SERVICE MANUAL
POWER STEERING UNIT

Form 556034 Rel. 1.0

STA
STY
STX
STH
STZ

ognibene®

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General Instructions:

- READ THE SERVICE MANUAL CAREFULLY BEFORE USE.
- CHECK THAT THE STEERING UNIT HAS NOT BEEN DAMAGED DURING TRANSPORT.
- CLEAN THE WORKING AREA BEFORE OPERATION.
- KEEP ANY SOURCE OF HEAT, FLAME (MAX. 50°C), CORROSIVE LIQUID, OIL AND GREASE AWAY FROM THE WORKING AREA.
- IN CASE OF REPLACEMENT OF COMPONENTS, THIS REPLACEMENT MUST ONLY BE CARRIED OUT BY STAFF TRAINED AND AUTHORISED BY "OGNIBENE S.P.A.".

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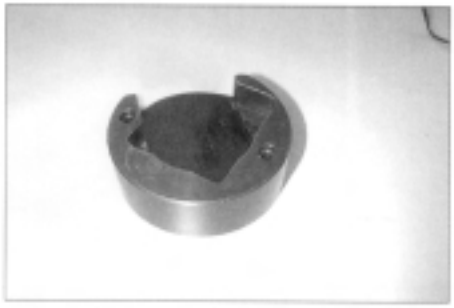
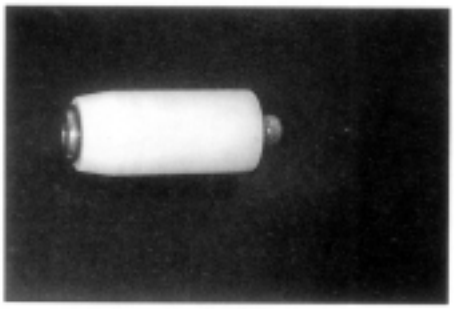
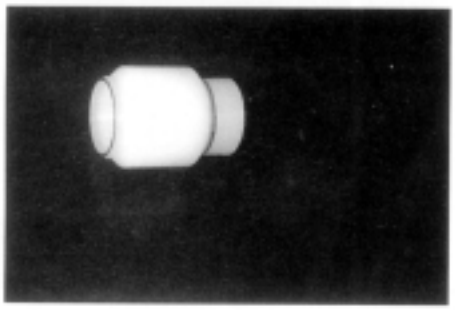
Tools



A) Holding tool ST: code: AT 4870

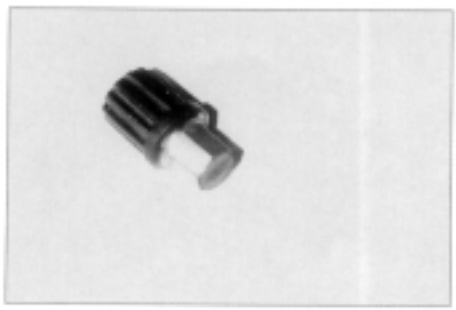


B) Assembly tool for rotary seal: code: AT 0710



C) Assembly tool for dust seal: code: AT 4871

D) Assembly tool for springs: code: AT 4873



E) Spline hub: code: AT 4883

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Tools

F) Screwdriver 2 - 12 mm
Hexagon socket spanners 6-8 mm
Vernier calliper
Ring spanner 13 mm
Torque spanner 30 Nm
Pliers
Tweezers
Plastic hammer
These tools are not available from "Ognibene S.p.A."

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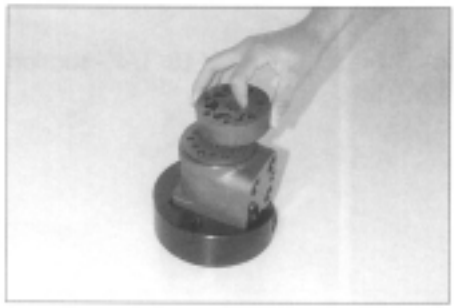
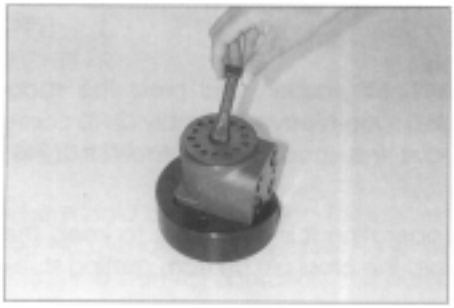
Disassembly

1 Disassemble steering column from steering unit and place the steering unit in the holding tool (code: AT 4870).
Unscrew the screws in the end cover (16): 6 (17) + 1 special (19).

2 Remove the end cover (16).
Take out the O-ring (21) and the spacer (18) (if present).



3 Lift the gerotor set (15) off the unit.



4 Remove cardan shaft (13).

5 Remove small flange (14).

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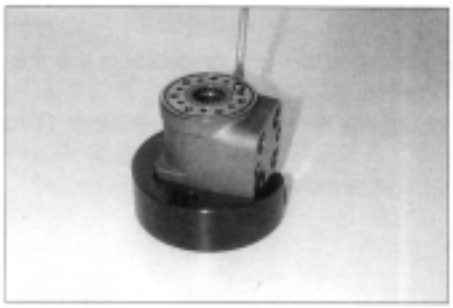
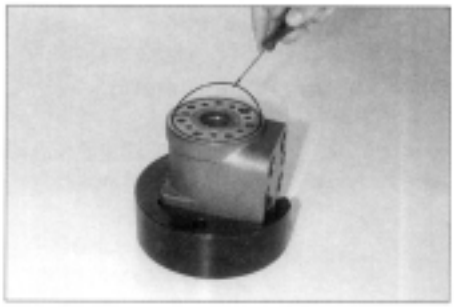
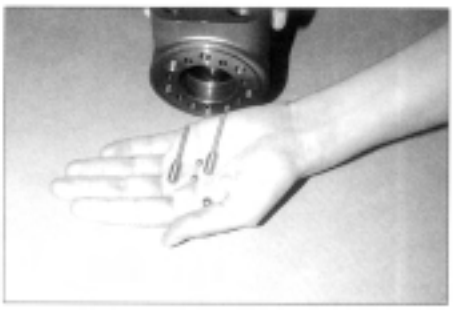
Disassembly



6 Screw out the threaded bushing (22) over the check valve.



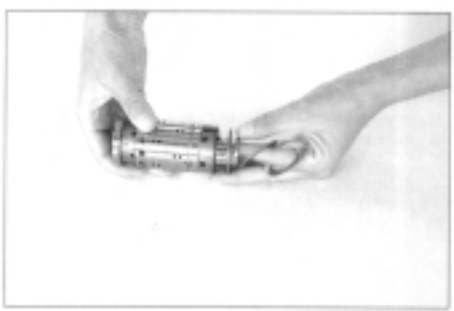
7 Remove O-ring (21).



