

MAY.2019

Hydraulic Breaker

SAGA10 ~ SAGA610 Operating & Maintenance Manual



Due to our policy of continual product improvements,
designs and specifications in this manual are subject to change without advance notice

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1. Introduction

Preface

The aim of this manual is to give you a good understanding of the breaker. You will find instructions for safe and effective operation and instructions for regular maintenance activities of the breaker as well.

Before installation or operation of the breaker for the first time, please read and understand this manual carefully from front to back.

In this manual, the units of measurement are metric. In some cases imperial unit follows in parenthesis.

The specifications and designs presented in this manual are subject to change without prior notice.

2. Safety Precautions

Operation

- ◆ Operate the breaker for its intended purpose only.
- ◆ Operate the breaker only when the operator is seated in the cabin with full control of the machine.
- ◆ No bystanders are allowed in the vicinity of the breaker when it is operating. Small pieces of stone or concrete can fly off causing serious injury to bystanders.
- ◆ Stay clear of the breaker when it is operating
- ◆ Before operating the breaker, read and follow the safety decals located on the housing and powercell.
- ◆ Be sure that all decals are clearly visible. Clean and replace as necessary.

Protective equipment

- ◆ Always wear the following personal protective equipment: safety glasses, ear protection, protective gloves and protective shoes

Maintenance

- ◆ The accumulator and back head are charged with nitrogen gas. Only use nitrogen gas to recharge them. Charging with any other gas could trigger an explosion and lead to serious or possibly fatal injuries.
- ◆ Make sure that all gas in the accumulator and back head is completely relieved before beginning disassembly to avoid potential accidents or injury.
- ◆ Stay clear of the tool when recharging the back head. Gas pressure may lead unexpected piston movement and hence the tool movement.
- ◆ Do not substitute alternate parts not intended for the application. Failure to comply can result in machine failure.

Hot parts

- ◆ Never touch the hot parts and wait for them to cool down first if you have to touch them.
- ◆ Hot hydraulic oil can cause burns. Never use your fingers to check for hydraulic fluid leaks and always keep your face away from a possible leak.

SPECIFICATION

1. Hammer Specifications

Specification	Unit	Small Sized															
		SAGA10		SAGA20		SAGA30		SAGA40		SAGA50		SAGA55	SAGA81		SAGA100		
		Open	Box	Open	Box	Open	Box	Open	Box	Open	Box	Backhoe	Open	Box	Open	Box	
Working Weight	kg (lb)	64 (141)	67 (148)	110 (245)	120 (265)	170 (375)	175 (385)	200 (440)	220 (485)	280 (620)	295 (650)	340 (750)	483 (965)	430 (950)	600 (1325)	570 (1255)	
Impact Rate	bpm	700 - 1100		700 - 1000		600 - 950		550 - 800		500 - 750			460 – 750		400 - 800		
Operating Pressure	bar (psi)	100 - 110 (1450 - 1600)		80 - 110 (1160 - 1595)		90 - 120 (1305 - 1740)		90 - 120 (1305 - 1740)		95 - 130 (1377 - 1885)			95 - 130 (1377 - 1885)		130 - 150 (1885 - 2175)		
–Relief Pressure	bar (psi)	140 -160 (2030 - 2320)								150 - 170 (2175 - 2465)			170 - 180 (2456 - 2610)		180 - 190 (2610 - 2755)		
Oil Flow	L/min (gal/min)	10 - 16 (2.6 - 4.2)		15 - 30 (4 - 8)		25 - 40 (7 - 10)		30 - 45 (8 - 11)		35 - 50 (9 - 13)			45 - 85 (11 - 22)		45 - 90 (11 - 23)		
Back Pressure	bar (psi)	10 (145)															
Back Head Pressure	bar (psi)	18.5 (268)		8 (116)		16 (232)		8 (116)		16 (232)							
Pressure Line Size	mm (inch)	12 (1/2)											19 (3/4)				
Return Line Size	mm (inch)	12 (1/2)											19 (3/4)				
Carrier Weight	ton (lb)	0.8 - 1.8 (1800 - 4000)		0.8 - 3 (1800 - 6600)		1.2 - 3.5 (2600 - 7700)		2 - 5 (4400 - 11000)		4 - 7 (8800 - 15400)			6 - 9 (13200 - 19800)		7 - 12 (15400 - 26400)		

