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SERVICE LETTER 920166 - How to succeed with HJ SIP

The HJ SIP principal is developed and patented by HANS JENSEN LUBRICATORS. The purpose of HJ SIP is to save lube oil- and thereby money in connection with the operation of a vessel. An additional profit is a cleaner exhaust system and an improved cylinder condition. Applying this equipment, the ship owners may reach the objective of considerable reduction in the lube oil consumption without trade off in the liner wear.

The purpose of this service letter is to give users of HJ SIP Lubrication a better foundation for succeed in practice.

We are often met with the questions: How do I get the most out of a SIP installation? What is the correct feed rate? These are subjects, which will be dealt with in this service letter.

Please consider the below reflections as guidelines. Guidelines based on our knowledge and experience accumulated through many years' activities in this field.

Content:

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Adjusting the SIP lubricator before start

The stroke length of the lubricators is an expression of how much lube oil is supplied to the cylinder. Therefore, the stroke length in the lubricators must be adjusted to the feed rate, which is requested to be supplied to the liners at each piston stroke. In this connection, it is important to know that the piston diameter in the lubricator for HJ SIP lubrication is different from that for a conventional lubricator. In other words, one must be aware that the stroke lengths on SIP lubricators cannot be immediately compared to the stroke length applied prior to the HJ SIP retrofit. Adjustment of the lubricator is described in appendix B page 10.

Please also remember, that machining of the cylinder wall must have been carried out before mounting the SIP valves.

The stroke length is adjusted on the adjusting bolts. Please note, that adjustment of the lube oil quantity is not made according to the position of the balls. The balls are only to be considered a visual confirmation of the lubricator function.

Choosing the feed rate

We are often met with the question: At which feed rate do we start? This question is difficult to answer. The optimal feed rate is a compromise between cylinder lube oil consumption, cylinder condition and liner wear/life. With HJ SIP Lubrication, our experience shows that a cylinder oil consumption of 0.9 g/kWh is a safe starting point. However, no two engines are similar, and there will therefore be individual differences. Feed rates less than 0.6 g/kWh with very satisfactory wear rates have also been seen. Before taking the system into use, one should consider a positive target for the oil reduction. We have seen cases where ship owners choose a lower feed rate after installation of HJ SIP than was applied before the installation. From there our experience shows that the stroke length is gradually reduced until the optimal feed rate has been found (See example 1 on page 4).

It is worth noting that we are aware of ship owners who have chosen to start at their target feed rate from the moment the system is started up after completed installation (see example 2 on page 5).

We have developed and produced the equipment with the potential. It is now your application of it, which will give you the advantages. The right approach is the one, which suits you and your preferences.

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As earlier indicated, the purpose of HJ SIP Lubrication is to reduce the cylinder oil consumption. Furthermore, our experience shows that at the same time the basis is laid for a longer life of the cylinder liners and piston rings, as the general cylinder condition normally is improved.

The reduction of the feed rate is carried out based on calculations or according to the actual lubrication condition of the cylinder. The latter is to be preferred, as several factors may influence the lubrication. Worth mentioning are e.g. the quantity of water which is not caught by the water mist catcher, the quantity of cat fines, sulphur in the fuel oil, the injection of the fuel oil and thereby the combustion.

It is thus our clear conviction that the best result is obtained if the lube oil consumption is reduced based on an evaluation of the actual lubrication condition, as in practice it will be possible to find the optimal point between the desired oil savings and the life of the liner.

Please note, that when applying HJ SIP you should primarily check the piston rings, as there will not be much oil on the cylinder wall due to the unique distribution method of the system. When evaluating the lubrication condition of the cylinder, one must be aware that with traditional lubrication, the main part of the cylinder oil is found at the lower part of the cylinder where the need is smallest, whereas with HJ SIP lubrication, the cylinder oil is found at the upper part where the need is largest and there is only a very small quantity of oil at the lower part.

In order to find out how much the feed rate with advantage can be reduced various parameters must be considered.

- Cylinder oil costs
- Cylinder oil delivery situation
- Cylinder liner and piston rings costs
- Cylinder liner and piston rings delivery situation
- Costs in connection with exchange of spares

A suitable way to determine how much the feed rate can be reduced is by evaluating, the actual lubrication condition of the cylinder by measuring the cylinder wear and compare it to the permissible wear.