8 Shake out the check valve ball (24) - ST: 11/32"; ST LS: 1/4"- suction valve pins (12) and balls (11) - 3/16"-.

9 Hold the steering unit in horizontal position and press the spool (2) carefully in order to make the spool/sleeve assembly (2+3) come out of the housing (6). Remove the spool/sleeve assembly (2+3) completely.

⚠ ATTENTION: During this operation it is necessary to keep the cross pin (8) horizontal, to avoid the cross pin (8) from getting stuck in the body.



10 Remove the bearing assembly (5).
The outer bearing race can sometimes "stick" in the housing, therefore check that it has come out.

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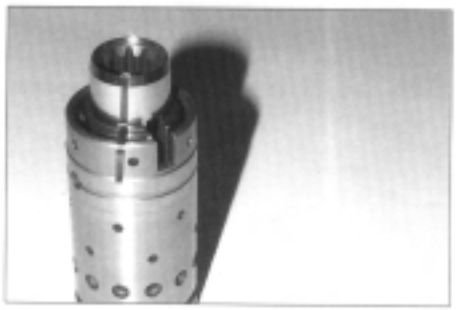
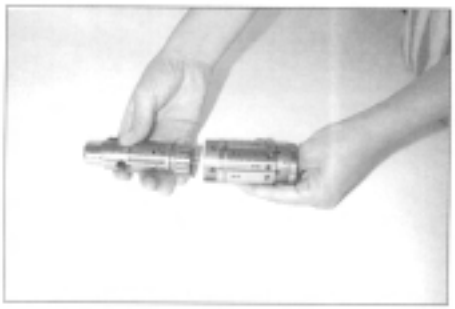
Disassembly

11 Press out the cross pin (8). Use the special screw (19) from the end cover (16).

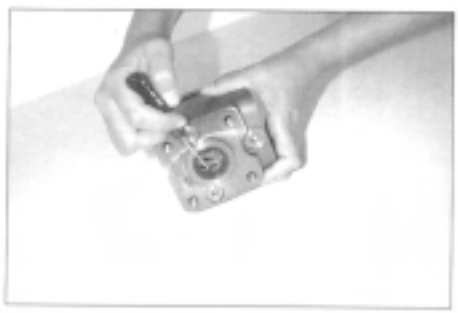


12 STEERING UNIT "CN" AND "LS"
In order to make a correct reassembling possible it is necessary to leave a mark on sleeve (3) and spool (2) before dismantling this part.



13 Press the spool (2) carefully out of the sleeve (3).

14 Press the springs (7) out of their slots in the spool (2).



15 Remove dust seal (1) and rotary seal (4) from the housing (6).

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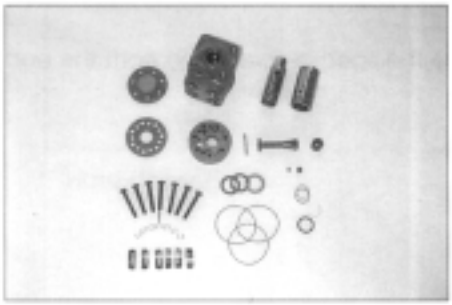
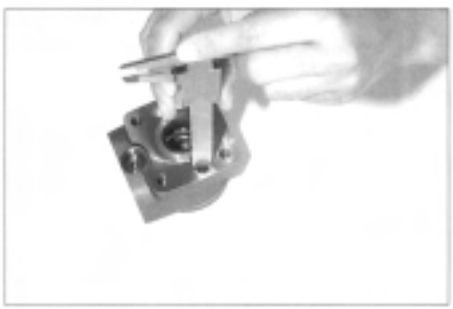


16 Steering unit STX is now completely disassembled.

MODEL STA disassembly anti-shock valves.

17 Remove plugs (25) from shock valves using a 6 mm hexagon socket spanner.

18 Remove seal washers (26).



19 Before unscrewing the setting screws, measure the distance of the plug from the edge of the housing (this distance must be kept during the reassembling in order to repeat the setting).

20 Unscrew the setting screws (27) using a 6 mm hexagon socket spanner.

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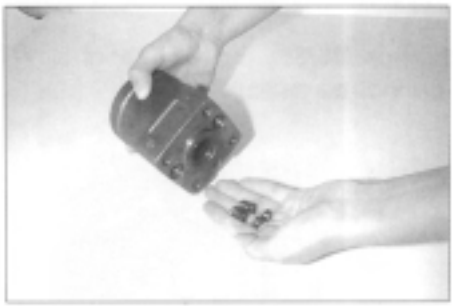
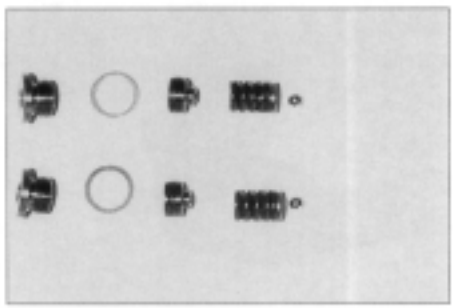
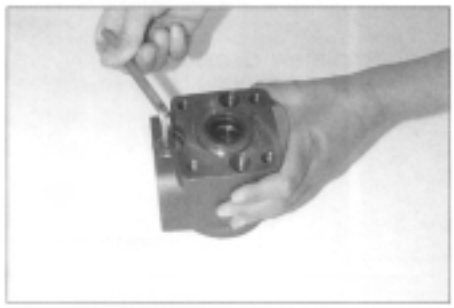


21 Shake out the two springs (28), the ball guides (29) and the two valve balls (11). The valve sets are bonded into the housing and cannot be removed.



22 The anti-shock valves are now dismantled.

MODEL STA ON/STA LS dismantling relief valve.



23 Screw out the plug (31) using an 8 mm hexagon socket spanner. Remove the seal washer (32).

24 Before unscrewing the setting screws, measure the distance between the plug and the edge of the housing (this distance must be kept during the reassembling in order to repeat the setting).

