

SK Series





Repair Manual





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4. REPAIR TOOLS



1. INTRODUCTION

This manual contains the instructions for the repair of the SK family of pumps. It must be carefully read and understood before any operation is carried out on the pump.

The proper functioning and lifetime of the pump depends on correct use and proper maintenance.

Interpump Group declines all responsibility for damage caused due to negligence and/or failure to observe the instructions described in this manual.

2. REPAIR INSTRUCTIONS



2.1 Repair of the mechanical part

Repairs on the mechanical part must be carried out after removing the oil from the casing.

To remove the oil, remove the oil filling plug pos. ①, fig.1 and then the drain plug pos. ②, fig.1 present on both sides of the casing.





The spent oil must be placed in a suitable container and disposed of properly at an authorised centre. Do not under any circumstances discard it in the environment.



2.1.1 Dismantling the mechanical part

The correct sequence is as follows:

Completely empty the pump of oil, as indicated in 2.1.

Separate the head and the spacer for liners from the pump casing as shown in 2.2.1 (from fig.106 to fig.109).

Remove the upper inspection cover and the lower inspection cover by unscrewing the 4+4 attachment screws, as shown in point 2.2.3 (fig.120 and fig.121). Slip off the O-rings and replace them if necessary.

Remove the three pistons with an open-ended spanner, as shown in 2.2.3 (fig.122).

Remove the three spray-guards, complete with O-rings (pos. ① and ②, fig.2).



Unscrew the M6 locking grub screws from the three oil seal covers (pos.①, fig.3).





Take out the oil seal covers by screwing a threaded bar or an extractor M6 screw in the holes in the cover (pos.①, fig.4) and take out the covers from the pump group (pos.①, fig.5).



Take out the radial seal ring (pos.0, fig.6) and the outside O-ring (pos.0, fig.7).



Remove the lug from the PTO shaft (pos. , fig.8).





Unscrew the attachment screws of the shaft end cover (pos. ①, fig.9) and slip the cover off the PTO shaft.



Unscrew the casing cover attachment screws (pos.①, fig.10) and remove it. Slip off the O-ring and replace it if necessary.



Now remove the two bearing covers by unscrewing the screws (pos. 0, fig.11).

To help with their removal, use 2 x M8 grub screws or screws (pos.①, fig.12) as extractors. Slip off the O-ring and replace it if necessary.





Insert a shim under the shank of the central connecting rod, to stop the rotation of the crankshaft (pos. \mathbb{O} , fig.13).



Unscrew and take out the bush locking flange attachment screws, from both sides (pos.①, fig.14). The bush locking flanges must be left in position (pos.①, fig.15).



On one side, screw a ferrule (type SKF KM20) onto the pressure bush (pos.①, fig.16), and then unblock the bush using a striking hammer (pos.①, fig.17), but do not remove it. Repeat the operation on the other side.





Remove the shim from under the shank of the central connecting rod.

Unscrew the connecting rod screws (pos.①, fig.18).



Dismantle the small ends of the connecting rods with the half-bearings. During this operation take particular care to note the order in which the parts are removed.

The connecting rod small ends and the big end halves must be reassembled in exactly the same order and pairings in which they were dismantled.

To prevent any errors, small ends and big end halves are numbered on one side (pos.①, fig.19).



Advance the three big end halves as far as possible in the direction of the head.

Slip off the three upper half-bearings of the big end halves (pos. 0, fig.20).





Take out both of the pressure bushes (pos. 0, fig.21).



Separate the bush locking flange from the pressure bush (pos. , fig.22).



Unscrew the screws of the two bearing support covers (pos.①, fig.23).





Apply an M16 threaded pin to one end of the crankshaft (pos. ①, fig.24) and, while keeping it raised, take out the bearing support cover complete with bearing and O-ring (pos. ①, fig.25). To help with their removal, use 2 x M10 grub screws or screws (pos. ②, fig.24) as extractors. Repeat the operation on the other side.



Lay the crankshaft on the bottom of the casing. Separate the bearing support cover from the bearing, using a striking hammer (pos.①, fig.26).



