New Sulzer Diesel

**Diesel After-Sales Service**

# Service Bulletin

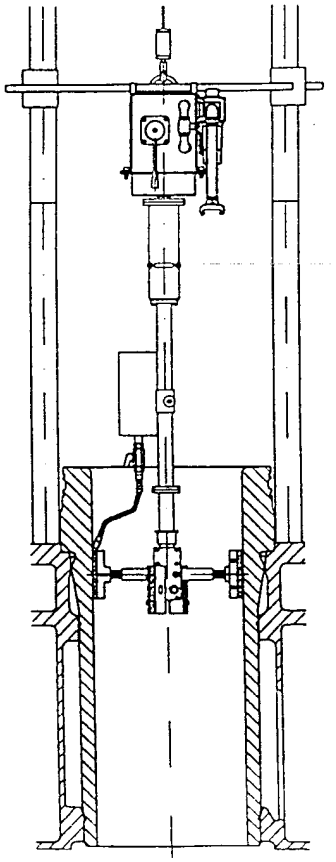
# ZAS-1.2

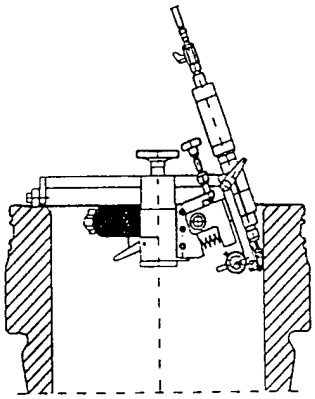
Technical Information to all the Owners of Sulzer ZA 40S Type Diesel Engines

02-02-96

(Supersedes Bulletin ZAS-1. 1 dated 20.10.93)

# Cylinder Liner Overhaul





Contents:

## INTRODUCTION

This bulletin informs you about the latest type of cylinder liner insulation to achieve optimum running conditions and also about the removal of the wear ridge on the cylinder liner running surface. which should be carried out during the overhaul of an individual unit.

## 1 REMOVAL OF WEAR RIDGE ON CYLINDER LINERS

With reference to the Maintenance Manual (section 2105) we would like to give you further information about the importance of removing the wear ridge on the cylinder liner running surface at the Top Dead Centre of the top piston ring, before the piston is withdrawn.

When fitting a new piston ring set to pistons which will have to run together with already used cylinder liners or when complete pistons have to be installed in liners already in use etc., it is necessary to remove such wear rift with an appropriate tool

The respective instructions on how to remove the wear ridge are given on the upper part of enclosure ZAS-1.2 / 1.

By this measure the following targets will be achieved:

- Prevention of any damage of the cylinder liner running surface due to using handgrinders.
- No knocking of a newly fitted top piston ring against the wear ridge.
- No twisting of a newly fitted top piston ring by the wear ridge with increased blow-by.
- The running-in of new top piston rings in used cylinder liners is ensured without running into problems.

Reason for not having the groove machined in new liners from the beginning:

- Tolerances of individual components.
- Difference in compression ratio for different engine ratings = variation in TDC height of top piston ring and, therefore, wear ridge position.

### 1.1. Remachining of the Wear Ridge

In the region of TDC of the piston ring, a ridge will become evident in the course of time due to liner wear.

During the time of a piston overhaul, removal of the wear ridge must be carried out b e f o r e the piston is withdrawn (also during inspections of individual pistons). The wear ridge has to be removed with the aid of a special milling tool as shown on the sketch on the lower part of enclosure ZAS-1.2 / 1. On enclosures ZAS-1.2 /2 and ZAS-1.2 /3 you will find the milling instructions of the improved Chris- Marine wear ridge milling machine type VKS 40 with new dial gauge device to adjust to the correct position height.

**Please note:**

If milling work is carried out with the liner remaining installed in the engine, the utmost care must be taken to protect the crankshaft and piston, i.e. to **prevent milling dust from entering into lubricating bores.**

After finishing such jobs the utmost care must be taken that all milling residues are removed from the crankcase!

In the event that there is no milling tool available on board or on site, such a special milling tool (Code No. 9421.09) can be ordered through the New Sulzer Diesel After Sales Service or their Representatives.

## 2. DEGLAZING OR RE HONING OF CYLINDER L INERS

Basically the running surface of a cylinder liner does not require de-glazing or **honing at the** time of a piston overhaul, as the new piston rings are provided with a profile for running-in. However for all practical purposes, we would normally allow **for a few deglazing strokes at** that time (single scratches caused by foreign particles can be tolerated).

Very light scoring stripes, if any, can be removed by honing. However, a cylinder liner with pronounced scoring or especially scuffing stripes, with martensite formation (white layer) should not be re-honed and re-used as there is a chance of breaking-out of brittle particles later on in service.

When re-honing, the limiting diameters at point A and B-D are to be considered for re-use (see Maintenance Manual group 0352, sheet 2A).

**Required surface roughness after honing:** $= 0.8 - 2.0$ µm or $32 - 80$ µinch
eferably, the lower figures should be
nieved.

**Grain size of honing blocks:** 60

For the above purpose, a new Chris-Marine Deglazing and Honing Machine Type DS is now available with flexible head and shorter stones (125mm length only).

Please refer to enclosure ZAS-1.2 /4

## 3. TYPES OF CYLINDER LINERS AND O-RINGS

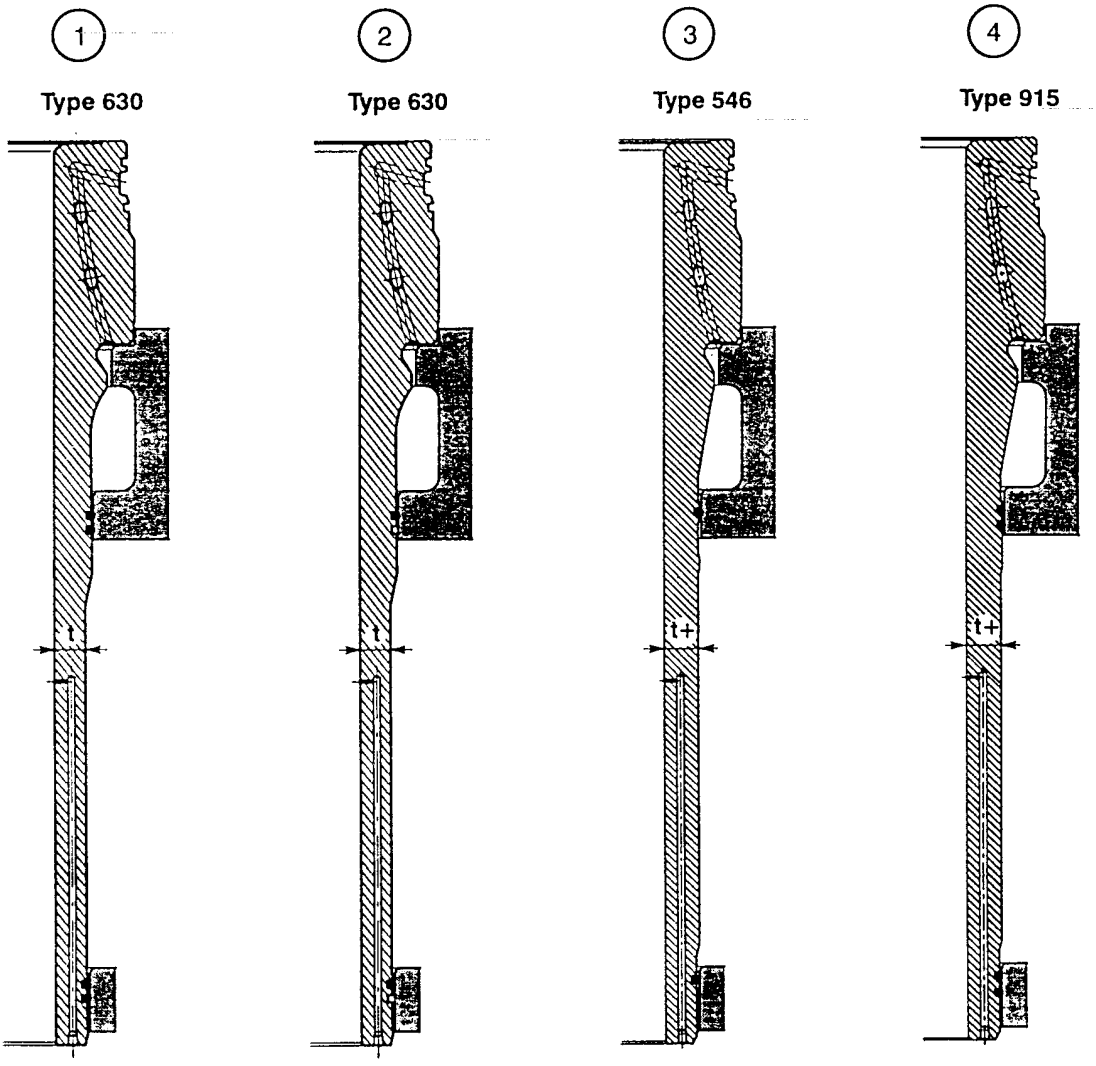
With our Service Bulletins ZAS- 1.1 and ZAS- 10, we informed you about the introduction of a new type of cylinder liner with only one O-ring groove (sketch 3 overleaf) at the middle and the lower sealing surfaces.