25 Unscrew the setting screws (33) using a 6 mm hexagon socket spanner.

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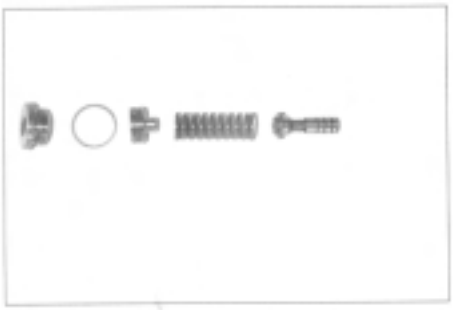
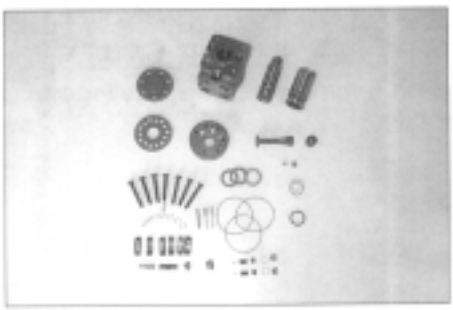
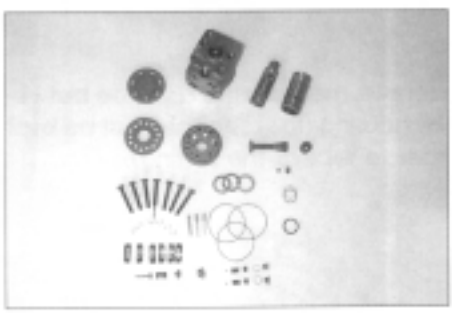
26 Shake out spring (34/37) and piston (35/38). The valve seat is bonded to the housing and cannot be removed.



27 The relief valve is now disassembled.



28 The steering unit STA ON is now completely disassembled.



29 The steering unit STA LS is now completely disassembled.

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Cleaning

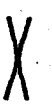
Clean all parts carefully in Shellsol K.

Replace all seals and washers. Check all parts carefully and make the necessary replacements.

Lubrication

Before the assembly operations, lubricate all parts with regular hydraulic oil.

SPRING SCHEME



SET TYPE	Q.ty	Q.ty
0	2	2
A	.	4
B	6	.
C	2	4
D	.	6
E	4	4
F	.	8

SPRING SETS

TYPE	DESCIPTION	INPUT TORQUE Nm	P/N
O	EXTRA SOFT	1,1	010005005
A	SOFT	1,6	010005010
B	STANDARD	2,2	010005020
C	MEDIUM	2,6	010005030
D	HARD	3	010005040
E	EXTRA HARD	3,5	010005050
F	STIFF	4	010005060

All steering units are delivered with set B. On special request, we can offer to our customers the other sets , as reported on the above table.

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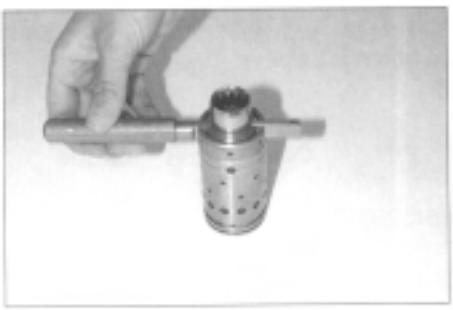
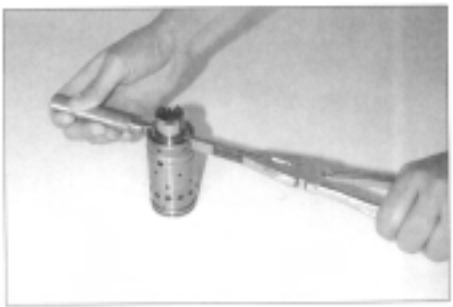
Reassembling

30 Guide the spool (2) into the sleeve (3). Make sure that spool and sleeve (only for CN and LS models) are placed correctly in relation to each other (see point 12).



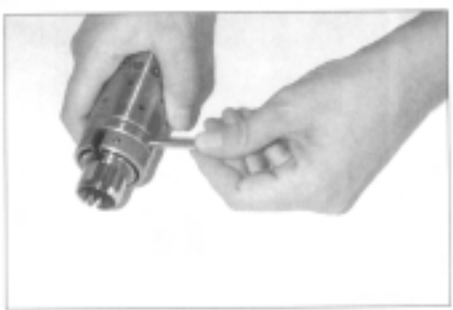
31 Insert the tool (code: AT 4873) in the spring slot.



32 Assemble the springs (7) as shown on page 11. Insert the springs in the slot of the tool and press them together using the pliers.

33 Push the neutral position springs into place in the sleeve.

⚠ ATTENTION The notches must be centred exactly in the slot of the sleeve.



34 Fit the cross pin (8) into the spool and sleeve.

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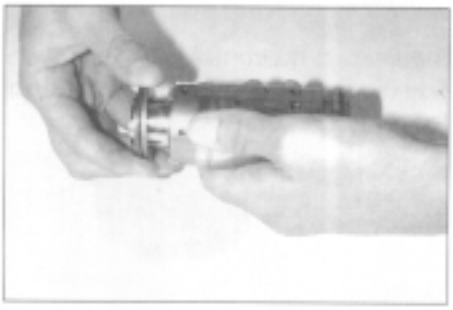
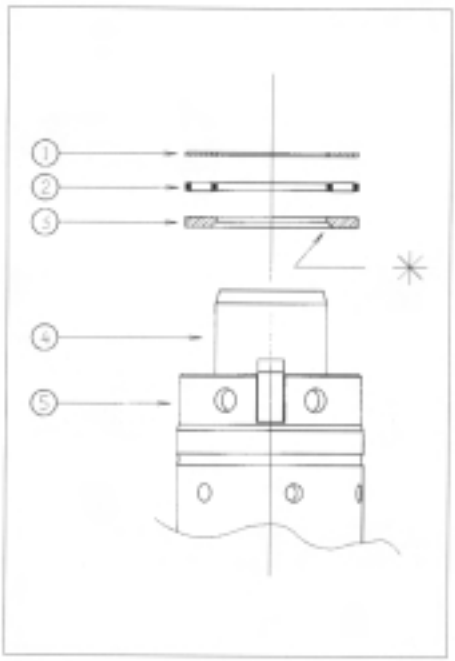


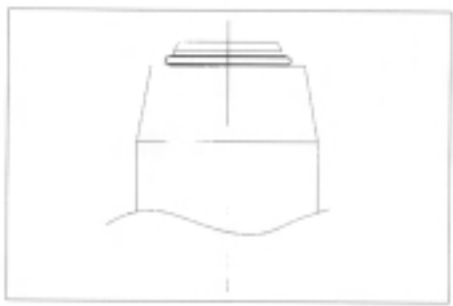
35 Insert the bearing package (5).