Fact is that we do not know the joint optimum of these variables as they are part of decisions both technical and political and we can therefore not comment on your optimum. Therefore, we must based on our experience (and in time on yours, too) refer to results which ship owners have obtained with HJ SIP.

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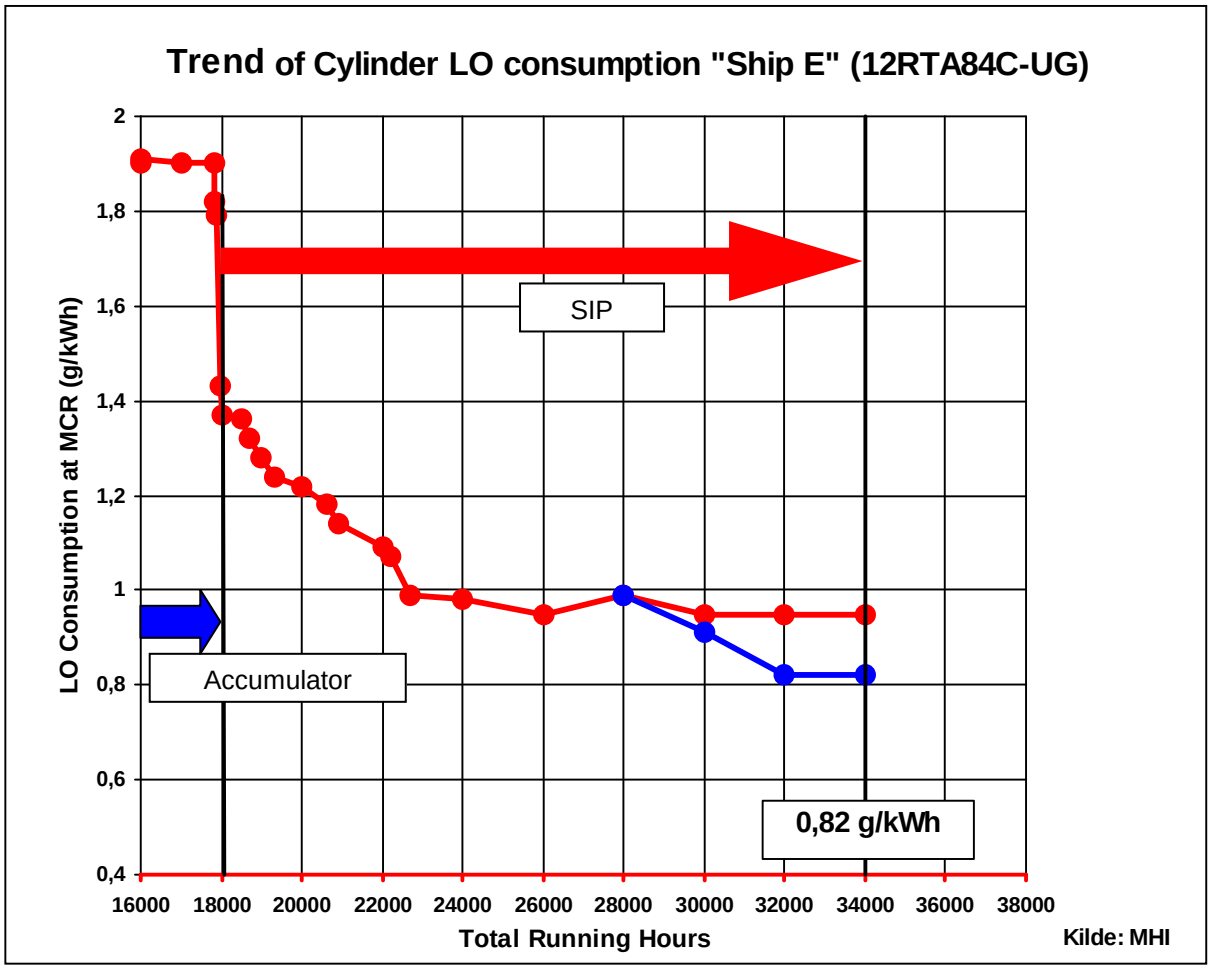
Example 1. Reduction of lube oil consumption on a 12RTA84C-UG WNSD