In the same Service Bulletins, it was also mentioned that the previous type of cylinder liners with double O-ring grooves can be refitted with only one O-ring each in the upper grooves of the middle and lower part, **provided that the sealing faces for the O-ring in the groove and in the bore of the engine block are in a satisfactory state.**

If any of the above sealing faces is found in an unsatisfactory or doubtful condition, for example as a result of insufficient cooling water treatment and/or too low water pressure, two O-rings should again be fitted in the middle and lower part, as before, to avoid possible water leakages. Therefore the latest version of cylinder liner (sketch 4) has, in addition to the advantages of the previous type (sketch 3), again two O-ring grooves in the middle and lower part.

**Please note:**
Make sure that the O-rings are made from **"VITON"** according to New Sulzer Diesel quality as well as material standards and specifications.

**Practical hint:**
Grease new O-rings with, for example, Molycote 111 or equivalent prior to fitting. This will reduce the possibility of an O-ring twisting during cylinder liner fitting.

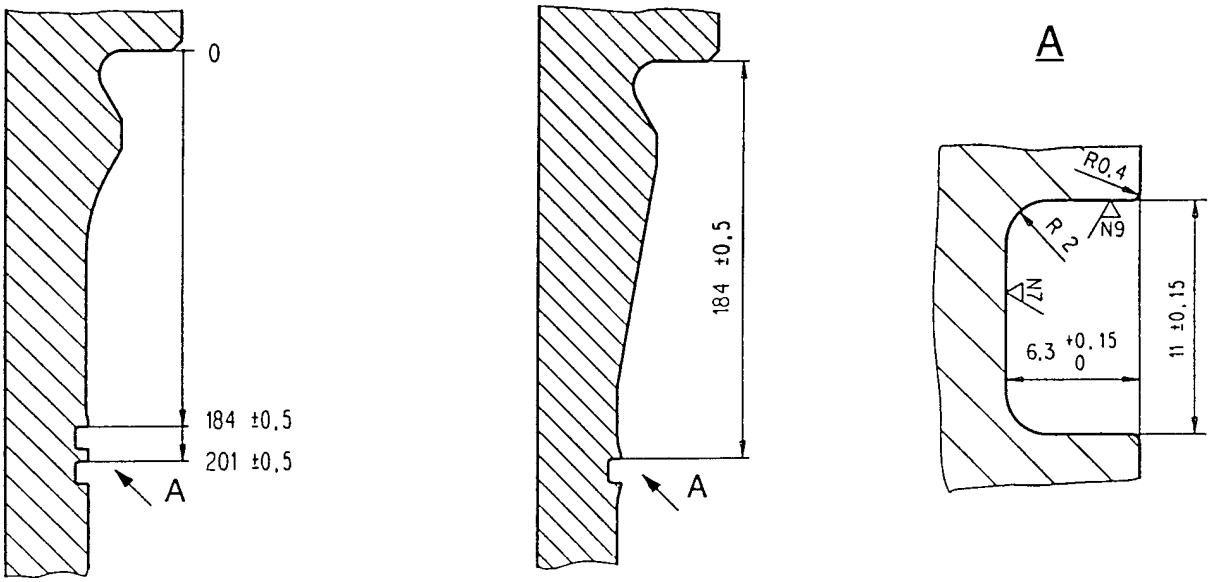



1) Original cylinder liner design with *double O-ring* arrangement
2) Original cylinder liner design with only the u p p e r O-rings fitted
3) Present cylinder liner design with *single O-ring* arrangement and increased wall thickness "t +"
4) Present alternative cylinder liner design with *double O-ring* arrangement and increased wall thickness "t+" (mainly introduced for spares for original type)

### 3.1 Reconditioning

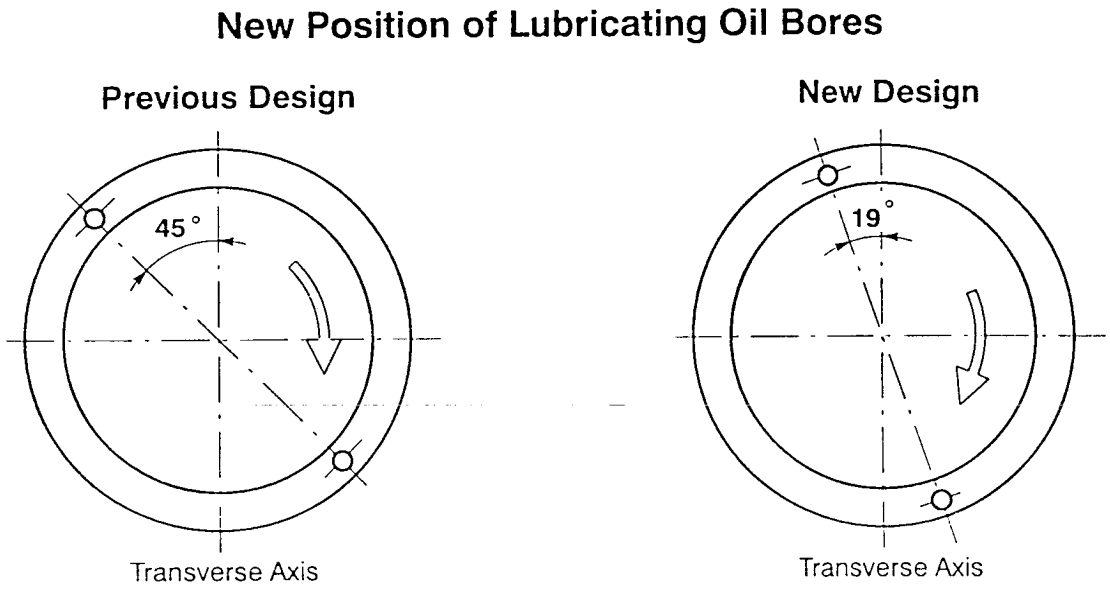
Furthermore, should the O-ring grooves of the middle part of a cylinder liner type 630 require reconditioning, re-machining can be carried out to oversized grooves applying oversized O- rings as per sketch below.