Unscrew the attachment screws of the left and right PTO bearing cover (pos.①, fig.27) and slip the two covers off the PTO shaft. To help with their removal, use 3 x M8 grub screws or screws (pos.①, fig.28) as extractors.





Take out the radial seal ring (pos.①, fig.29) and the outside O-ring (pos.①, fig.30) and the lubrication hole O-ring (pos.①, fig.31).





Roll back the three connecting rods as far as possible (until they touch the crankshaft).

Using a striking hammer or mallet (pos. ①, fig.32), take out the PTO crankshaft from either one of the two sides (pos. ①, fig.33).





Slip the internal bearing rings off the PTO shaft (pos.①, fig.34) and also slip off the two internal bearing spacers (pos.②, fig.34).



The internal and external bearing rings must be reassembled in exactly the same order and pairings in which they were dismantled.

Using a sufficiently long bar (pos.①, fig.35) and a striking hammer, take the bearing rings out of the pump casing (pos.①, fig.36), along with the external bearing spacer (pos.①, fig.37) and the bearing lubrication bush (pos.①, fig.38).





Advance the big end halves in the direction of the hydraulic part and lock them in place using the special device (order code 27566200) (pos.0, fig.39).



Move the crankshaft from the lower part of the casing (pos.①, fig.40).



Proceed to unscrew the screws of the device (order code 27566200) to unlock the connecting rods (pos. ①, fig.41) and then take out the connecting rod/piston head assemblies from the rear opening of the casing (pos. ①, fig.42).





Couple the big end halves to the small ends that were previously dismantled, with reference to their numbering scheme (pos. ①, fig.43).



Remove the two pin-locking Seeger rings using the correct tool (pos.①, fig.44).



Slip out the pin (pos.①, fig.45) and take out the connecting rod (pos.①, fig.46).





To separate the stem from the piston head, it is necessary to unscrew the hexagonal-head M10 screw using a no. 17 socket wrench (pos.①, fig.47).



Complete the dissassembly of the mechanical part by removing the oil level lights, the eyebolts and the 90° quick-fit connection.

2.1.2 Assembling the mechanical part

Proceed with the assembly, following the reverse of the procedure shown in 2.1.1. The correct sequence is as follows:

Attach the two oil level lights, the two oil drain plugs and the 90° quick-fit connection (pos. ①, ② and ③ fig.48).





Connect the stem to the piston head.

Insert the Ø5 roll pin in the hole on the piston head (pos.①, fig.49) and connect the stem to the piston head using a M10x35 screw (pos.①, fig.50).



Place the stem in a vice, closing the teeth of the vice on the two flat areas, and proceed with setting, using a torque wrench (pos. ①, fig.51) as shown in section 3.



Insert the connecting rod into the piston head (pos.①, fig.46) and then insert the pin (pos.①, fig.45). Apply the two shoulder Seeger rings using the correct tool (pos.①, fig.44).

Separate the small ends from the big end halves. Correct pairing is ensured by the numbering on one side (pos. ①, fig.43).

After verifying that the casing is perfectly clean, insert the big end half/piston head assembly into the cylinder tube in the casing (pos.①, fig.42).



The big end half/piston head assembly must be inserted into the housing with the numbering of the big end halves visible from above.



Lock the three assemblies using the special device (order code 27566200) (pos.①, fig.41). Insert the crankshaft through the rear opening of the casing and lay it on the bottom.



The crankshaft must be inserted into the casing so that the teeth on the ring bevel gears are oriented as shown in fig.52.



Pre-assemble the PTO shaft:

Onto the PTO shaft, slip on the 2 internal rings of the bearings (one per side) (pos.^①, fig.53).



The internal and external bearing rings must be reassembled in exactly the same order and pairings in which they were dismantled.



From one side of the casing, insert the bearing lubrication bush (pos. ①, fig.54) and an external bearing ring (pos. ①, fig.55) using a pad and a mallet or striking hammer.



Remove the device for locking the connecting rods (order code 27566200) (pos.①, fig.41) and roll back the connecting rods until they touch the crankshaft.

Insert the pre-assembled PTO shaft into the casing (pos.①, fig.56). Insert it from the other side to the side where the external bearing ring and the bearing lubrication bush were inserted.