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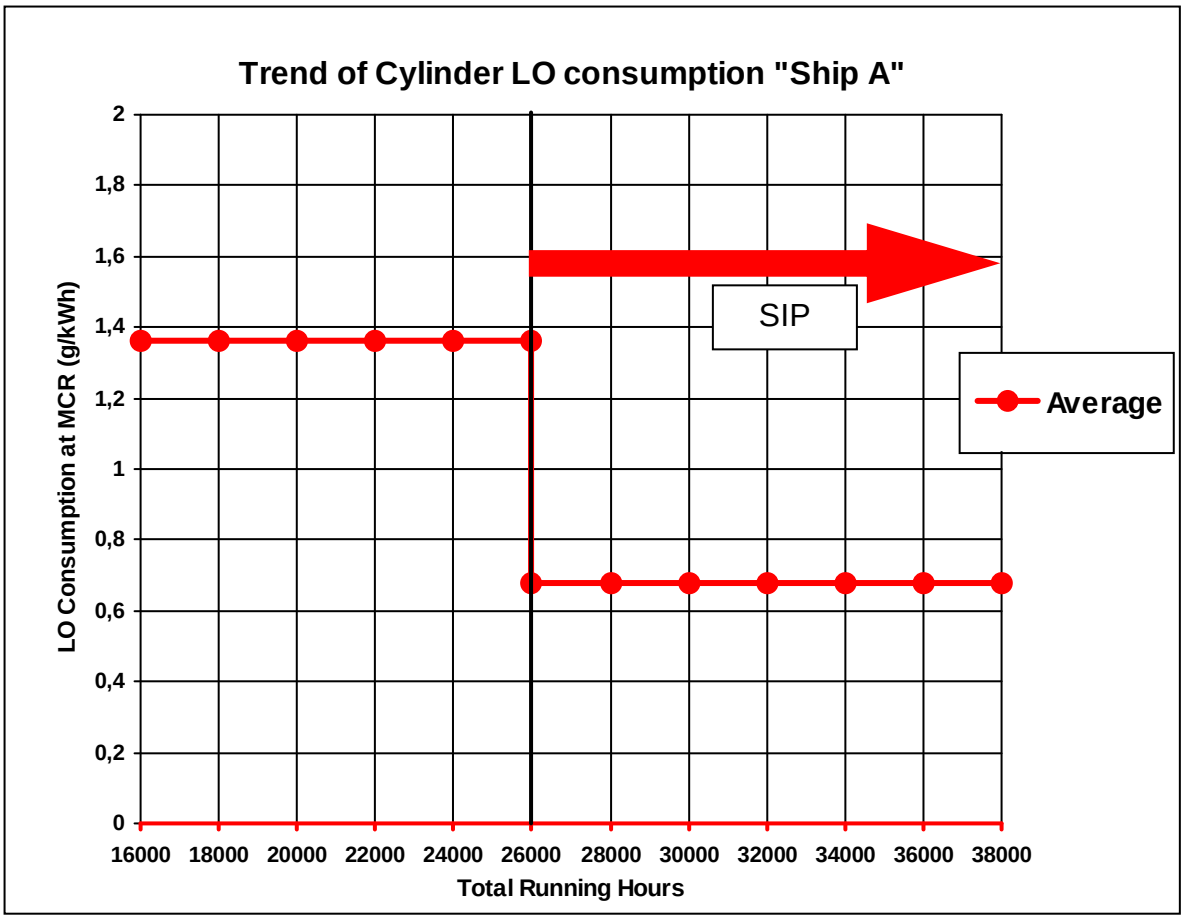
Example 2. Reduction of lube oil consumption on a 7K80MC-C



When evaluating the lubrication condition of the cylinder, one must be aware that with traditional lubrication, the main part of the cylinder oil is found at the lower part of the cylinder where the need is smallest, whereas with HJ SIP lubrication, the cylinder oil is found at the upper part where the need is largest and there is only a very small quantity of oil at the lower part.

The effect of the oil on the cylinder surface is important to avoid corrosive wear and therefore the maintenance of the system is essential.

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Optimising the operation

After installation and running-in of the HJ SIP Lubrication system, time has come to adjust the system to the optimal operation conditions.

Before carrying out the optimisation, it is necessary to ensure that the engine is working as intended. The below list is not a key but a short presentation of the essential conditions affecting the cylinder lubrication, which should be observed.