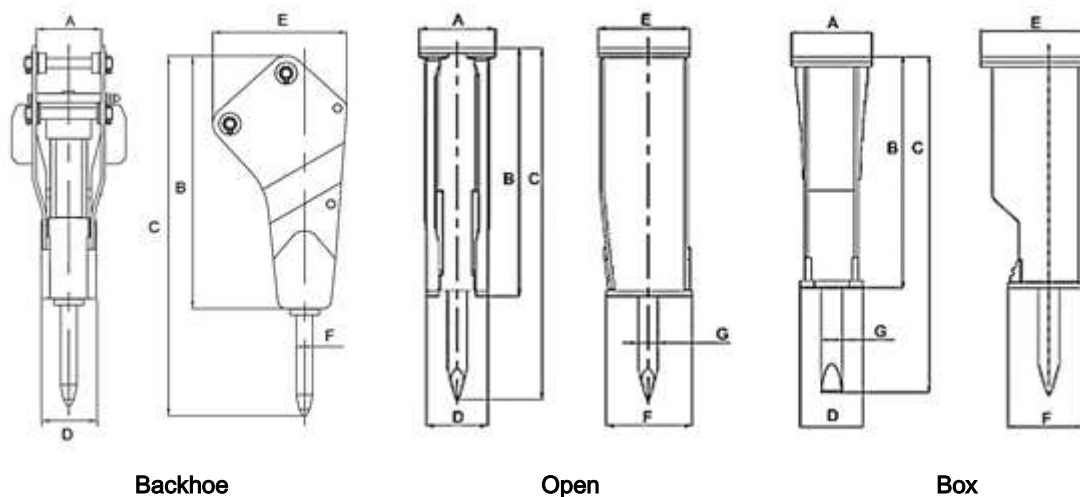
Specification	Unit	Mid-Sized									
		SAGA120		SAGA180		SAGA200		SAGA220		SAGA250	
		Open	Box	Open	Box	Open	Box	Open	Box	Open	Box
Working Weight	kg (lb)	1082 (2385)	1050 (2315)	1235 (2920)	1268 (2795)	1730 (3813)	1720 (3790)	1730 (3813)	1720 (3790)	1750 (3858)	1760 (3880)
Impact Rate	bpm	450 - 650		450 - 800		400 - 800					
Operating Pressure	bar (psi)	140 - 160 (2030 - 2320)		145 - 170 (2175 - 2465)		160 - 180 (2320 - 2610)					
Relief Pressure	bar (psi)	190 - 200 (2755 - 2900)		200 - 210 (2900 - 3045)							
Oil Flow	L/min (gal/min)	80 - 100 (21 - 26)		90 - 120 (23 - 31)		125 - 150 (33 - 39)					
Back Pressure	bar (psi)	10 (145)									
Back Head Pressure	bar (psi)	16 (232)		6 (87)				8 (116)			
Accumulator Pressure	bar (psi)	60 (870)									
Pressure Line Size	mm (inch)	19 (3/4)		25 (1)							
Pressure Line Size	mm (inch)	19 (3/4)		25 (1)							
Carrier Weight	ton (lb)	11 - 16 (24200 - 35200)		13 - 18 (28600 - 39600)		18 - 25 (39600 - 55100)					

SPECIFICATION

Specification	Unit	Large Sized									
		SAGA310		SAGA350		SAGA400		SAGA510		SAGA610	
		Open	Box	Open	Box	Open	Box	Open	Box	Open	Box
Working Weight	kg (lb)	2300 (5070)	2340 (5158)	3005 (6624)	3040 (6700)	3050 (6724)	3090 (6810)	4200 (9260)	3900 (8600)	4900 (10800)	4600 (10100)
Impact Rate	bpm	350 - 700		250 - 550		200 - 450		200 - 400		180 - 340	
Operating Pressure	bar (psi)	140 - 160 (2030 - 2320)		160 - 180 (2320 - 2610)						160 -180 (2320 – 2610)	
Relief Pressure	bar (psi)	200 - 210 (2900 - 3045)									
Oil Flow	L/min (gal/min)	160 - 180 (42 - 47)		180 - 220 (47 - 58)		190 - 260 (50 - 68)		250 - 300 (66 - 79)		250 -360 (66 – 95)	
Back Pressure	bar (psi)	10 (145)									
Back Head Pressure	bar (psi)	6 (72)		9 (130)		16 (232)					
Accumulator Pressure	bar (psi)	60 (870)									
Pressure Line Size	mm (inch)	32 (1-1/4)									
Pressure Line Size	mm (inch)	32 (1-1/4)									
Carrier Weight	ton (lb)	25 - 32 (55100 - 70547)		30 - 40 (66100 - 88100)		36 - 45 (39360 - 99200)		40 - 55 (88100 - 121200)		45 – 60 (99200 – 132200)	