**O-ring size to be used with oversized grooves: ∅ 435 x 8 or ∅ 444 x 8.**




### 4. CYLINDER LINER LUBRICATION

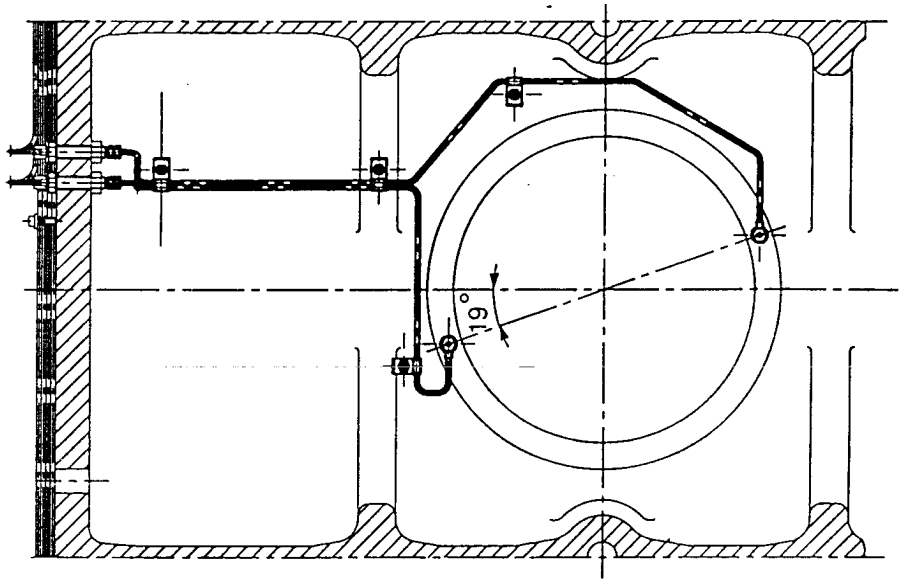
Cylinder liners manufactured now for ZA 40S engines have a new positioning for the cylinder lubricating points, i.e. at 19° instead of the previous 45°



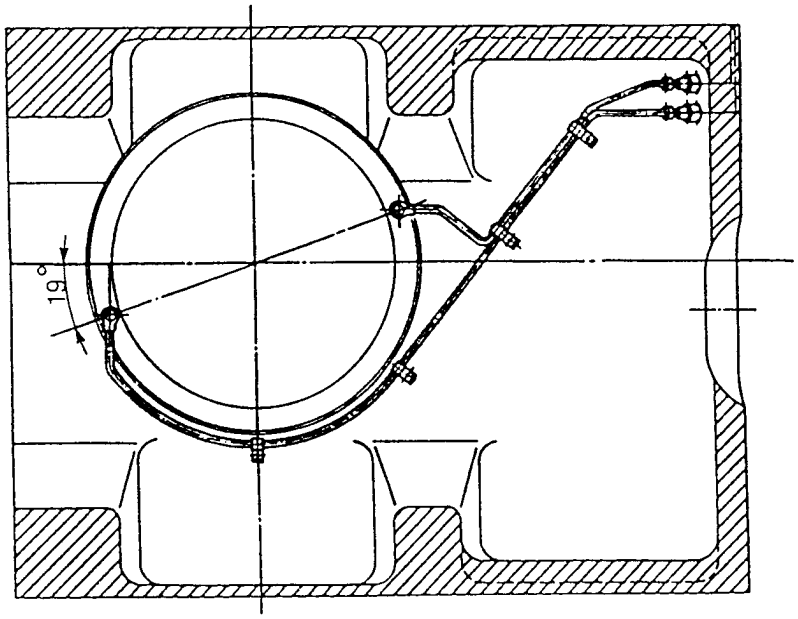

Spares supply of original cylinder liners will in future also be the v ersion with the lubricating points 19° offset from the transverse axis and will be supplied together with two modified lubricating oil pipes (different for In-line and V-version).

For your information please refer to the sketches overleaf.

**Cylinder Lubricating Oil Pipes as supplied with New Cylinder Liner Type 546 or 915 (suitable for In-Line Version ZA40S Engines)**




**Cylinder Lubricating Oil Pipes as supplied with New Cylinder Liner Type 546 or 915 (suitable for V-Version ZA40S Engines)**



## 5. CYLINDER LINER INSULATION

### 5.1. Length of Insulating Tubes

To achieve optimum running conditions we have introduced lengthened insulating tubes (from 110mm to 160mm es shown on enclosure ZAS-1.2/5) in the cylinder linercooling bores of original type 630 some time ago.

We recommend fitting these longer insulating tubes to the cooling bores wherever a cylinder liner has to be removed (but is still good for further use) or for any replacement.
However, it has to be verified whether new cylinder liners are already equipped with long ( 1 60mm) insulating tubes by inserting a wire from the bottom and checking if the length from the bottom of the lower spring dowel pin to the top of the upper spring dowel pin is 200mm (only 150mm with insulating tubes of 110mm).

On the other hand, we strongly recommend fitting these longer tubes as soon as ovalisation of the cylinder liner at measuring point A or above (see Maintenance Manual, section 2105) can be noted.

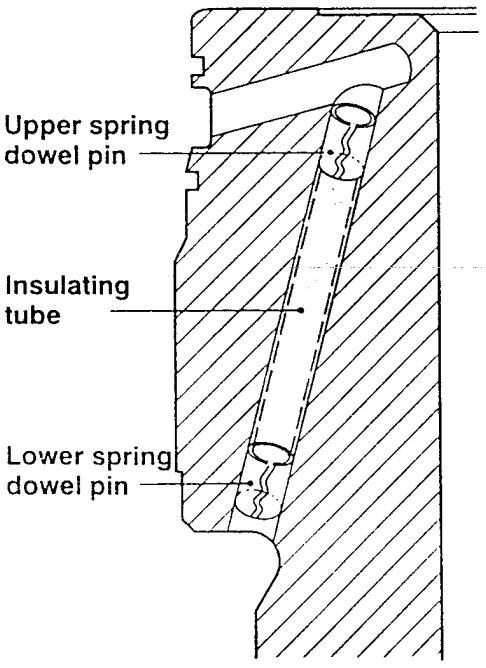
### 5.2. Checking of Condition of Insulating Tubes

We also recommend to check the condition of the insulating tubes at every cylinder liner withdrawal.

Should any blistering on the inside wall of the insulating tubes be observed, the insulating tubes should be replaced in order to avoid any obstruction to the cylinder cooling water flow.

Since the lower spring dowel pin has to be removed before the tube can be extracted we recommend to replace the upper and lower spring dowel pins at the same time.

### .3. Replacing the Insulating Tubes




To replace the insulating tubes the cylinder liners have to be withdrawn from the engine. Then proceed as follows:

The centre-pin inside the extraction tool is pulled back out of the pincer-type end of the tool.
The extraction tool is then inserted into the cooling bore through the lower spring dowel pin.
Once the outside edges of the tool's end have fully passed the lower spring dowel pin, the centre-pin is pushed forward. By means of the striker-piece the spring dowel pin is hammered out.

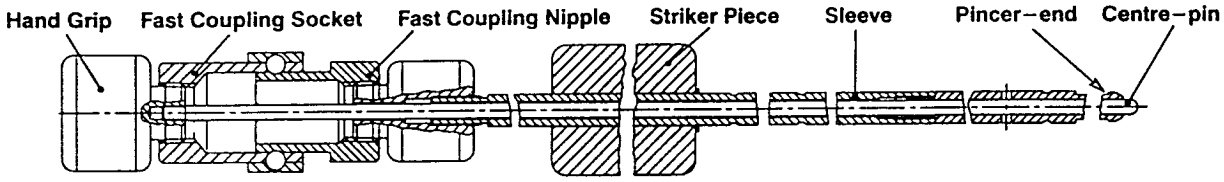
. The old insulation tube can best be removed with the aid of a screw tap to which a steel handle is welded on to the tap's shaft end. The tap should have a slightly larger diameter than the inside diameter of the tubes. The tube can be pulled out after the tap has been forced into the tube by a few turns.

. The new tubes are pushed into the cooling bores with the fitting tool until the tool's end is in contact with the upper end of the cooling bore.

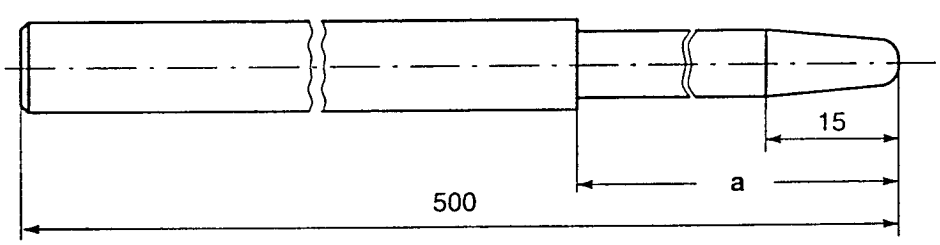
. The fitting tool is then used to insert the lower spring dowel pin. The pin has reached the correct position, if the end of the fitting tool has reached the upper end of the cooling bore.