Assembly pattern for bearings

1 outer bearing race
2 needlebearing
3 inner bearing race
4 spool
5 sleeve

* The inner bearing race is thicker than the outer bearing race and the inside chamfer on the inner bearing race must face the inner spool.



Grease rotary seal (4) with hydraulic oil and place it on the tool (cod. AT 0710).

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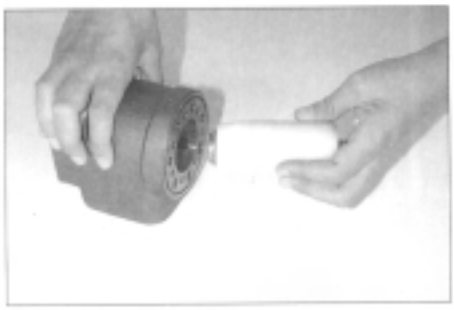

36 Place the steering unit with the bore in horizontal.
With a rotating movement, guide the outer part of the assembly tool into the bore for the spool/sleeve.

37 Unthread the rotary seal from the internal part of the tool in the housing, holding the outer part of the tool against the body of the steering unit and then guide the inner part of the tool right to the bottom.

38 With a light rotating movement, guide the lubricated spool (2) and sleeve (3) set into the lubricated bore.
Make sure the spool and sleeve are fully in contact with the bearing assembly (5) and totally inserted in the body.

⚠ **ATTENTION** Fit the spool and sleeve set while holding the cross pin horizontally.

39 Turn the steering unit so as to position the bore vertically again and make sure the spool and sleeve do not stick out of the housing. Put the check valve ball (24) into the hole pointed by the arrow.

40 Screw the threaded bush (22) lightly into the check valve bore. The top of the bush must lie just below the surface of the housing.

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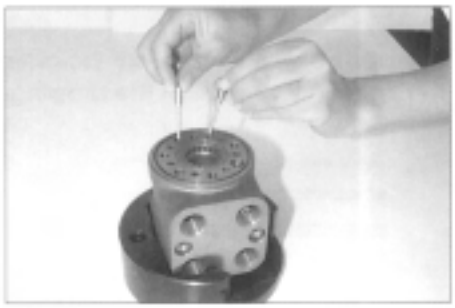
Assembly of the two suction valves for STA

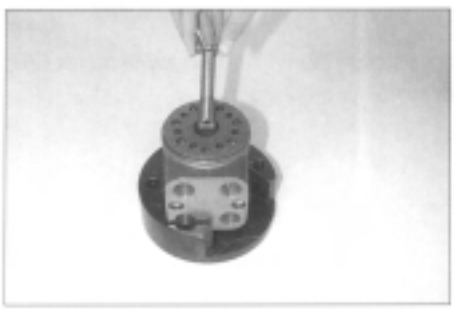
41 Place the 2 balls (11) in the holes as pointed by the arrows.



42 Place the 2 pins (12) in the same two holes.

43 Lubricate the O-ring (21) with hydraulic oil and place it in the groove.

44 Place the small flange (14) so that the channel holes match the holes in the housing.



45 Drive the cardan shaft (13) down into the bore together with the pin so that the slot and the pin itself are normal with the oil port flange.

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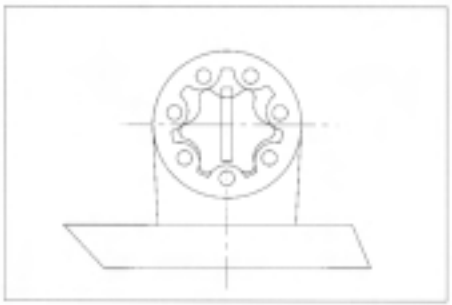
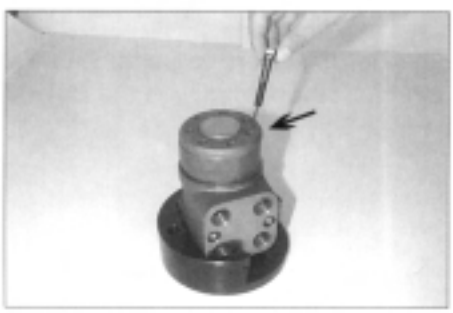
46 Lubricate the two O-rings (21) with mineral oil (viscosity ~500cSt at 20°C) and place them in the two grooves in the gerotor (15). Fit the gerotor on the cardan shaft.



47 **⚠ ATTENTION:** Fit the gerotor and cardan shaft so that the cross pin takes the position indicated in the drawing.

48 Fit the spacer (18) if necessary.

49 Place the end cover (16) in position.



50 Lubricate and insert the special screw (19) with the new washer (20) and place it in the indicated hole.

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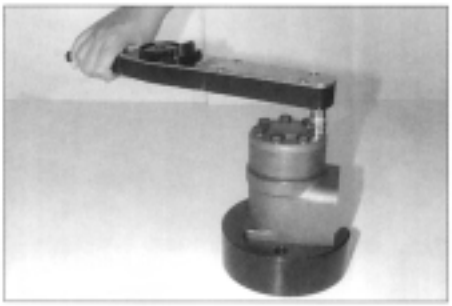
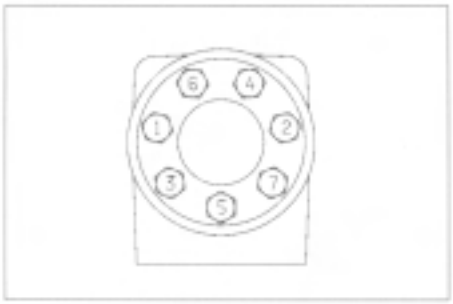
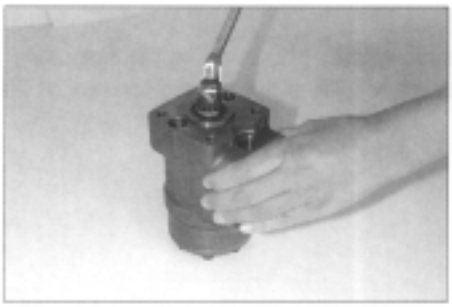


51 Drive the six screws (17) with washers (20) into the holes. Cross tighten all the screws with a torque of 30 ± 5 Nm (3 Kgm.) using the torque spanner.