SPECIFICATION

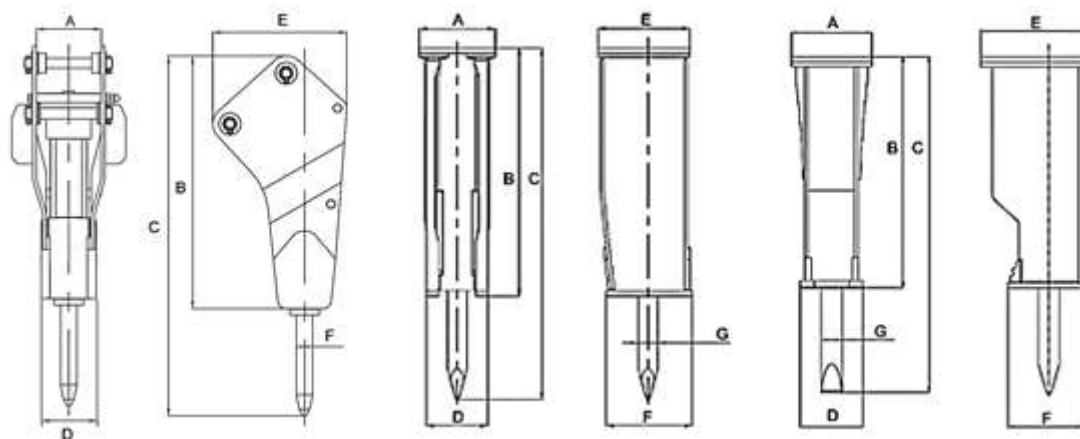
2. Main Dimensions



Backhoe	A mm	B mm	C mm	D mm	E mm	F mm	G mm
SAGA55	227	1082	1623.6	251	638	68	-

Open	A mm	B mm	C mm	D mm	E mm	F mm	G mm
SAGA10	202	571.8	812	132	191	-	38
SAGA20	244	615	961	144	280	-	44.5
SAGA30	260	724	1148	163	310	-	53
SAGA40	280	722	1192	182	320	-	59.5
SAGA50	320	825	1391	205	360	-	68
SAGA81	346	882	1487	231	460	-	74.5
SAGA100	360	1086	1893	236	430	-	85
SAGA120	500	1460	2013	350	580	440	98
SAGA180	500	1460	2167	422	600	595	120
SAGA200	525	1634	2389	449	632	572	135
SAGA220	525	1634	2389	449	632	572	135
SAGA250	525	1672	2439	449	632	526	140
SAGA310	585	2396	2632	512	655	590	150
SAGA350	635	1960	2900	530	730	680	153
SAGA400	635	2031	2867	540	730	680	160
SAGA510	705	2409	3242	565	860	775	180
SAGA610							

SPECIFICATION



Backhoe

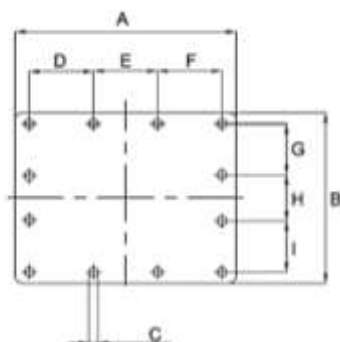
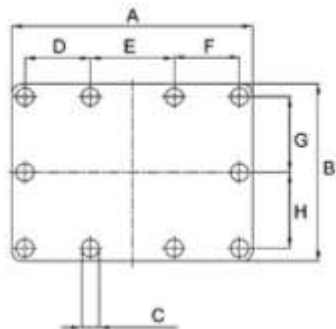
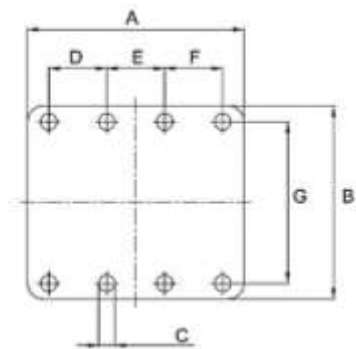
Open