For your information we would like to draw your attention to the sketch below, which show' YOU the special extraction tool (A) and the fitting tool (B) for the spring dowel

**A. Extraction Tool for Spring Dowel Pins**




**B. Fitting Tool for Spring Dowel Pins**



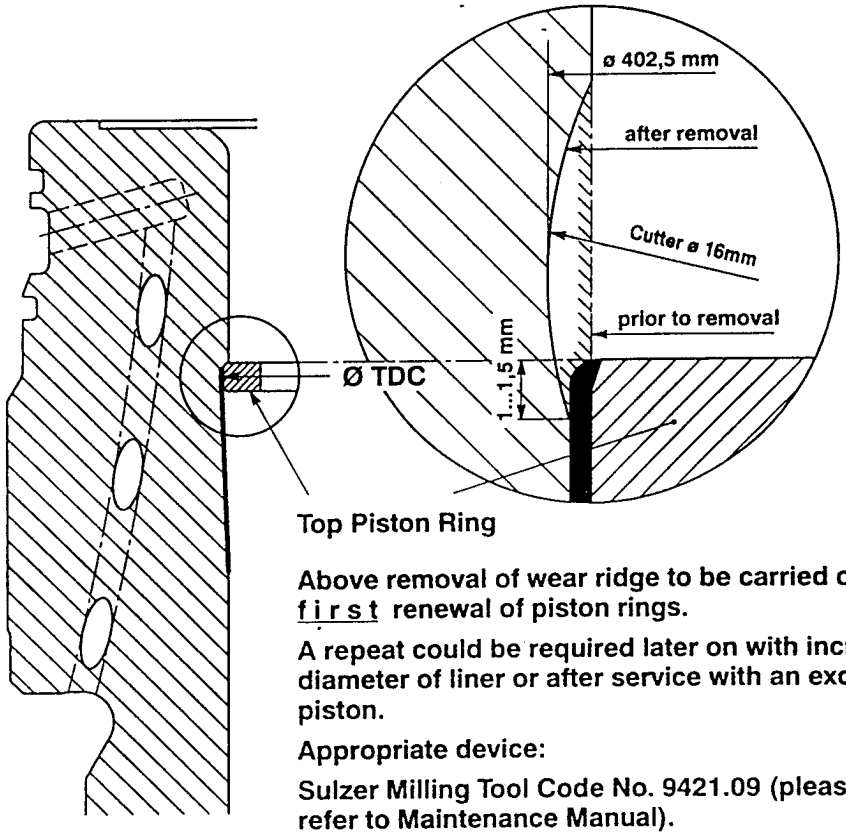

Length for fitting the upper spring dowel
a = 43 ±0,2 mm

Length for fitting the lower spring dowel
a = 223 ±0,2 mm

REMARK: It is of utmost importance to purchase spare parts from *reputable manufacturers applying current material, design and manufacturing technology.* Genuine spare parts for ZA 40S engines, the necessary insulating material as well as the special tools for removing and fitting of the insulating tubes are available from:

**New Sulzer Diesel France S.A., Mantes, Telephone: 01-34 78 88 00 / Telefax: 01-34 78 88 05 or New Sulzer Diesel After Sales Service, Winterthur and any of their Representatives.**

# REMOVAL OF CYLINDER LINER WEAR RIDGE



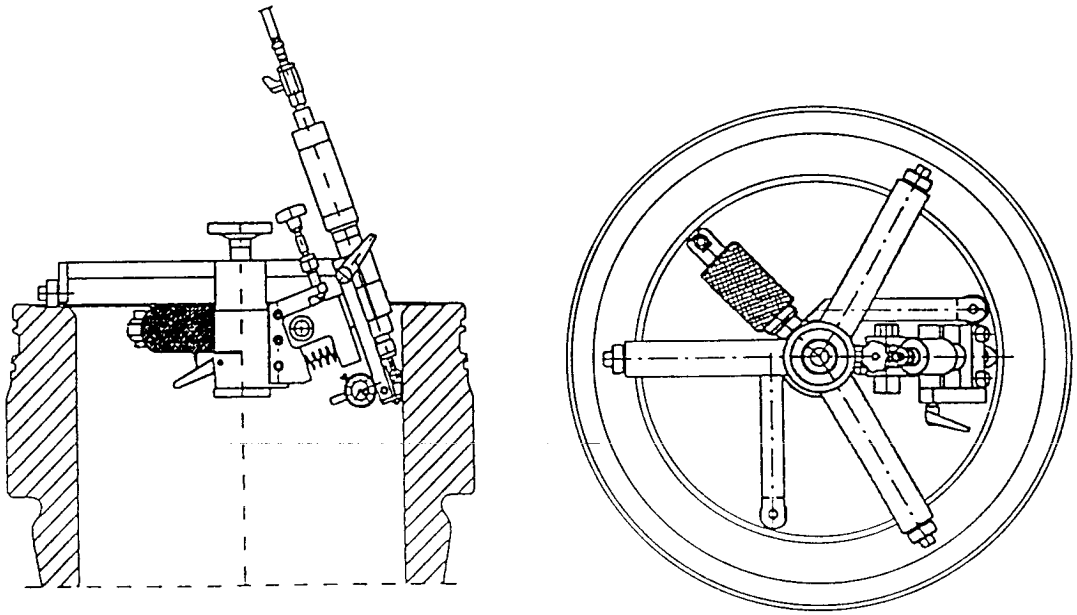

Above removal of wear ridge to be carried out at first renewal of piston rings.

A repeat could be required later on with increased diameter of liner or after service with an exchange piston.

Appropriate device:

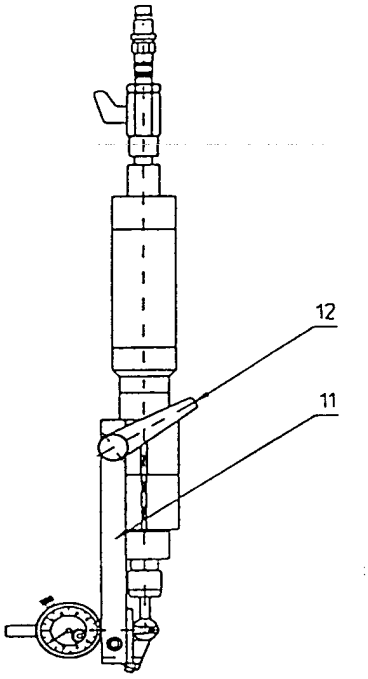
Sulzer Milling Tool Code No. 9421.09 (please refer to Maintenance Manual).

## MILLING TOOL (CODE NO. 9421.09):
## CHRIS-MARINE WEAR RIDGE MILLING MACHINE TYPE VKS 40



# CHRIS MARINE, WEAR RIDGE MILLING MACHINE

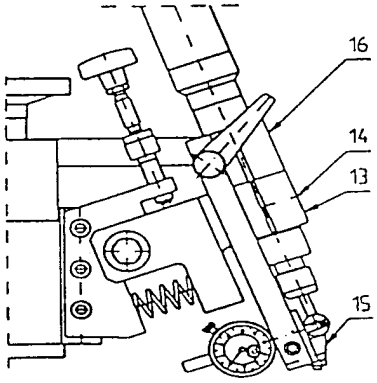
MILLING INSTRUCTIONS




Remove the arm and stopper unit (11) from the milling motor by unscrewing the handle (12).

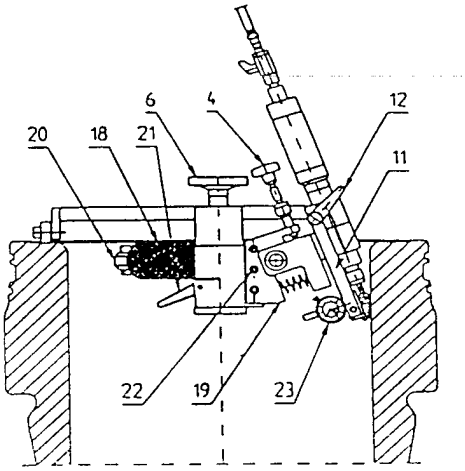
Insert the milling motor into the holder (13) and reassemble the stopper unit (11).

Before securing the milling motor with the screws (14), make sure that the stopper (15) touches the milling cutter both at the bottom and at the side. If adjustment is necessary, loosen the screws (16).




Turn the knurled cylinder (18) cockwise and the feeding screw (4) also clockwise, until the machine can be lowered into the cylinder without problems.