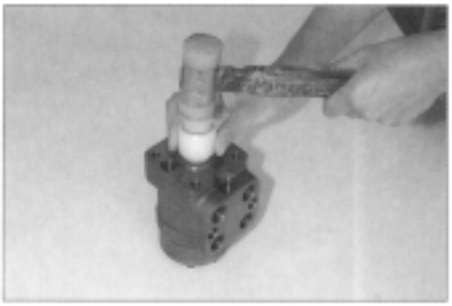


⚠ ATTENTION: The cross tightening of the screws and the accurate torque, as indicated in the drawing, are a key factor in the good functioning of the steering unit.



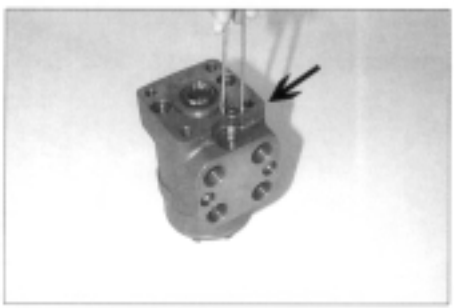
52 Verify the free rotation of the spool with the tool (code: AT 4883) and the ring spanner 13 mm.

N.B. In case the necessary torque for rotation is higher than the resistance of the springs (3 Nm), loosen the seven screws and repeat the tightening (fig. 51).



53 Place the dust seal (1) in the housing with the tool (code: AT 4871) using the plastic hammer.

Assembly of the relief valve for STA ON/STA LS.



54 Insert the piston (35/38) and verify the correct position in the seat.

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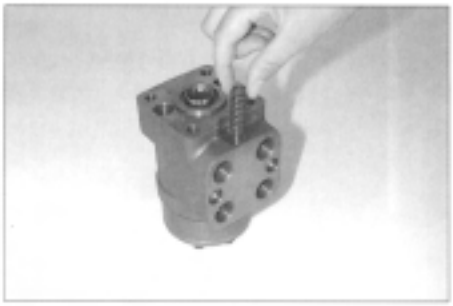
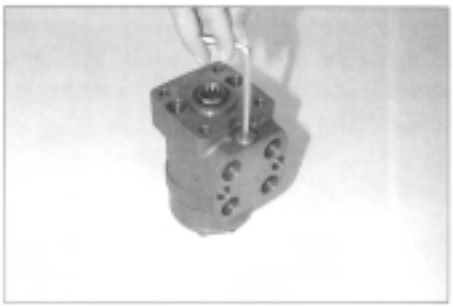
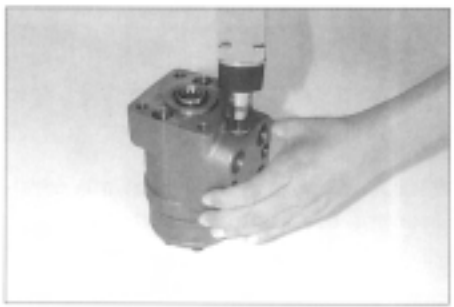


55 Insert the spring (33/37) centred on the piston.

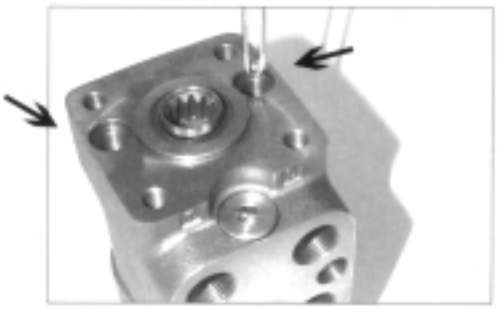


56 Screw in the setting screw (33) with a 6 mm hexagon socket spanner, positioning the setting screw according to the measuring done in the dismantling phase (fig. 24 page 9). The setting of the pressure can also be done on the test bench or on the vehicle.

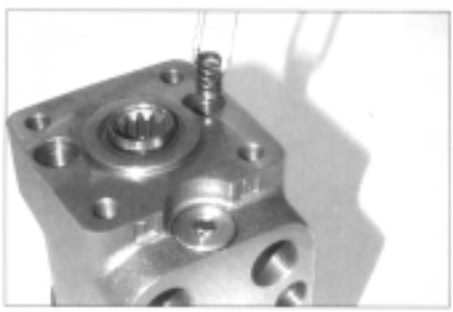


57 Screw plug (31) with a new seal washer (32) into the housing using an 8 mm hexagon socket spanner with a tightening torque of 20 ±10 Nm.

Assembly of the anti-shock valves for STA/STA LS/STA LSR



58 Put the balls (11) in the two holes indicated by the arrows.



59 Place springs (28) and valve cones (29) over the two balls.

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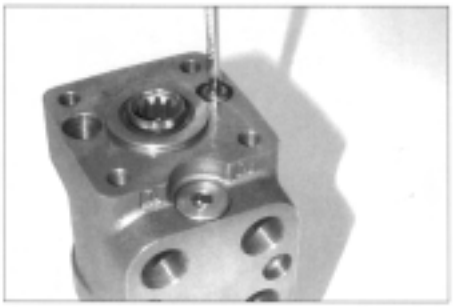
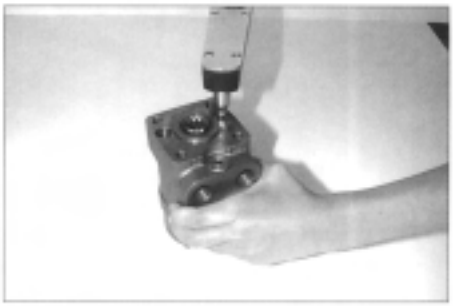


60 Screw in the two setting screws (27) using a 6 mm hexagon socket spanner, positioning the setting screw according to the measuring done in the dismantling phase (fig. 19 page 8). The setting of the pressure can also be done on the test bench.



61 Screw the plugs (25) with seal (26) into the two anti-shock valves and tighten them with a torque of 20 Nm using a 6 mm hexagon socket spanner.

The steering units are now assembled.