Box

Box	A mm	B mm	C mm	D mm	E mm	F mm	G mm
SAGA10	202	625	848	164	191	183	38
SAGA20	250	714	902	190	270	180	44.5
SAGA30	260	838	1113	196	270	220	53
SAGA40	280	858	1168	212	290	226	59.5
SAGA50	310	998.5	1308	234	320	270	68
SAGA81	340	1071	1487	250	460	300	74.5
SAGA100	380	1342	1884	270	490	340	85
SAGA120	450	1505	1998	330	630	400	98
SAGA180	480	1465	2167	400	620	440	120
SAGA200	520	1642	2378	405	700	480	135
SAGA220	520	1642	2378	402	700	480	135
SAGA250	520	1638	2378	405	700	480	140
SAGA310	620	1835	3455	470	740	520	150
SAGA350	700	2050	2785	470	830	570	153
SAGA400	700	2075	2900	488	830	570	160
SAGA510	625	2415	3208	487	880	595	180
SAGA610							

SPECIFICATION

3. Bolt Patterns



Model	Housing	A mm	B mm	C mm	D mm	E mm	F mm	G mm
SAGA10	Open	191	202	14	55	53	55	174
	Box	191	202	14	55	53	55	174
SAGA20	Open	280	244	21	75	75	75	204
	Box	270	250	20	75	75	75	210
SAGA30	Open	310	260	20	75	80	75	215
	Box	270	260	21	72.5	75	72.5	220
SAGA40	Open	320	280	21	80	80	80	240
	Box	290	280	21	80	80	80	240
SAGA50	Open	360	320	21	90	90	90	270
	Box	320	310	21	90	90	90	266
SAGA55	Backhoe	-	-	-	-	-	-	-
SAGA81	Open	460	346	21	125	160	125	296
SAGA100	Open	430	360	21	110	125	110	300

Model	Housing	A mm	B mm	C mm	D mm	E mm	F mm	G mm
SAGA81	Box	460	340	21	125	160	125	290
SAGA100	Box	490	380	21	145	150	145	330

Model	Housing	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	I mm
SAGA120	Open	580	500	27	135	180	135	135	180	135
	Box	630	450	27	185	190	175	130	130	130
SAGA180	Open	600	500	26	116	124	160	120	180	120
	Box	620	480	27	180	180	180	147.5	130	147.5
SAGA200	Open	632	525	27	192	150	150	120	200	120
	Box	700	520	27	200	200	200	155	150	155
SAGA220	Open	632	525	27	192	150	150	120	200	120
	Box	700	520	27	200	200	200	155	150	155
SAGA250	Open	632	525	27	192	150	150	120	200	120
	Box	700	520	27	200	200	200	155	150	155
SAGA310	Open	655	585	33	168	168	168	180	145	180
	Box	740	620	39	215	215	215	165	180	165
SAGA350	Open	730	635	39	175	220	175	130	275	130
	Box	830	700	39	240	250	240	200	200	200
SAGA400	Open	730	635	39	175	220	175	130	275	130
	Box	830	700	39	240	250	240	200	200	200
SAGA510	Open	860	705	39	220	220	220	175	165	175
	Box	880	625	39	265	260	265	177.5	180	177.5

SPECIFICATION

4. Carrier Weight

Breaker Model	Carrier Weight ton											
	0	5	10	15	20	25	30					
SAGA10												
SAGA20		0.8 - 3										
SAGA30		1.2 - 3.5										
SAGA40		2 - 5										
SAGA50			4 - 7									
SAGA55			4 - 7									
SAGA81			6 - 9									
SAGA100				7 - 12								
SAGA120					11 - 16							
SAGA180						13 - 18						
SAGA200						18 - 25						
SAGA220						18 - 25						
SAGA250						18 - 25						

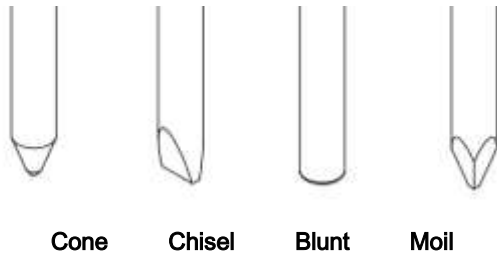
Breaker Model	Carrier Weight ton											
	25	30	35	40	45	50	55					
SAGA310		25 - 32										
SAGA350			32 - 40									
SAGA400				36 - 45								
SAGA510				40 - 55								

