lift handles into the cylinder head to lift it from the block. If a cylinder head is excessively tight, do not drive a chisel or screwdriver between the cylinder block and head to remove it, as this will _____ both surfaces. Lightly tap the cylinder head with a bronze or lead hammer or use a block of wood to break it loose.

Carefully inspect the combustion chamber once it is exposed. Close scrutiny can often reveal the cause of high oil consumption, overfueling, water leakage, or overheating. Damage to pistons, cylinder sleeves, and cylinder block can also be seen.

Caution When removing the cylinder head, take ____not to damage it or the cylinder block surface or threads. If studs are used, take care not to bend them. After removal, place the cylinder head in a holding fixture, or if it happens to be square, you may place it on a workbench.

E.J. Schulz, *Diesel Mechanics* (second edition), pp 23–4. McGraw-Hill, 1983.

B. Check your understanding

Now study the text carefully. As you do, look for the answers to these questions:

1. The alloy used to make the cylinder head should have the following properties (tick all those which will complete the above sentence):

- strength ☐
- flexibility ☐
- ductility ☐
- brittleness ☐
- elasticity ☐
- good electrical conductivity ☐
- good thermal conductivity ☐
- stiffness ☐
- low thermal expansion rate ☐
- high thermal expansion rate ☐

size of the cylinder head depends on (tick all the statements which are correct):

(a) the number of main bearings ☐
(b) the number of cylinders ☐
(c) the design of the cylinder block ☐
(d) the amount of thermal stress it must withstand ☐
(e) the cost of the engine ☐
(f) the cost of raw materials ☐

3. Tick all the statements below which refer to things that *must be done* or *must happen*:

(a) The coolant must flow quickly around the valves and injector tubes. ☐
(b) The fuel spray must reach the total combustion area. ☐
(c) The cooling passages must have dead ends. ☐
(d) Turbulence must be prevented. ☐
(e) The valves must be located as close together as possible. ☐
(f) The accumulation of scale must be prevented. ☐
(g) The cylinder head must be removed when it is hot. ☐
(h) A screwdriver must be used to loosen the cylinder head when removing it. ☐

4. What problems of a general kind might be discovered by removing the cylinder head and inspecting the combustion chamber?
Make a list (seven are mentioned in the text).

C. Increase your vocabulary

1. Notice the use of these words in the text:

• adequate/inadequate • sufficient • excessive

Read the following sentences and notice how they can be expressed in another way:

We had sufficient supplies to last three days.
= We had *enough* supplies to last three days.
The instructions they gave were inadequate.
= The instructions they gave were *not good enough*.
The costs were excessive (or: excessively high).
= The costs were *too high*.

Now re-write these sentences in the same way:

- The accumulation of deposit was excessive.
- The strength of the material was inadequate to withstand stress.
- The cylinder block cracked because it was not sufficiently strong.
- The mechanic used excessive force to remove the block.
- The inspection was not carried out with sufficient care.
- There is an inadequate amount of detail in the text.

2. Now look in the text to see how these words were used.

• provide • prevent • permit • ensure

When you have studied the use, decide which one can be used in each of these sentences:

- Lubricants are used to _____ friction.
- The coolant system must _____ the coolant to expand.
- An outlet is _____ so that excess coolant can escape.
- Piston rings must fit correctly to _____ proper sealing and oil control.