Tightening torque

The values listed up in the following charts must be observed for the tightening torque of oil ports and installation screws:

oil ports chart

Oil ports	Torque Nm	*lbf in*	Nm	*lbf in*	Nm	*lbf in*	Nm	*lbf in*
	Cutting edge		Copper washer		Aluminium washer		O-ring	
G 1/4	40	*354*	20	*177*	30	*265*		
G 3/8	60	*531*	20	*177*	50	*442*		
G 1/2	100	*885*	30	*265*	80	*708*		
7/16- 20 UNF	40	*354*	20	*177*	30	*265*	20	*177*
3/4 - 16 UNF	100	*885*	30	*265*	80	*708*	60	*531*
7/8 - 14 UNF	100	*885*	30	*265*	80	*708*	70	*619*
M 18 x 1.5	70	*619*	20	*177*	50	*442*	50	*442*

installation screws chart

Installation screws	Torque Nm	*lbf in*
M 10x1	65	*575*
M 10	30	*265*
M 8x1	30	*265*
3/8 - 16 UNC	25	*221*

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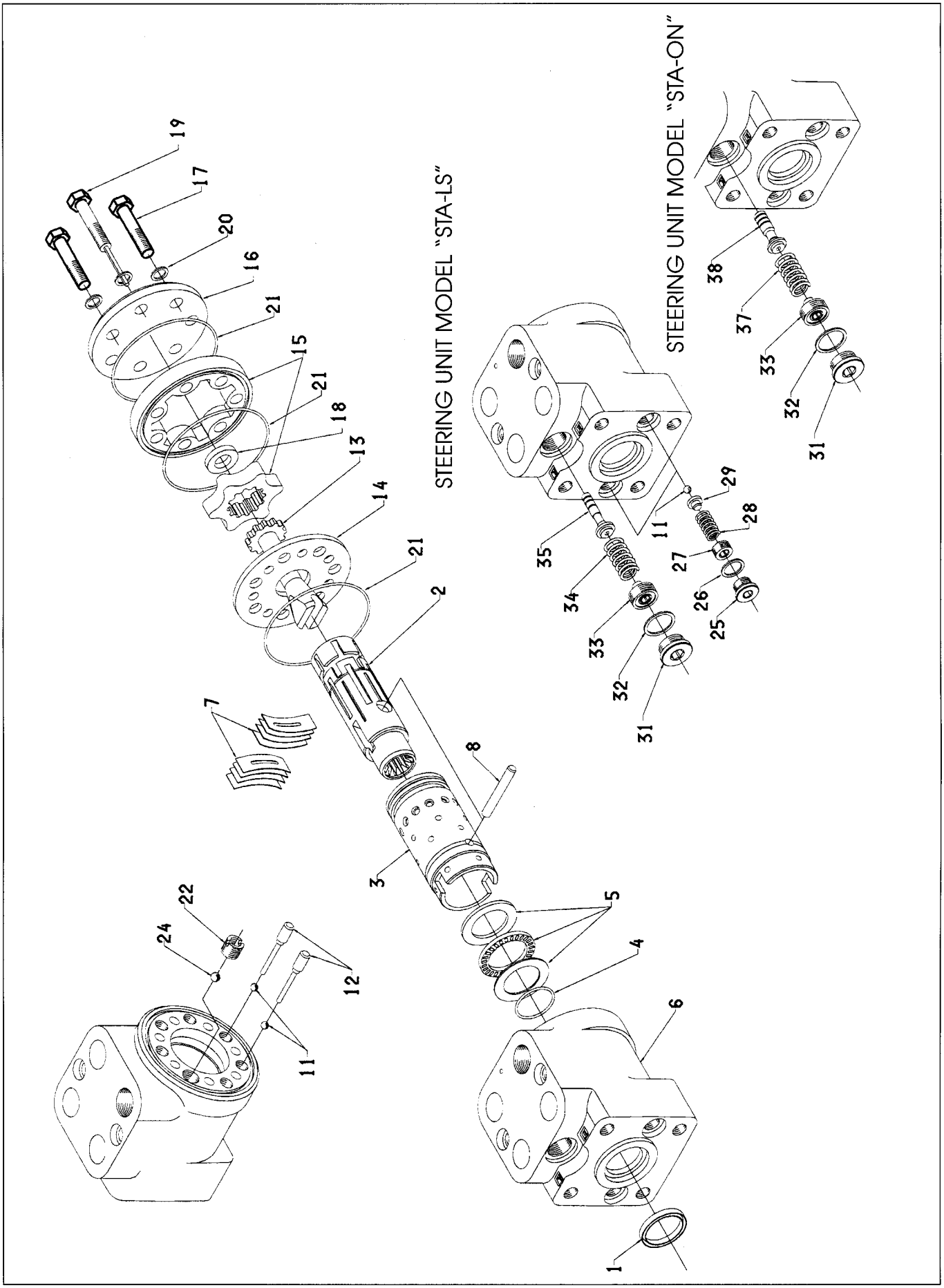