SPECIFICATION

Breaker Model	Carrier Weight ton																			
	45				50				55				60				65			
	75																			
SAGA610																				

SPECIFICATION

5. Tool Specifications



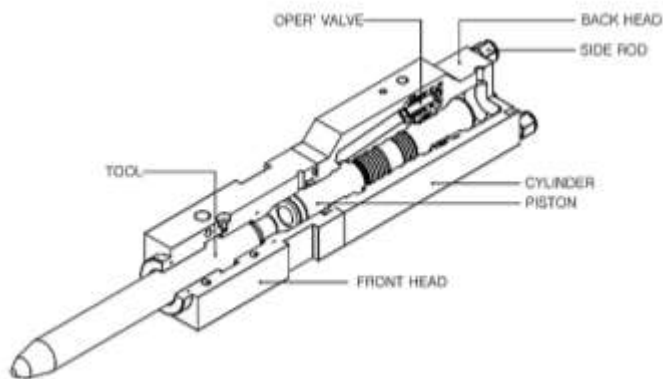
Cone Chisel Blunt Moil

Model	Type	Length mm (in)	Weight kg (lb)	Diameter mm (in)
SAGA10	Cone	380 (14.96)	3.0 (6.6)	38 (1.49)
	Chisel	380 (14.96)	3.1 (6.8)	38 (1.49)
	Blunt	380 (14.96)	3.2 (7.1)	38 (1.49)
	Moil	380 (14.96)	3.0 (6.6)	38 (1.49)
SAGA20	Cone	403 (15.86)	4.2 (9.3)	44.5 (1.75)
	Chisel	403 (15.86)	4.4 (9.7)	44.5 (1.75)
	Blunt	403 (15.86)	4.8 (10.6)	44.5 (1.75)
	Moil	403 (15.86)	4.3 (9.5)	44.5 (1.75)
SAGA30	Cone	500 (19.69)	7.3 (16.1)	53 (2.09)
	Chisel	500 (19.69)	7.6 (16.8)	53 (2.09)
	Blunt	500 (19.69)	8.1 (17.9)	53 (2.09)
	Moil	500 (19.69)	7.4 (16.3)	53 (2.09)
SAGA40	Cone	560 (22.04)	11 (24)	59.5 (2.34)
	Chisel	560 (22.04)	11.3 (25)	59.5 (2.34)
	Blunt	560 (22.04)	11.8 (26)	59.5 (2.34)
	Moil	560 (22.04)	10.5 (23)	59.5 (2.34)
SAGA50	Cone	697 (27.44)	17.5 (38.6)	68 (2.68)
	Chisel	697 (27.44)	17.5 (38.6)	68 (2.68)
	Blunt	697 (27.44)	18.7 (41)	68 (2.68)
	Moil	697 (27.44)	17 (37.5)	68 (2.68)
SAGA55	Cone	697 (27.44)	17.5 (38.6)	68 (2.68)
	Chisel	697 (27.44)	17.5 (38.6)	68 (2.68)
	Blunt	697 (27.44)	18.7 (41)	68 (2.68)
	Moil	697 (27.44)	17 (37.5)	68 (2.68)
SAGA81	Cone	742 (29.37)	23.3 (51.4)	74.5 (2.93)
	Chisel	742 (29.37)	23.2 (51)	74.5 (2.93)
	Blunt	742 (29.37)	24.3 (53.6)	74.5 (2.93)
	Moil	742 (29.37)	22.2 (49)	74.5 (2.93)
SAGA100	Cone	895 (25.24)	36 (79.5)	85 (3.35)
	Chisel	895 (25.24)	35.6 (78.5)	85 (3.35)
	Blunt	850 (33.47)	35.8 (79)	85 (3.35)
	Moil	895 (25.24)	34.6 (76.3)	85 (3.35)
SAGA120	Cone	950 (37.4)	50 (110.2)	98 (3.86)
	Chisel	950 (37.4)	51 (112.3)	98 (3.86)
	Blunt	950 (37.4)	53 (116.8)	98 (3.86)
	Moil	950 (37.4)	49 (108)	98 (3.86)