The PTO shaft must be inserted into the casing so that the teeth are oriented as shown in fig.56.

It is easier to insert the PTO shaft completely inside the bearing by applying an M16 screw to the end of the shaft being inserted, to keep the shaft lifted up (pos.①, fig.57).







From the side of the casing where the PTO shaft was inserted, proceed to insert the bearing lubrication bush (pos.①, fig.58) and an external bearing ring (pos.①, fig.59) using a pad and a mallet or striking hammer.



At both sides, insert the internal bearing spacers (pos.①, fig.60) and the external bearing spacers (pos.①, fig.61).



Insert the internal ring (pos.①, fig.62) and external ring (pos.①, fig.63) of a bearing from one side of the pump only.





Pre-assemble the left and right PTO bearing covers:

Insert the radial seal ring into the PTO bearing cover using the device (order code 27539500) (pos.①, fig.64).

Before proceeding with the assembly of the radial seal ring, verify the condition of the seal lip. If it is necessary to replace it, position the new ring as shown in fig.65.

If the PTO shaft shows diametral wear corresponding to the seal lip, then to avoid grinding you can position the ring as a second step as shown in fig.65.



TRADUZIONE TERMINI POSIZIONE ANELLO AL PRIMO MONTAGGIO = RING POSITION AT FIRST ASSEMBLY POSIZIONE ANELLO PER RECUPERO ALBERO SE USURATO = RING POSITION TO RECOVER SHAFT IF WORN

Apply the external O-ring (pos. ①, fig.66) and the lubrication hole O-ring (pos. ①, fig.67) to the PTO bearing covers.





Mount one of the PTO bearing covers (left or right) on the pump casing (pos. ①, fig.68) and attach it with 4 x M8x30 screws (pos. ①, fig.69).



Be careful of the direction of assembly of the cover. The lubrication hole in the cover must correspond to the hole in the casing.



Repeat the operations on the other side:

Insert the internal ring (pos. ①, fig.62) and external ring (pos. ①, fig.63) of the second bearing. Mount the second PTO bearing cover on the pump casing (pos. ①, fig.68) and attach it with 4 x M8x30 screws (pos. ①, fig.69).

Set the 4+4 screws with a torque wrench, as shown in section 3.

Pre-assemble the two bearing support covers:

Insert the bearing using a mallet or striking hammer (pos.①, fig.70) until 4÷4.5 mm of the bearing is still protruding, as shown in fig.71.







TRADUZIONE TERMINI conicità = conicity

The bearing in fig.71 has a conical internal ring. Verify that the conicity is from the outside to the inside, to allow the subsequent insertion of the bush.

Apply the O-ring to the outside of the bearing support cover (pos.0, fig.72).



Repeat the operation with the other cover.

Lock the three connecting rod assemblies, using the special device (order code 27566200) (pos. ①, fig.41). Apply two M16 threaded pins to the end of the crankshaft and, while keeping it raised (pos. ①, fig.73), insert the bearing support cover complete with bearing and O-ring (pos. ①, fig.74) using a mallet or striking hammer. Repeat the operation on the other side.





Fasten the bearing support covers with 6+6 x M10x30 screws (pos.①, fig.75). Set the screws with a torque wrench, as shown in section 3.



Partly insert the two pressure bushes, keeping the crankshaft lifted up by means of the previously-mounted M16 pin (pos. ①, fig.76).



Insert the pressure bush completely onto the crankshaft (pos. ①, fig.77 and fig.78) using a mallet/striking hammer and a pad.





Insert the bush until the outside (conical) surface perfectly couples with the inside of the bearing. During insertion, make sure that the bearing stays in contact with the crankshaft shoulder.

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Repeat the operation on the other side.

Insert the bush locking flanges into the conical bushes (pos.①, fig.79).

Apply a sufficiently long (35-40 mm) M16 screw to the M16 hole on the crankshaft and screw it in, until the flange is touching the bush (pos. ①, fig.80). Do not tighten the screw.



Repeat the operation on the other side.

Remove the device for locking the connecting rods (order code 27566200) (pos.0, fig.41).