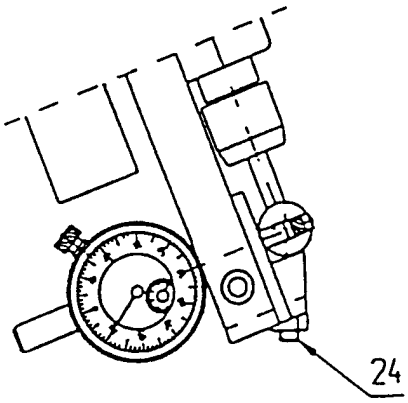
Turn the knurled cylinder (18) anticlockwise until the guiding wheel (20) is in contact with the liner wall. Turn the cylinder two more turns to make sure that the built in spring is activated.




Loosen the handle (21) and adjust the milling cutter height position with the wheel (6).

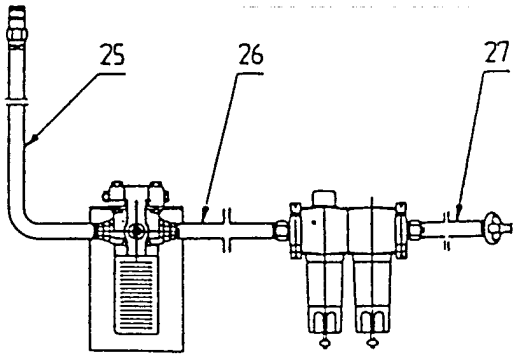
The height position is correct when the dial gauge (23) makes a sudden step, indicating that the wear ridge has been passed.

If the relation between the groove position and the dial gauge needs to be changed, use the stop screw (24) to raise the height position of the groove.




Before grinding, loosen handle (12) and swing the arm and stopper unit (11) away from the cylinder wall.

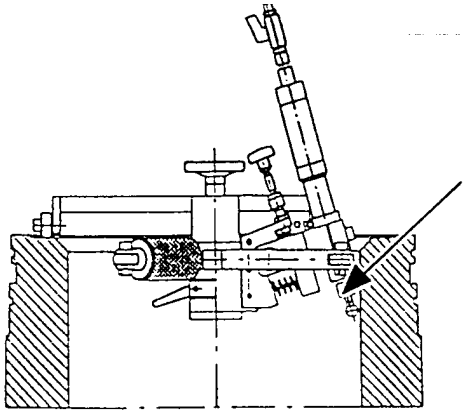
For extended working range, the complete motor holder (19) can be raised or lowered by loosening the screws (22).



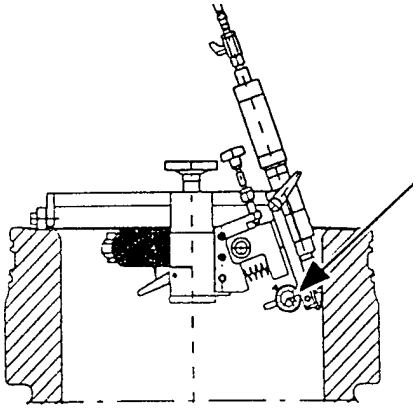

NOTE: BEFORE CONNECTING THE MACHINE TO THE MAIN AIR SUPPLY, MAKE SURE THAT THE MILLING CUTTER IS NOT IN CONTACT WITH THE CYLINDER WALL

Connect the three hoses (25), (26) and (27) to the foot pedal and filter / oil mist lubricator. Make sure that the air flow direction is correct (arrows on the filter unit). Put a few drops of oil into the air hose and connect to the milling motor.

**Please note:**
**Previous executions of this wear ridge milling machine not being equipped with a stopper unit (Item 11), also called wear ridge detecting template, can be retrofitted.**

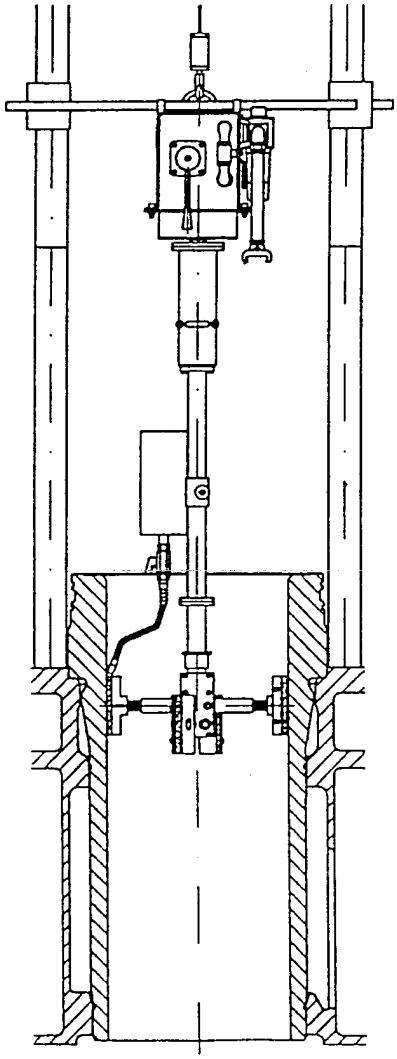


without stopper unit



with stopper unit

# CHRIS-MARINE DEGLAZING AND HONING MACHINE TYPE DS

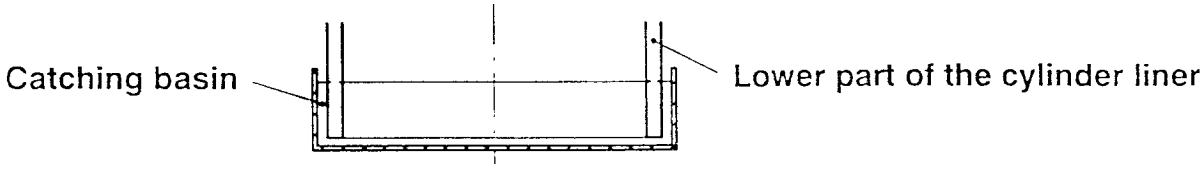


**Practical hints:**

Apply diesel oil (not lubricating oil!) for cooling and clean surfaces later on carefully and thoroughly with, for example Electro cleaner, to remove any honing particles, which later on in service will cause scratches.

**IMPORTANT:**

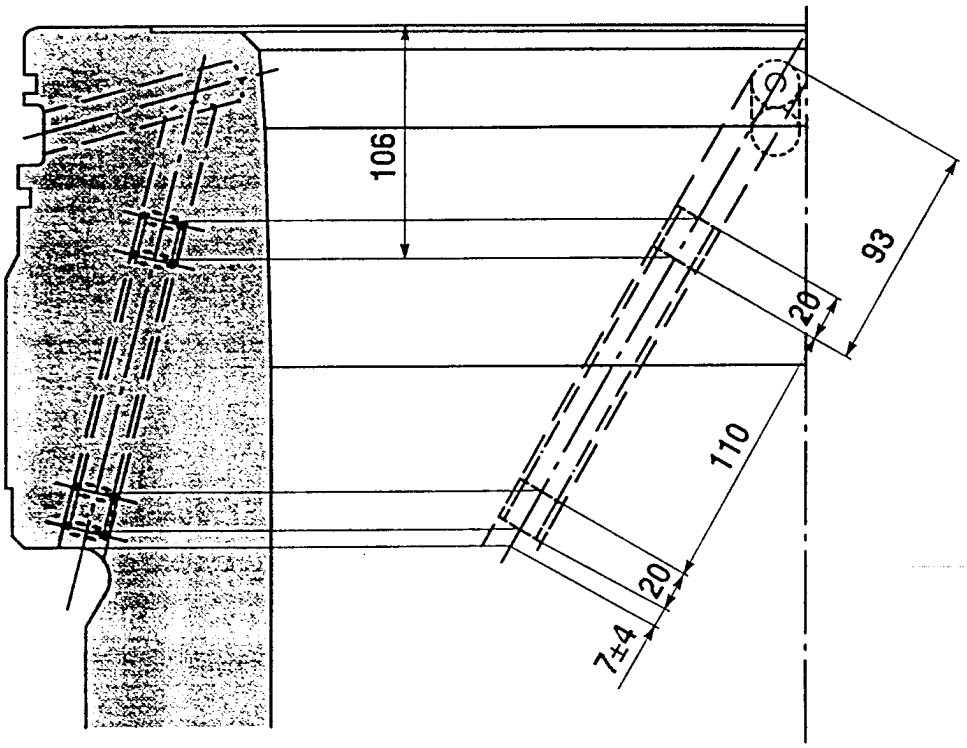
To avoid any kind of contamination of the crankcase, a catching basin can be attached on the bottom of the cylinder liner (please refer to sketch below) and the crankpin bearing assembly should be covered with rags.