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MATRIX COMPONENTS -ST-

Reference of drawing 905xxxxxx

Quantities for single steering units

Note	KEY	P/N	DESCRIPTION	ST-A-ON-G	ST-A-ON-I	ST-Y-ON-G	ST-Y-ON-I	ST-X-ON-G	ST-X-ON-I	ST-H-ON-G	ST-H-ON-IM	ST-X-OR-G	ST-X-OR-I	ST-X-CN-G	ST-X-CN-I	ST-A-LS-G-F	ST-A-LS-G-S	ST-A-LS-I-S	ST-Y-LS-G-S	ST-X-LS-G-S	ST-X-LS-I-S	ST-Z-LSR-G-
**	1	425910010	DUST SEAL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*	2	102130060	SPOOL ON (50-80-100 cc)	1	1	1	1	1	1	1	1											
*	2	102140010	SPOOL ON>Q (more than 100 cc)	=	=	=	=	=	=	=	=											
*	2	102130031	SPOOL OR (50-80-100 cc)									1	1									
*	2	102130033	SPOOL OR>Q (more than 100 cc)									=	=									
*	2	102130032	SPOOL CN											1	1							
*	2	102130040	SPOOL LS													1	1	1	1	1	1	
*	2	102130070	SPOOL LSR																			1
*	3	122000090	SLEEVE ON (50-80-100 cc)	1	1	1	1	1	1	1	1											
*	3	122000070	SLEEVE ON>Q (more than 100 cc)	=	=	=	=	=	=	=	=											
*	3	122000011	SLEEVE OR (50-80-100 cc)									1	1									
*	3	122000080	SLEEVE OR>Q (more than 100 cc)									=	=									
*	3	122000012	SLEEVE CN											1	1							
*	3	122000050	SLEEVE LS													1	1	1	1	1	1	
*	3	122000100	SLEEVE LSR																			1
**	4	425371254	ROTARY SEAL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	5	437490010	BEARING ASSEMBLY	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*	6	131210010	HOUSING ST-A-ON-G	1																		
*	6	131210011	HOUSING ST-A-ON-I		1																	
*	6	131210180	HOUSING ST-Y-ON-G			1																
*	6	131210190	HOUSING ST-Y-ON-I				1															
*	6	131210090	HOUSING ST-X-ON-G					1														
*	6	131210091	HOUSING ST-X-ON-I						1													
*	6	131210240	HOUSING ST-H-ON-G							1												
*	6	131210242	HOUSING ST-H-ON-IM								1											
*	6	131210120	HOUSING ST-X-OR-G									1										
*	6	131210121	HOUSING ST-X-OR-I										1									
*	6	131210110	HOUSING ST-X-CN-G											1								
*	6	131210111	HOUSING ST-X-CN-I												1							
*	6	131210050	HOUSING ST-A-LS-G-F													1						
*	6	131210060	HOUSING ST-A-LS-G-S														1					
*	6	131210061	HOUSING ST-A-LS-I-S															1				
*	6	131210132	HOUSING ST-Y-LS-G-S																1			
*	6	131210130	HOUSING ST-X-LS-G-S																	1		
*	6	131210131	HOUSING ST-X-LS-I-S																		1	
*	6	131210220	HOUSING ST-Z-LS-G-S																			1
	7	151320030	SPRINGS	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	8	141210010	CROSS PIN D.6*42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	9	193524016	NAME METAL PLATE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	10	427011200	RIVET CHOBERT D. 2,4 L=3,2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	11	428620032	BALL D.3/16	4	4					2	2					4	4	4				2
	12	302000020	PIN	2	2											2	2	2				2
	13	102240010	CARDAN SHAFT	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	14	147140010	SMALL FLANGE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	15	301210XXX	GEROTOR (SEE SETTING MARTIX)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	16	147140020	END COVER	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	17	4260270XX	SCREW M8*1 (SEE SETTING MATRIX)	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	18	137210XXX	SPACER (SEE SETTING MATRIX)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	19	302000XXX	SPECIAL SCREW M8* (SEE SETTING MATRIX)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
**	20	187100030	WASHER D.12/8*1	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
**	21	425830054	O-RING 2-40	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	22	116250010	THREAD BUSHING	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*	23	302000010	ONE WAY VALVE G 1/2	1		1		1		1		1		1		1	1		1	1		1
*	23	302000011	ONE WAY VALVE I 3/4 16 UNF		1		1		1		1		1		1			1			1	
	24	428620042	BALL D. 1/4"													1	1	1	1	1	1	1
	24	428620056	BALL D. 11/32	1	1	1	1	1	1	1	1	1	1	1	1							
	25	182030100	PLUG FOR ANTI-SHOCK VALVE	2	2					2	2					2	2	2				
**	26	451430020	COPPER WASHER	2	2					2	2					2	2	2				
	27	182030090	SETTING SCREW FOR ANTI-SHOCK VALVE	2	2					2	2					2	2	2				
	28	151050140	SPRINGS FOR ANTI-SHOCK VALVE	2	2					2	2					2	2	2				
	29	150060010	BALL GUIDE FOR ANTI-SHOCK VALVE	2	2					2	2					2	2	2				
	31	182030200	PLUG FOR RELIEF VALVE	1	1	1	1			1	1					1	1	1	1			1
**	32	451430050	SEAL WASHER	1	1	1	1			1	1					1	1	1	1			1
	33	182030111	SETTING SCREW FOR RELIEF VALVE	1	1	1	1			1	1					1	1	1	1			1
	34	151050152	SETTING SPRING FOR RELIEF VALVE LS													1	1	1	1			1
	35	160840021	PISTON FOR RELIEF VALVE LS													1	1	1	1			1
	37	151050150	SET. SPRING FOR RELIEF V. HIGH SET. (110-175 BAR)	1	1	1	1			1	1											
	37	151050151	SET. SPRING FOR RELIEF V. LOW SET (70-100 BAR)	=	=	=	=			=	=											
	38	160840020	SPOOL FOR RELIEF VALVE	1	1	1	1			1	1											
	56	428506090	MALE PLUG R1/2"	4		4		4		4		4		4		4	4		4	4		4
	56	428508310	MALE PLUG 3/4"-16 UNF		4		4		4		4		4		4			4			4	
	58	451441200	WASHER	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	61	800030010	SEAL KIT ST (**SEAL KIT COMPONENTS)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*	NOTE : THESE COMPONENTS CAN NOT BE SUPPLIED SEPERATLY																					

MATRIX COMPONENTS FOR DISPLACEMENT -ST-

Reference of drawing 905xxxxxx

KEY	P/N Drawing	DESCRIPTION (Quantity)	DISPLACEMENT 50 CC	80 CC	100 CC	125 CC	160 CC	200 CC	250 CC	315 CC	400 CC
15	301210XXX	GEROTOR 6 LOBES 8 SERIES (1 PCS.)	301210010	301210020	301210030	301210040	301210050	301210060	301210150	301210070	301210080
17	4260270XX	SCREW M8*1 UNI 5738 10K (6 PCS.)	426027081	426027082	426027082	426027083	426027084	426027085	426027085	426027088	426027090
19	302000XXX	SPECIAL SCREW M8*1 UNI 5738 DIN 960 10.9 (1 PCS.)	302000030	302000030	302000040	302000040	302000050	302000060	302000070	302000110	302000120
18	137210XXX	SPACER (1 PCS.)	/	137210040	137210050	137210060	137210070	137210080	137210050 137210080	137210150	137210160

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ERROR FINDING AND CORRECTIVE ACTIONS (x)

ERROR	POSSIBLE REASON	CORRECTIVE ACTIONS
Leakage of oil from circuit	Non efficient seals of the steering unit	Replace the seals
	Leakage of oil from the oil ports of the distributor, of the pump or of the steering cylinders	Tighten the fittings according to the recommended torque; if necessary replace the seals of the oil ports
Hard steering	Air in the circuit	Vent the circuit
	Incorrect setting of the relief valve	Correct the setting, eventually replace the valve
	The circuit is contaminated	Flux the circuit and eventually clean the anti-shock valves
	Too low input pressure from the pump	Control and eventually replace the pump
	Too low oil level	Fill up to the correct oil level
	Throat on the suction pipe	Chance the run of the pipe and eventually replace it
Noise in the power steering system	Too little oil in the system	Refill with the recommended oil to the correct oil level, then continue to let out air
	Air in the circuit	Vent the circuit
	Loose fittings on the suction line	Fasten the plugs according to the recommended torque
Blocked steering unit	Unclean oil	Replace the steering unit and eliminate the reasons for overheating and/or the origin of the contamination
	Overheated oil (more than 90° C)	
The steering wheel is turning by its own and constant correction of the driving wheels is necessary	Defected neutral position springs	Replace the neutral position springs
Impossible to bring the steering wheel in neutral position	Impurity present between spool and sleeve	Clean spool and sleeve
Oscillation of the wheels	Air in the circuit	Vent the circuit
	Wearing of the ball joint and bearings of the driving wheel	Replace the defected parts
Turning the steering wheel there is no steering, or at the end of the steering there is no stop	Steering cylinder with worn piston bearings	Replace the seals
	Worn gerotor group	Replace the internal gerotor group
Wheels are turning jerkily	Incorrect setting between sleeve and internal gear of the steering unit	Remake the setting