Insert the upper half-bearings between the connecting rods and the crankshaft (pos. ①, fig.81).

To correctly assemble the half-bearings, make sure that the lug on the half-bearing is positioned in the slot on the big end half (pos. \mathbb{O} , fig.82).





Apply the lower half-bearings to the small ends (pos.①, fig.83), making sure that the lugs on the half-bearings are positioned in the slots on the small ends (pos.②, fig.83).

Attach the small ends to the big end halves using the M12x1.25x87 screws (pos. ①, fig.84). Set the screws with a torque wrench, as shown in section 3, at the same time bringing the screws to the tightening torque.

Be careful of the correct direction of assembly of the small ends. The numbering must face upwards.



Insert a shim under the shank of the central connecting rod, to stop the rotation of the crankshaft (pos. \mathbb{O} , fig.85).





Measure the distance X indicated in fig.86 between the conical bush and the crankshaft bearing.



Screw in the M16 screw until there is a reduction in the distance X of between 0.7 mm and 0.8 mm (fig.87).



Repeat the operation on the other side.

Remove the M16 screw from the crankshaft.

Screw the two bush locking flanges onto the crankshaft using $4+4 \times M12x25$ screws (pos. ①, fig.89).

Apply LOCTITE 243 to the threads of the M12x25 screws (pos.①, fig.88).

Set the screws with a torque wrench, as shown in section 3.





Remove the anti-rotation shim from under the shank of the central connecting rod.

Mount the two bearing covers (with their O-rings) (pos.①, fig.90) using 6+6 x M8x20 screws (pos.①, fig.91). Set the screws with a torque wrench, as shown in section 3.



Insert the O-ring into the rear cover (pos.①, fig.92) and affix it to the casing using 10 x M8x20 screws (pos.①, fig.93).

Set the screws with a torque wrench, as shown in section 3.



Mount the radial seal ring onto the oil seal cover (pos. ①, fig.94) using a pad (order code 27910900).





Position the O-ring (pos. ①, fig.95) on the seat of the oil seal cover, and insert the assembly into the casing in the seat provided (pos. ①, fig.96).



Make sure that the cover completely enters its seat (pos.①, fig.97), being careful not to damage the lip of the radial seal ring. Screw in the oil seal covers using 2 x M6x30 grub screws (pos.①, fig.98).



Set the screws with a torque wrench, as shown in section 3.

Position the spray-guard complete with O-ring in the seat on the piston head (pos. ①, fig.99 and 100).





Screw in the three pistons (pos. 0 , fig.101) and set using an open-ended torque wrench as shown in section3.



Insert the O-rings on the two inspection covers (pos. \mathbb{O} , fig.102) and mount the covers using 4+4 x M6x14 screws (pos. \mathbb{O} , fig.103).



Set the screws with a torque wrench, as shown in section 3.

Mount the shaft end cover and affix it to the casing using 3 x M8x20 screws (pos. ①, fig.104). Set the screws with a torque wrench, as shown in section 3.







2.1.3 Classes of increase

INCREASE TABLE FOR CRANKSHAFT AND CONNECTION ROD HALF-BEARINGS					
Recovery classes (mm)	Upper Half- bearing Code	Lower Half- bearing Code	Grinding on shaft pin diameter (mm)		
0.25	90931100	90930100	Ø92.75 0/-0.03 Ra 0.4 Rt 3.5		
0.50	90931200	90930200	Ø92.50 0/-0.03 Ra 0.4 Rt 3.5		

INCREASE TABLE FOR PUMP CASING AND PISTON HEAD				
Recovery classes (mm)	covery classes (mm) Piston Head Code Grinding on Pu (n			
1.00	74050243	Ø81 H6 +0.022/0 Ra 0.8 Rt 6		



2.2 Repair of the hydraulic part

2.2.1 Dismantling the head - liners - valves

The head does not need periodic maintenance. Operations are limited to inspection or replacement of the valves, when necessary. To extract the valve assemblies work as follows:

Loosen, without removing, the M10x140 screws affixing the liners to the head (pos.①, fig.106), to make them free.