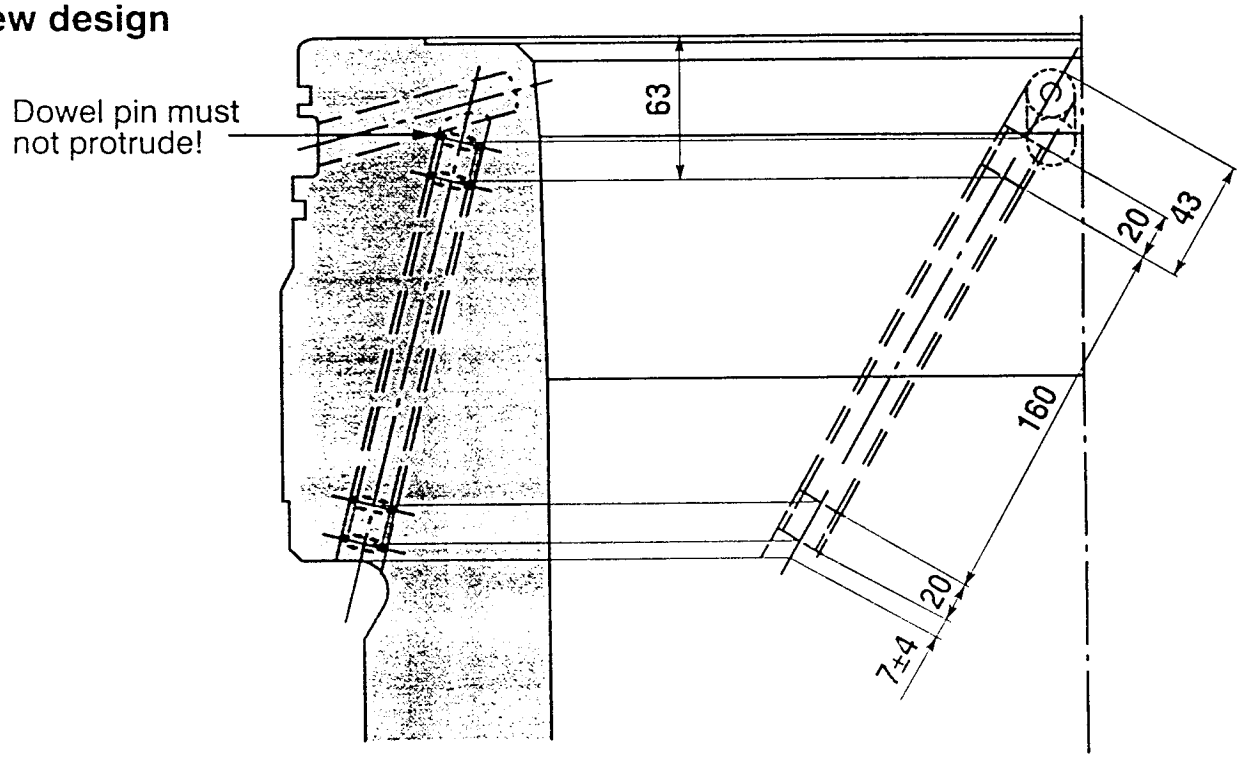
ZA 40S TYPE ENGINES

IMPROVED INSULATION OF 630 TYPE CYLINDER LINERS

Previous design




**New design**



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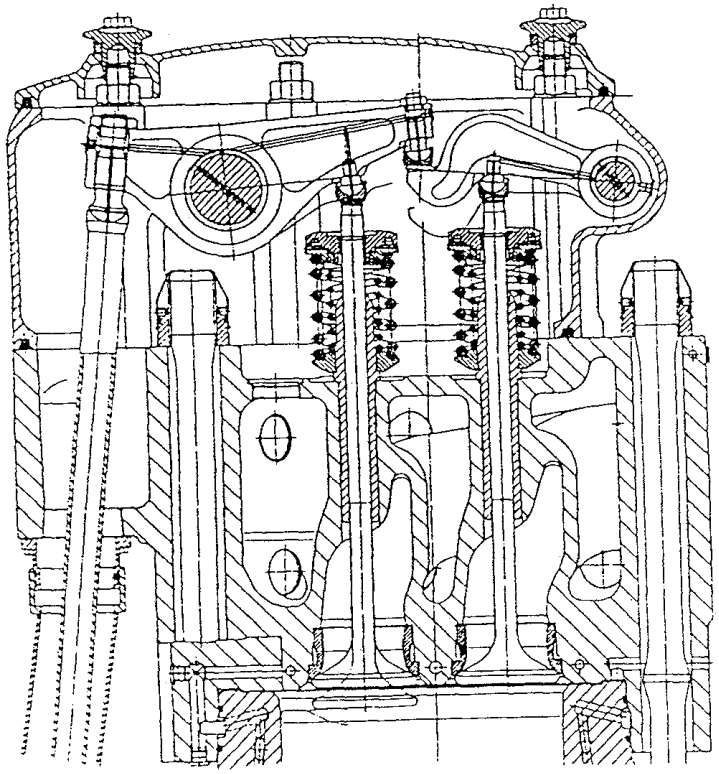
# Service Bulletin

Technical Information to all the Owners
of Sulzer ZA 40S Type Diesel Engines

ZAS–2.1
29.08.97
(Supersedes Bulletin
ZAS-2 d. 06.11.92)

# Overhaul of Cylinder Head



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INTRODUCTION

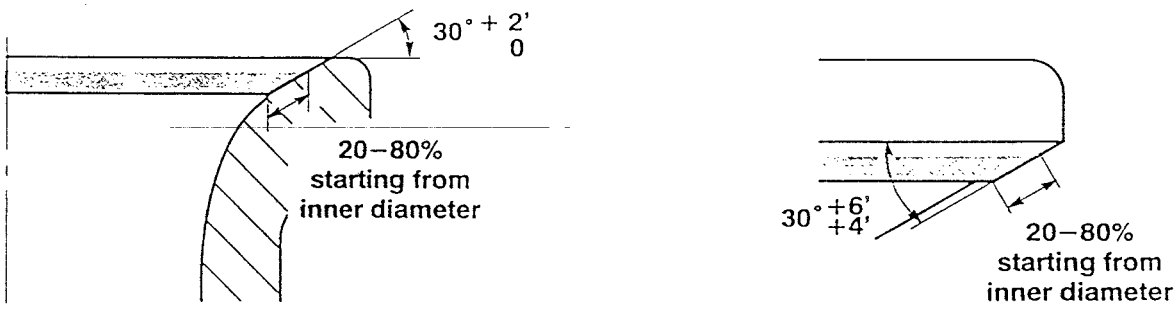
This Service Bulletin deals with various design and overhaul aspects on components of the cylinder head i.e. inlet/exhaust valves and seats with their accessories, relief valve and joint ring between cylinder head and liner. It also contains as enclosure an extract of specific pages from the maintenance manual.

1. GRINDING OF INLET VALVES AND SEATS

Due to thermal expansion on the inlet valve body, which is bigger on the combustion side of the valve plate than on the side facing the spindle, the specified seat angle on the valve spindle amounts to $30^\circ\ ^{+6'}_{+4'}$.

We therefore recommend that the required contact surface on the inlet valve seat is checked in the cold condition. This way it can be established that the contact surface of 20-80% starts from the inner diameter and no seating takes place on the outermost diameter.

Required contact surface




***IMPORTANT- Never lap valve and valve seat neither individual nor together!***

If any correction has to be carried out on the angle of the seating, surface to regain the contact area of 20-80%, we strongly recommend that any correction of the angle is made on the seat of the valve spindle only. The seat in the cylinder cover is only ground when it is necessary to clean up the seating surface, but never to correct the angle!

Care must be taken that the original angle on the inlet valve seat in the cylinder head of $30^\circ\ ^{+2'}_{0'}$ is maintained since this angle is fixed on the grinding device. Please refer to the enclosed grinding instructions.