(x) the prerequisites for a correct error finding are:

- control of pressure and tear of the tyres
- control of the convergence
- the vehicle must be arranged on a level and dry surface

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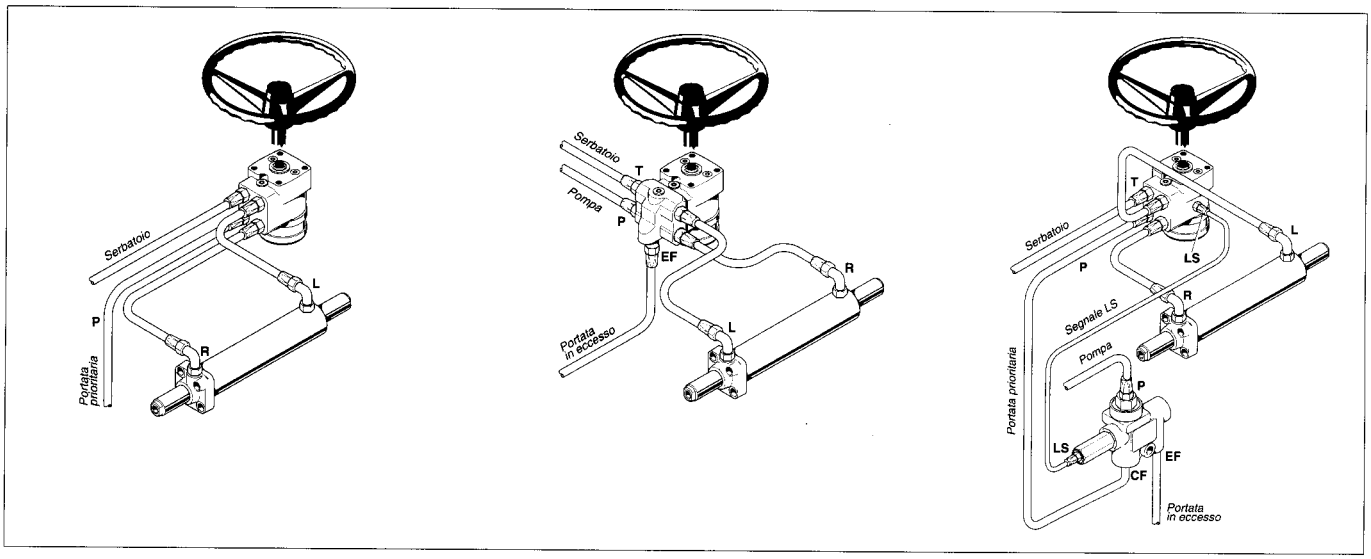
Installation

Installation must be carried out in clean conditions where pipes are hot bent.
It is important to have all scale removed chemically. Ognibene recommends the use of metallic seals (copper or aluminium), for pipe fitting joints.
Cylinder ports must be fixed facing upwards. If this is not possible, vending ports must be provided in the upper part of the cylinders.
It is advisable to connect a gauge attachment point on the pressure line (P) of the steering unit.

Connect the pipes with the respective holes of the steering unit, like indicated on the illustration, avoiding making folds or chap curves when using flexible hoses (under pressure the hoses are stiffening very hard).
Before starting make sure that all connections are tight, all venting ports open, and the tank filled. Make sure the above operations are carried out after careful cleaning.

Chard oil ports



(LEFT)	L	(TANK)	T
(RIGHT)	R	(PUMP)	P

Starting and venting

There should be no reaction torque on the steering axle when starting the system (lift the front axle or disconnect the steering cylinder from the steering wheels).
During the start-up operation, the pump must run slowly.
Turn the steering wheel alternately from the right to the left stop, but do not hold the steering wheel in the extreme (stop) position for a long time.
The circuit will be completely vented when oil coming from the venting ports is free of air bubbles or air/oil emulsions.
It is recommended that the oil level is checked and topped during this operation.

At this point it is possible to test the steering system directly doing work, controlling the pressure at oil port (P) and the temperature generated in the circuit.

During the first 30 hours of operation, be sure to check oil level regularly, possible leaks in the circuit, and filter clogging.

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SPECIFICATIONS

OIL:
We recommend the use of mineral based hydraulic oils containing antiwear additives with a viscosity of 21cSt at working temperature of 50°C.
Viscosity must be in the range of 10-1.000 cSt.

TEMPERATURE:
Working temperature ranges from +30°C up to +60°C.
Maximum working temperature is +90°C.
Operation under such conditions reduces oil life considerably.
Minimum working temperature is approximately -25°C.

FILTRATION:
Filtration is recommended in the tank line to limit contamination to ISO 4406 classes as specified below:

19/16 for LS and CN
20/17 for ON and OR

A magnetic insert is recommended when using filters larger than 25 micron.

REPAIR IN WARRANTY: We underline that repair free of charge as stated in the general sales conditions of Ognibene S.p.A., can only be carried out in the headquarters of Ognibene S.p.A. or by distributors authorised by Ognibene S.p.A.

N.B. In case the component needs servicing, please specify all the data on the metal plate together with the life of the component.

⚠ ATTENTION:

Ognibene S.p.A. does not take any responsibility for possible errors in manuals, catalogues or other written documentation. Ognibene S.p.A. reserves the right to modify its products without notice, also for products already in order, until such modifications do not change already agreed specifics.

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Notes

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Ognibene spa - 42010 Reggio Emilia Italy - Via De Pisis, 3/5 Z/I Mancasale - tel. +39 522 502501 - fax +39 522 502500
tel. international +39 522 502502 - e-mail: **sales@ognibene.com.** - home page: http://**www.ognibene.com**

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