- Water mist catcher, air cooler and drain must be in order before adjustment of feed rate is commenced. If these are not in order, too much water will get into the cylinder, which may cause adverse conditions.
- The fuel valves must be in order as otherwise there is a risk that the fuel oil is supplied completely or partly un-atomized whereby soot and cinders are collected at the piston top resulting in increased wear.
- Piston rings and piston cleaning rings (PCR), if such are mounted, very much affect the function of the cylinder.
- The lubricators must be timed for SIP lubrication to secure optimal distribute of the oil (the timing is different from that for traditional lubrication).
- It is important that the heating in the cylinder lubricators is active. To remove dissolved air from the lube oil.
- The system from the day tank and all the way to the SIP valves must be kept clean (this is particularly essential during the installation phase to avoid impurities blocking the SIP valves).
- One or more 40 µm filters must be mounted between the day tank and the lubricators – not only the usual strainer in the cylinder lubricator. To ensure a clean system.

Please note that one single cylinder cannot be applied as an impression of the SIP function, as the conditions between the cylinders on the same engine may vary.

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SIP and sulphur in the HFO

The sulphur content in the fuel oil is very much in focus at present, and in this connection our opinion is clear. In practice, it has turned out that if low sulphur fuel oil is applied at the same time as CLO with a high TBN content, engines may experience wear and scuffing problems.
In above mentioned situation it is our experience that a low feed rate minimizes the risk of wear and scuffing due to low sulphur fuel.

Therefore we are confident that HJ SIP lubrication is the optimal solution, as by applying HJ SIP it is possible to operate with the same CLO oil at low feed rates but at the same time maintain the sublime distribution of CLO in the cylinder.

Maintenance

Further information on maintenance can be found in the manual, on our homepage or in specified service letter.

Contact HJL

For further information please feel free to contact us directly or visit our WEB site:

www.hjlubri.dk

Where among others some answers can be found in the “FAQ” section.

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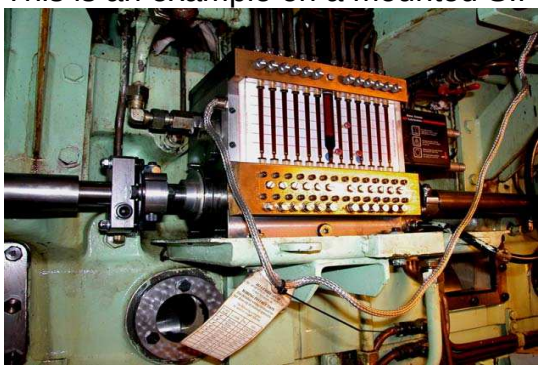
Appendix A – Scope of Supply

In this paragraph we have chosen to explain the major components in the scope of supply. The scope of supply of course depends on the specific engine in question. Please note that the complete scope of supply contains more components than those being dealt with here.

HJ pressure-tight cylinder lubricators designed especially for HJ SIP

These **lubricators** are specially designed for the HJ SIP system and are in some cases equipped with an integrated safety valve. The lubricators deliver the oil to the SIP valves at a pressure of approx. 37 bars. The new lubricators are mounted instead of the existing lubricators.

This is an example on a mounted SIP lubricator.



The **HJ SIP (I/II or III) valves** replace the conventional non-return valves in the cylinder liner. A spare set of valves for one liner is included. The valves spray the lube oil into the cylinder liner, thereby creating the unique distribution on the liner walls.

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Appendix A – continued

The **drive components** include among others the mechanical connection between the engine and the lubricators, including strengthened intermediate shafts, couplings and safety guards.

In some cases, we recommend the installation of a reduction gear. This will allow the user of the system to reduce the feed rate to lower levels than otherwise possible AND still maintain injection of fresh lube oil at every engine piston stroke. The gear is installed between the engine's drive shaft and the lubricators' drive shaft.

A **filter** of 40µ is installed in the supply tubes from the vessel's gravitation tank to the lubricators. This ensures that no impurities are led to the HJ SIP system.

An arrangement of return tubes is also installed. It is mounted between the HJ SIP valves' return oil outlet and the lubricators. The HJ SIP valves have a small leak quantity of 10±10 ml/hour. The return tubes are delivered partially prepared for assembly and mounting.