After the introduction of the new angle on the inlet valve spindle seating surface, the seat will, under normal running conditions and temperatures, seal over the full width of the sealing surface and not only on the outer rim as was occasionally the case with the original angles.

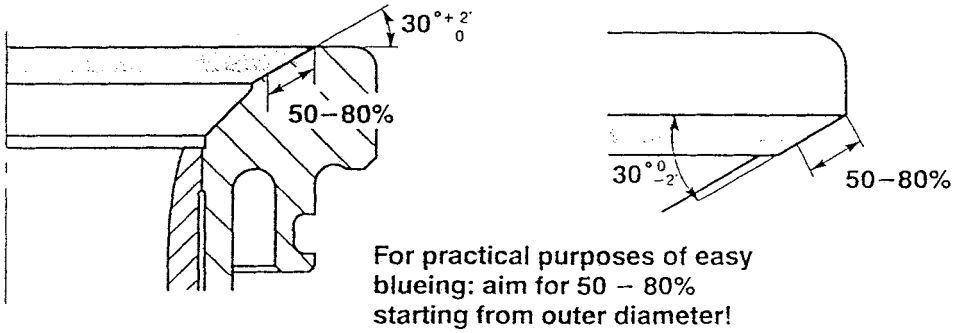
Inlet valve spindles on presently to be built engines as well as all spare inlet valve spindles supplied through Wärtsilä NSD Corporation have angles of $30^\circ\ ^{+6'}_{+4'}$

Note: When grinding both inlet and exhaust valves, the use of a centring piece on the valve seat grinding machine is required. (Item 7 on enclosure ZAS-2.1/5)

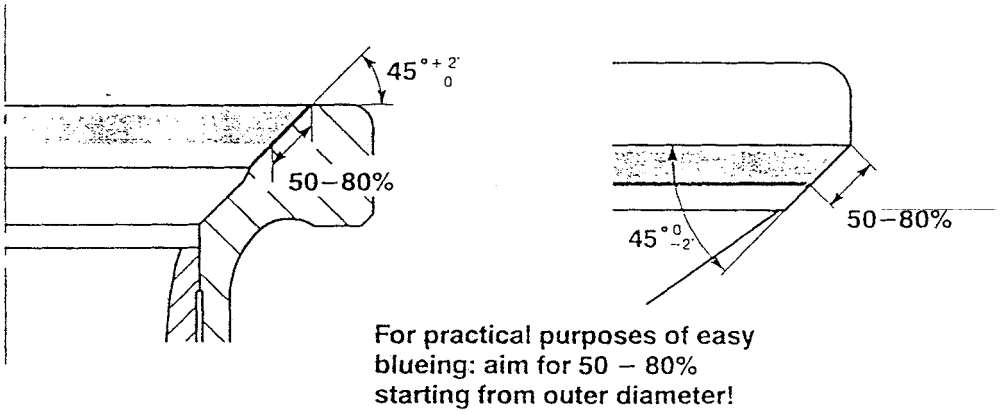
## 2. GRINDING OF EXHAUST VALVES AND SEATS

The contact surface on the exhaust valve, contrary to the inlet valve, starts at the outer (bigger) diameter. The required contact area of 50 - 80% should also be checked in the cold condition.

**Required contact surface on exhaust valves with 30° seating angle**




**Required contact surface on exhaust valves with 45° seating angle**




***IMPORTANT Never lap valve and valve seat neither individual nor together!***

## 3. VALVE SEAT DESIGN

To improve the sealing effect the design of both inlet and exhaust valves has been changed to a bigger seating surface. Since the outer diameter of the valve seat is bigger and the inner diameter smaller, it allows the spindle to enter the seat with its entire face, thus giving a bigger sealing surface area which is equivalent to the whole spindle seating area. Enclosure ZAS-2.1/1 gives you an overview of the modifications done.

Exhaust valve seats with an angle of 30° do not have a lower O-ring groove any more. This modification was carried out to further improve the cooling of the valve seat and also to increase the seating area. Exhaust valves with 45° seats, were already designed without a lower O-ring groove from the beginning.

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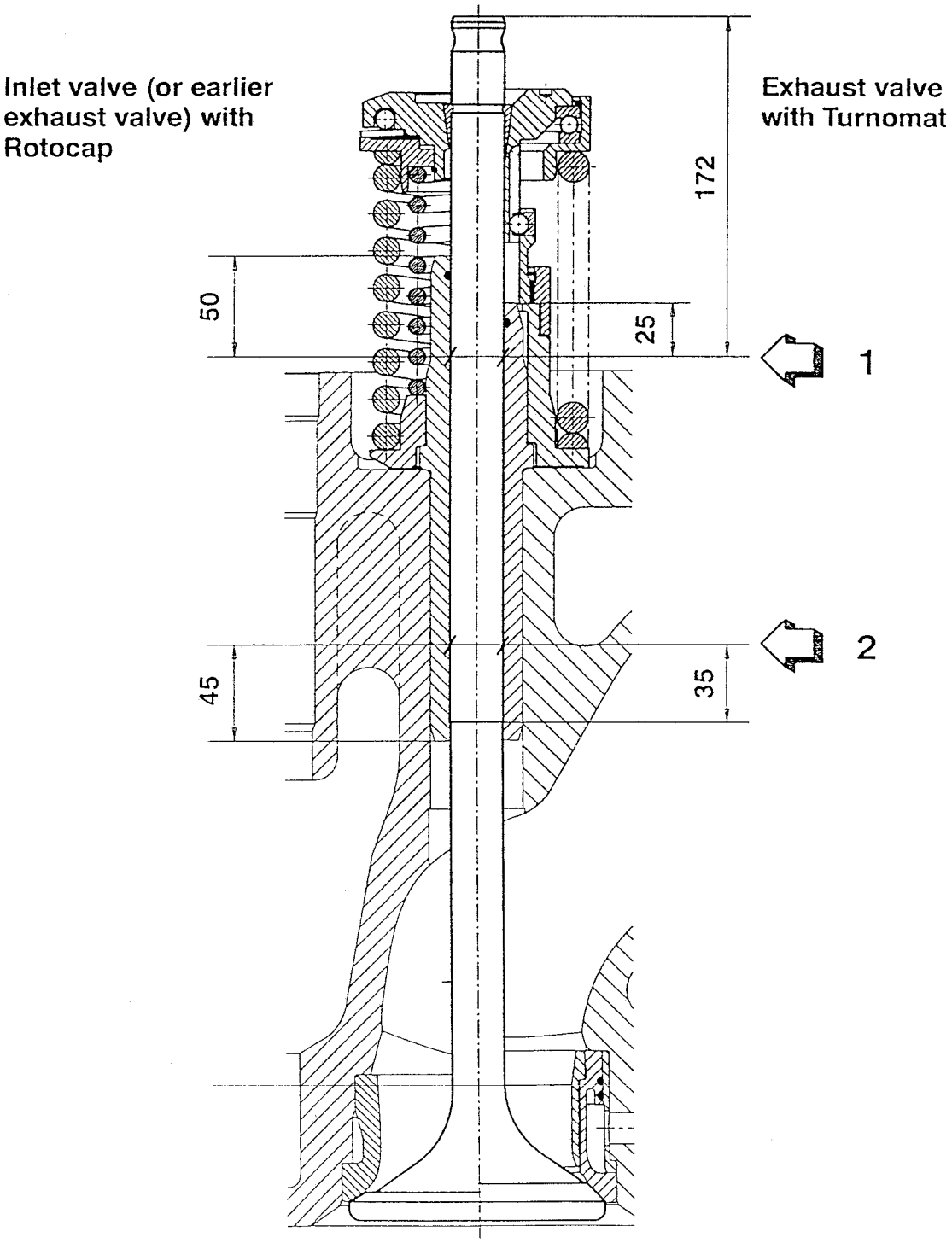
## 4. MEASURING THE CLEARANCE BETWEEN VALVE AND VALVE GUIDE

Please find on the sketch below the new standard measuring points recently introduced for measuring the clearance between valve and valve guide.