Unscrew two diametrically-opposite M16x280 head affixing screws (pos. ① and ②, fig.107) and replace them with two service pin-screws (order code 27540200) (pos. ①, fig.108), and then proceed to remove the remaining screws.



Separate the head and the spacer for liners from the pump casing (pos. ①, fig.109).





Remove the O-rings of the gasket supports (pos.①, fig.110) and slip off the spacer for liners from the liner assemblies (pos.①, fig.111).



Remove the M10x140 screws affixing the liners to the head (pos.①, fig.112) and take out the liner assemblies (pos.①, fig.113).



When removing the liners be careful not to lose the valve springs and their flat valves (pos. ① and ②, fig.114). Because they are only held in position by the surrounding parts, they could easily fall out.





If the valve seats are stuck on the head due to the formation of limescale or oxide, they must be freed by inserting the special tool (order code 034300020 for SK20-22-24, or 034300010 for SK26-28-30) into the outlet hole (pos. ①, fig.115).



Take out the valve seats and check the state of wear of the gaskets. If necessary, replace them (pos. 0, fig.116).





At each inspection of the valves, replace the seal rings and the frontal seal O-rings between liner and head, and between head and liner spacer in the recirculation hole area. Before reassembly clean and dry the various components and all their seats inside the head.



Take out the outlet cotters (pos.①, fig.117), and their holders (pos.①, fig.119), and the springs (pos.①, fig.118), check their state of wear and, if necessary, replace them. (Replace them in any case at the intervals specified in section 11 of the Manual for Use and Maintenance.)





2.2.2 Assembling the head - liners - valves

To reassemble the various components, reverse the operations listed previously, paying particular attention to the correct assembly of the spacer for liners: the two as-cast discharges present on one of the two sides must be facing towards the lower part of the casing (the pump support side) after assembly.

Head – liners: proceed with assembly and setting of the head affixing screws and then proceed with setting the affixing screws for the liners.

For the tightening torque values and for the tightening sequence of the screws, follow the specifications given in section 3.



2.2.3 Dismantling the piston - supports - seals assembly

The piston assembly does not need periodic maintenance. Operations are limited to a visual check of the draining of the cooling circuit. If there are anomalies/oscillations in the outlet pressure gauge, or pulsations in the cooling circuit drainage pipe (if elastic), then the seal packing must be checked and, if necessary, replaced. To extract the piston assemblies work as follows:

Separate the head and the spacer for liners from the pump casing as shown in 2.2.1 (from fig.106 to fig.113).

Remove the upper inspection cover (pos.①, fig.120) and the lower inspection cover (pos.①, fig.121) by unscrewing the 4+4 attachment screws. Slip off the O-rings and replace them if necessary.



Remove the pumping elements with an open-ended wrench (pos.①, fig.122) and check their state of wear (pos.①, fig.123). Replace them if necessary.





Remove the M8x50 screws affixing the support to the liner (pos.①, fig.124) and separate the support from the liner (pos.①, fig.125).



Remove the Seeger ring and the seal retainer ring (pos.①, fig.126) and with a special plastic pin, take out the LP (low pressure) gasket seal (pos.①, fig.127).



At every dismantling, the low-pressure seals and the O-rings must be replaced.



With the liner separated from the seal support and with a special plastic pin (pos.①, fig.128) push out the HP (high pressure) packing (pos.①, fig.129).



At every dismantling the HP packing (pos. 0, fig. 129) must be replaced.



2.2.4 Assembling the piston - supports - seals assembly

To reassemble the various components, reverse the operations, paying particular attention to the sequence outlined below. For the tightening torque values and for the tightening sequence, follow the specifications given in section 3.

Insert the upper bush into the liner.

For correct axial positioning of the bush, use the special device (order code 27911200 for SK20, code 27911400 for SK22, code 27911500 for SK24, code 27911600 for SK26, code 27911700 for SK28 and code 27911800 for SK30) (pos. \mathbb{O} , fig.130 and 131).





Insert the H.P. (high pressure) packing (pos.^①, fig.132). Given the slight interference between the seal and the liner, to avoid causing damage we recommend using the special tool (order code 27540100 for SK20, SK22 and SK24, code 27540900 for SK26, for SK28 and for SK30) (pos.^①, fig.133).