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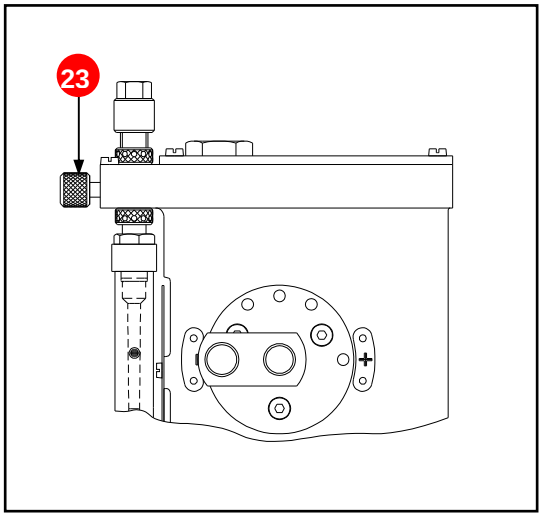
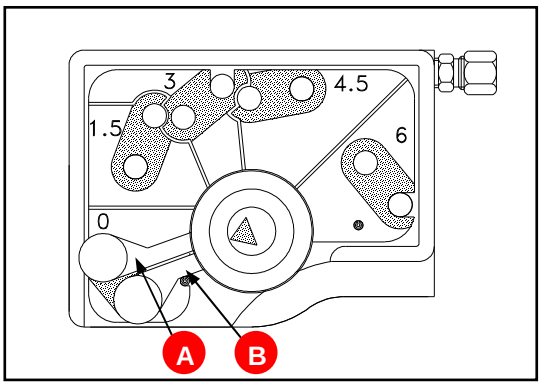
Appendix B – Adjustment of output

The oil supply is proportional to the stroke setting in the lubricator and the revolutions of the camshaft.

The basic setting of stroke **must** be carried out with the handle for joint quantity adjustment in position minus. If the lubricator is equipped with LCD regulation, the handles (A and B) must be locked in pos. 0.

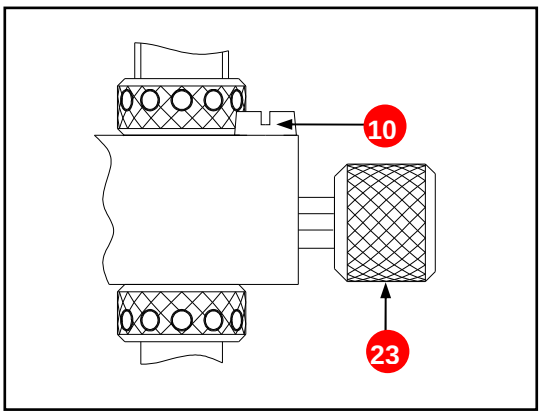


The adjustment of the oil quantity for the individual lube points (cc/pump stroke) is carried out by adjusting the strokes of the pump pistons by means of the adjusting bolts (23).



The pump stroke may be adjusted individually from 0 to 7mm at intervals of 0.125mm, which corresponds to 1/4 turn of the adjusting bolts (23).

Loosen the key screws (10) above the adjusting bolts (23) when adjusting the stroke of the pump pistons. Then turn the adjusting bolts clockwise for a decrease of stroke or counter clockwise for an increase of stroke. Tighten the screw (10) after adjustment has been completed. Make sure that the screw catches the key way in the adjusting bolt.



The pump piston diameter is stamped on the front side of the pump block. Typically the piston diameter is 7.5mm.