Maximum admissible clearance at 1 or 2: 0.3mm
Minimum spindle diameter at 1 or 2 : 27.85mm

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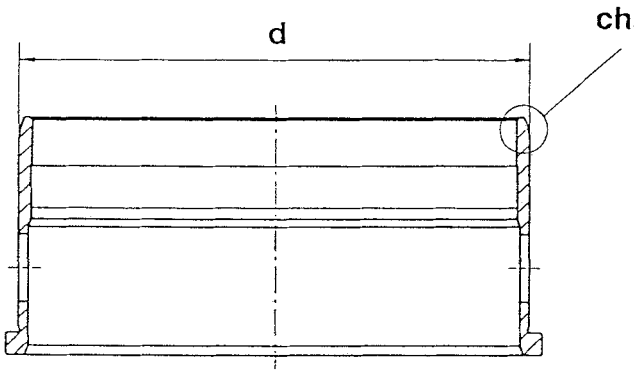
CORPORATION

## 5. INSERT BUSH IN THE EXHAUST VALVE SEAT BORE

As a standard, new engines are equipped with an insert bush Code No. KS 27123 in the bore of the exhaust valve seat. Earlier engines may still have a nickel layer instead of this bush. However, on cylinder heads showing a damaged nickel layer a conversion to the built-in bush is advised. Therefore the exhaust valve seat bore in the cylinder head has to be modified according to the drawing on enclosure ZAS-2.1/2.

This insert bush must only be fitted into a bore which is free of scratches and notches. For bores showing some notches or scratches after machining or extracting an old bush, two oversize bushes are available. So the bore in the cylinder head can be machined out to remove the damage. In any case the lowest possible oversize diameter should be aimed for. The insert bush should be obtained from Wärtsilä NSD Corporation.

Insert Bush KS 27123




Diameter d

| | | | |
|---|---|---|---|
| Standard | : | 135 r6 | $^{+0.088}_{+0.063}$ |
| Oversize I | : | 136 r6 | $^{+0.088}_{+0.063}$ |
| Oversize II | : | 137 r6 | $^{+0.088}_{+0.063}$ |

### 5.1 Fitting Instructions

Note: Prepare yourself well for this work in order to have good results.

1. Check surface of the bore in the cylinder head for axial scratches. Axial scratches are not permitted.

2. Check the outside diameter of the bush and the diameter of the bore in the cylinder head. Cylindricity and ovality should not exceed 0.02mm.
(Avoid transport or storing damage etc.)

   Important: For an easier fitting, the leading edge of the bush should be chamfered.

3. Before fitting the bush, the bore in the cylinder head must be free of dirt and grease.

4. Apply Loctite 648 in the bore only and not on the bush collar landing (see sketch on next page).

5 - Bush to be cooled down to - 190°C with liquid nitrogen. The correct bush temperature is reached after the liquid nitrogen has stopped bubbling.

6. Carefully mount the bush into the cylinder head.

7. Align the bores in the bush with the cooling bores in the cylinder head.

   Note: The bush must slide into the bore without additional force.
   Remove bush again immediately if a resistance is felt before the bush has reached the final, correct position.

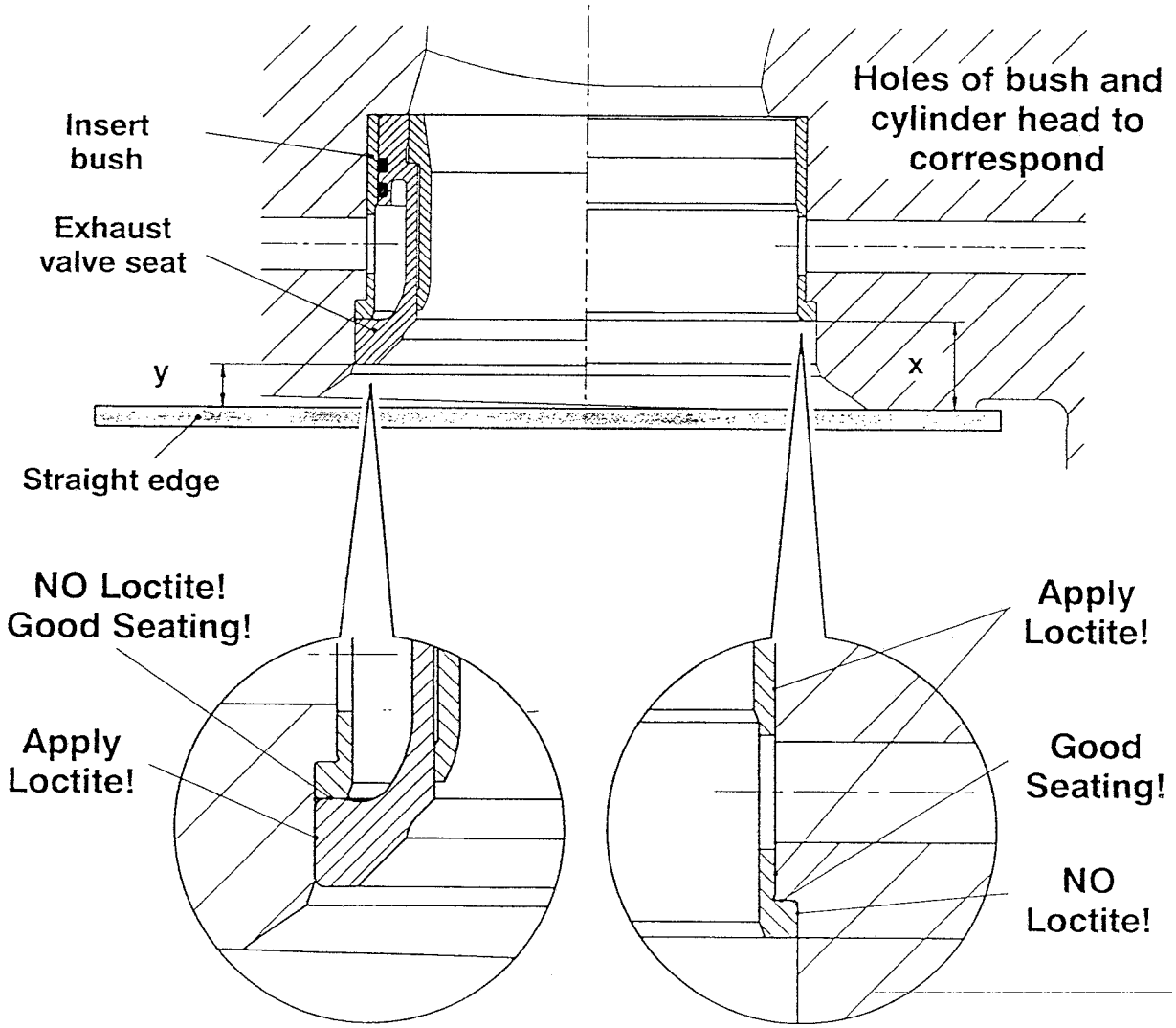
8. Press bush in bore for good seating on landing, and keep it in position until expansion of bush has been completed.

9. If possible start with mounting of the valve seat after about 12 hours (curing time for Loctite).

10. The good seating on the landing of the bush is to be checked by measuring the distance between the bush and the outer side of the combustion space (distance" x" on the sketch below). As the shape of the side facing the combustion chamber is slightly concave, a straight edge laid over the whole diameter may be helpful. In this case its thickness has to be considered.

Note: The correct seating on the landing of the exhaust valve seat is to be verified as well; the distance "y" (see sketch below) is then within the specified tolerance.

Repairs of this nature should only be carried out by a qualified repair shop which has the necessary machining instructions from Wärtsilä NSD Corporation




$y = 11.8\ ^{+0.4}_{-0.3}$ $x = 27\ ^{+0.2}_{-0.1}$

## 5.2. Extraction of a Bush

If, for any reason, it should become necessary to extract a bush from the exhaust valve seat bore, utmost care has to be taken to avoid any damage to the cylinder head. The following method has shown promising results:

1. Insert a round shim (1) with a diameter slightly smaller than the inside diameter of the bush.

2. Apply three to four axial electric welding seams equally distributed on the inner circumference of the bush (2).

Important: As the thickness of the bush is quite moderate, the welding process parameters have to be adapted accordingly.

3. The bush is now carefully removed by means of some blows with a hammer onto a suitable mandrel (3) inserted through the valve guide.