Before inserting the H.P. seals, they must be lubricated with silicone grease (type OKS 1110), following the instructions below:

The external diameter must be only lightly lubricated On the internal diameter the grease must be applied taking particular care to fill all the indentations between the seal lips, as shown in fig. 135.





TRADUZIONE TERMINI

Direzione lavoro pistone = Direction of travel of piston Sacche da riempire con grasso = Indentations to be filled with grease



Insert the anti-extrusion ring and the gasket bush (pos. ① and ②, fig.136 - 137 and 138).

The gasket bush @ must be inserted into the liner with the two discharges facing outside (casing side) as shown in fig. 137.







TRADUZIONE TERMINI Lato carter = Casing side



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The L.P. seal must be inserted into the liner with the seal lip in the direction of travel of the piston (pos.①, fig.139 and 140), lightly lubricating the outside diameter with silicone grease (OKS 1110 type). Replace the L.P. seal when it is worn.



TRADUZIONE TERMINI Direzione lavoro pistone = Direction of travel of piston Reassemble the seal support assembly (fig.141 and 142), replacing the ① and ② components.





Assemble the support/liner assembly, manually tightening the M8x50 screws as shown in fig.143, and then proceeding with setting with torque wrench as shown in section 3.



3. SCREW CALIBRATION

Screws are to be fastened exclusively using a torque wrench.

Description	Exploded view position	Fastening Torque Nm
M8x20 screw, casing cover	42	25
G1/2x13 plug, casing	66	40
M8x30 screw, PTO bearing cover	85	25
M8x20 screw, shaft end cover	42	25
M10x30 screw, bearing support	57	45
cover		
M6x14 screw, upper & lower covers	70	10
M8x20 screw, bearing cover	42	25
M12x1.25x87 screw, connecting rod tightening	40	75
M10x35 screw, piston head	38	60
M12x25 screw, bush locking flange	51	68.5
Complete piston	16	50
Choke fitting D.3 3/8M-3/8F	72	45
M8x50 screw, supports	26	40 *
M16x280 screw, head	14	333 **
M10x140 screw, liners	13	83 ***

The screws in positions 13-14-26 must be tightened with a torque wrench and the threaded shaft must be lubricated with molybdenum bisulphide grease, order code 12001500.

* Screws for affixing supports must be tightened following the phases and order shown in the scheme in fig.144.

** Screws for affixing the head must be tightened following the phases and order shown in the scheme in fig.145.

*** Screws for affixing liners must be tightened following the phases and order shown in the scheme in fig.145.





TRADUZIONE

Tightening of screws for gasket supports, position 26

Tighten M8x50 screws in the sequence indicated (1-2-3-4-5-6-7-8-9-10), performed in a single phase and with the specified torque



TRADUZIONE

- Tightening of screws for head and screws for liners, positions 14 and 13 OPERATION 1: Tightening M16x280 screws (position 14) in two phases 1^{st} phase = 250 Nm 2^{nd} phase = 333 Nm OPERATION 2: Tightening M10x140 screws (position 13) in four phases 1^{st} phase = 40 Nm 2^{nd} phase = 65 Nm 3^{rd} phase = 83 Nm 4^{th} phase = 83 Nm



4. REPAIR TOOLS

Pump maintenance can be carried out using simple equipment for dismantling and reassembling the components. The following equipment is available:

For assembly:

- Piston head radial seal ring code 27910900
- PTO shaft radial seal ring code 27539500
- Gasket bush code 27911200 (SK20), code 27911400 (SK22), code 27911500 (SK24) code 27911600 (SK26), code 27911700 (SK28), code 27911800 (SK30)
- HP seal packing code 27540100 (SK20 SK22 SK24) code 27540900 (SK26 SK28 SK30)
- Head / liner spacer code 27540200

For disassembly:

- Valve seat code 034300020 (SK20-22-24), code 034300010 (SK26-28-30)
- Head / liner spacer code 27540200
- Shaft (for locking connecting rods) code 27566200



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