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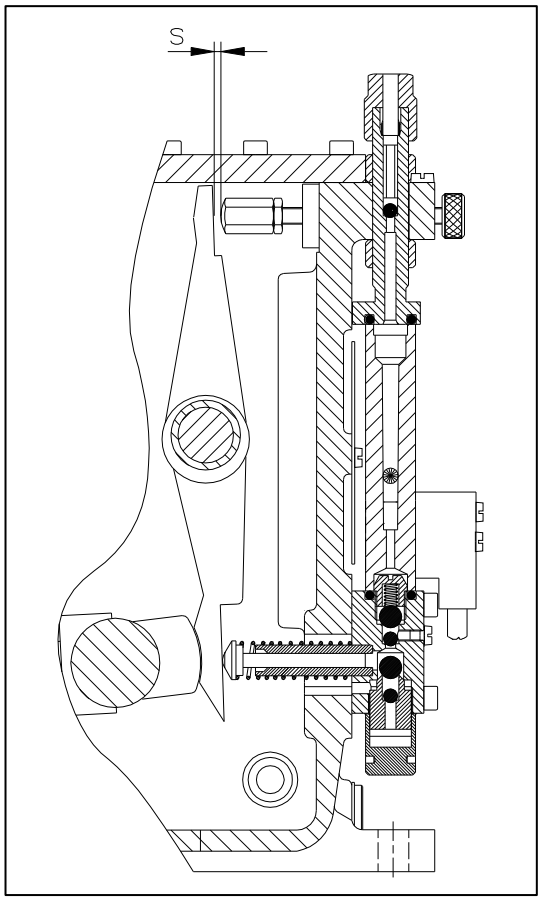
Appendix B – continued

For calculating the **initial stroke setting** and for later stroke settings based on engine condition and engine maker/ designer recommendation about guiding feed rate, or for adjustments of the stroke, we suggest the following formula:

$$S = \frac{(g / BHPh) \bullet BHP / Cyl \bullet 25}{d^2 \bullet n \bullet k}$$

s	=	Pump stroke in lubricator in mm
d	=	Piston diameter in mm in lubricator
n	=	Lubricator revolutions per minute
K	=	Total number of active oil outlets for one cylinder
BHP	=	BHP when lubricators run n revolutions
g/BHPh	=	Specific lube oil consumption



The formula includes specific gravity of the lube oil 0,945g/cm^3 (945g/litre.), This is of course depending on several factors including oil viscosity, lubricator rpm, and counter pressure at outlet. During normal DE operating conditions, the efficiency is 0.9 or above using an oil with viscosity 220 cSt (SAE 50 at 40℃) and lubricator revolutions not exceeding 130 rpm.

In the function range, the efficiency is typically 0.95 or more under conditions as described above in lubricators, which are clean, well bleed, and equipped with heating elements to ensure against temperatures below 40℃.

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Appendix B – continued

We suggest the following formula for calculating the **actual lube oil output** per lube point based on actual measured stroke - the formula may of course also be used for calculating required stroke:

$$q = \frac{s \bullet d^2 \bullet \eta}{1270}$$

Q	=	Output (cc/pump stroke)
D	=	Piston diameter in mm in lubricator
S	=	Pump stroke in mm
η	=	Volumetric efficiency of lubricator

Determination of the pump piston stroke:

Please see the manual for the lubricator.

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Appendix C – Replacement of broken ball control glass

If a ball control glass (1) in a lubricator breaks, it is probably due to dirt in the SIP valve, which is connected to the present glass (1) and thereby the valve has been blocked.

It is not necessary to stop the engine in order to replace a broken glass (1).

1. The adjusting bolt (2) of the lube point where the glass (1) has broken is screwed completely in, so that the pump function and oil flow stop – ***see figure A.***

2. The adjusting bolt (2) of the other lube points, which are connected to the same cylinder as the lube point with the broken glass (1), is screwed out ¼ of a turn, so that the stroke length is increased and extra oil is given to the other SIP valves in the cylinder – ***see figure B.***

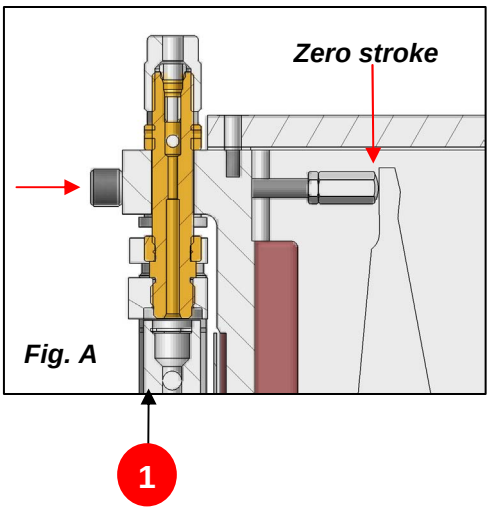
3. After that, the glass (1) is replaced while the engine is still running.

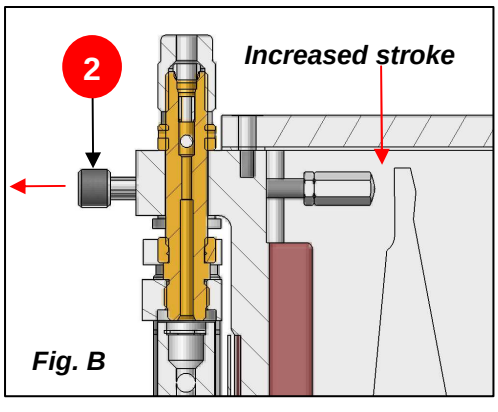
4. In the next harbour the SIP valve, which has caused the broken glass, is replaced/cleaned.

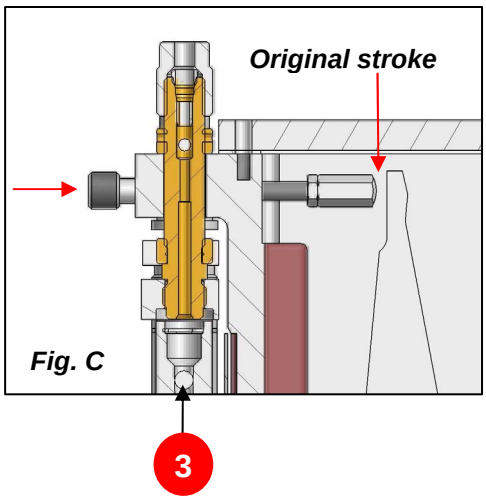
5. When the SIP valve has been replaced/cleaned, it is important that the adjusting screws (2) for all the lube points are screwed back to the original position – ***see figure C.***

On lubricators with survey blocks, the block will not break when a SIP valve is blocked since this type of lubricators is equipped with integrated safety valves. From the ball (3) in the survey block you can see if a SIP valve has been blocked, because the ball will then be placed at the bottom of the bore.

If this occurs, please follow the above articles 1, 2, 4 and 5.







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Appendix D – Clogged SIP valves

This section has been drawn up, as we have observed that our SIP valves sometimes clog when they have been in operation for a shorter period.
We recommend that SIP valves are overhauled /checked every 12,000 – 15,000 hours. For this number of running hours our SIP valves can operate normally without problems. Under special operational conditions, however, it sometimes happens that the SIP valves clog before the 12,000 – 15,000 operation hours, and the cause can be the following.

If there are impurities in the lube oil system, which are being transported to the SIP valves, the valves can clog. This might occur when the SIP valves are replaced, or if the system for some reason has been opened. If you do not pay attention to securing the open pipe ends towards impurities. When our service engineers install the valves, they flush the system thoroughly before the pipe fittings are fixed to the SIP valve.

Moreover, cristobalites are used during production of the lube oil, and this mineral is removed again when the lube oil production is completed. It happens, however, that micro particles of these minerals remains in the finished lube oil. If the lube oil contains large amounts of these surplus particles, they might cause the valve to clog. This has happened in a few cases.

An advice, which might prevent impurities in the oil from collecting in nozzle/needle, is to increase the feed rate for shorter periods, so that the impurities are pushed out. On systems with LCD, it can be an advantage to activate the LCD regulation for 10 minutes/day.

Obviously, it is a precondition that the system's filters works optimally in order to catch the impurities. Thus, it is important to clean them regularly. TBO for the filters is naturally depending on the oil's pollution.
If the valves clog, or start atomizing poorly, they need to be overhauled /cleaned. There has to be a continuous cone of oil mist through the nozzle hole – "droplets" is not accepted.

Kindly see our service letter no. **920160** – Instruction for disassembly, cleaning and testing. For this purpose, Hans Jensen Lubricators have developed special test equipment for SIP valves, which we recommend is onboard all vessels with SIP valves. Without the test equipment it is not possible to check the SIP-valves for opening pressure and spray performance. The pressure test equipment has part no. 102503.

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Appendix D – continued

In connection with this section, where problems with SIP valves are the focus, we will not refrain from directing your attention to the following. In the majority of vessels where HJ SIP valves are installed, there is no clogging of the nozzles. In some cases, we have experienced that the SIP valves have been in place for far beyond our recommendations that is 25,000 – 30,000 hours, without having to clean them. We still recommend, however, that the SIP valves are checked and cleaned after 12,000 – 15,000 hours of operation.