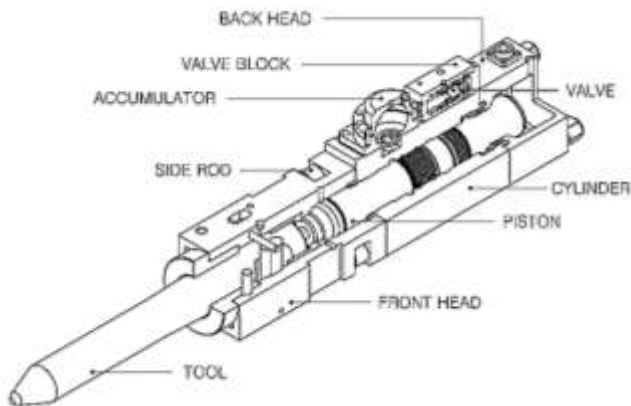
Model	Type	Length mm (in)	Weight kg (lb)	Diameter mm (in)
SAGA180	Cone	1100 (43.31)	88 (194)	120 (4.72)
	Chisel	1100 (43.31)	90 (198)	120 (4.72)
	Blunt	1100 (43.31)	95 (209)	120 (4.72)
	Moil	1100 (43.31)	86 (190)	120 (4.72)
SAGA200	Cone	1200 (47.24)	122 (248.7)	135 (5.31)
	Chisel	1200 (47.24)	124 (273.3)	135 (5.31)
	Blunt	1200 (47.24)	131 (288.8)	135 (5.31)
	Moil	1200 (47.24)	121 (266.7)	135 (5.31)
SAGA220	Cone	1200 (47.24)	122 (248.7)	135 (5.31)
	Chisel	1200 (47.24)	124 (273.3)	135 (5.31)
	Blunt	1200 (47.24)	131 (288.8)	135 (5.31)
	Moil	1200 (47.24)	121 (266.7)	135 (5.31)
SAGA250	Cone	1235 (48.6)	130.9 (288.6)	140 (5.5)
	Chisel	1235 (48.6)	134 (295.4)	140 (5.5)
	Blunt	1200 (47.24)	137 (302)	140 (5.5)
	Moil	1235 (48.6)	130 (286.6)	140 (5.5)
SAGA310	Cone	1300 (51.18)	164 (362)	150 (5.91)
	Chisel	1300 (51.18)	165 (364)	150 (5.91)
	Blunt	1300 (51.18)	173 (381)	150 (5.91)
	Moil	1300 (51.18)	160 (353)	150 (5.91)
SAGA350	Cone	1400 (55.11)	175 (385)	153 (6.02)
	Chisel	1400 (55.11)	179 (394)	153 (6.02)
	Blunt	1400 (55.11)	175 (385)	153 (6.02)
	Moil	1400 (55.11)	170 (374)	153 (6.02)
SAGA400	Cone	1400 (55.11)	189 (417)	160 (6.30)
	Chisel	1400 (55.11)	194 (428.6)	160 (6.30)
	Blunt	1400 (55.11)	206 (454)	160 (6.30)
	Moil	1400 (55.11)	188 (414)	160 (6.30)
SAGA510	Cone	1500 (59.06)	258 (568)	180 (7.09)
	Chisel	1500 (59.06)	273 (601)	180 (7.09)
	Blunt	1500 (59.06)	273 (601)	180 (7.09)
	Moil	1500 (59.06)	263 (579)	180 (7.09)
SAGA610	Cone	1650 (64.96)	344 (758)	195 (7.670)
	Chisel	1650 (64.96)	361 (796)	195 (7.670)
	Blunt	1650 (64.96)	377 (831)	195 (7.670)
	Moil	1650 (64.96)	349 (769)	195 (7.670)

6. Structure

SAGA20 - 100



SAGA120 – 510



Side rod

Three major parts of the breaker, front head, cylinder and back head, are secured by four side rods.

Back head

Hydraulic ports along with nitrogen gas chamber are built into the back head.

Operating valve

Operation control valve is built into the cylinder and controls piston reciprocation.

Cylinder

Hydraulic circuit for reciprocating the piston is built into the cylinder.

Accumulator

Accumulator stores hydraulic fluid for use during hammering cycle and absorbs any pulsations in the hydraulic circuit.

Piston

Kinetic energy of the piston is converted into impact energy when it is transmitted to the working steel.

Front head

Front head holds the tool via thrust ring and built-in upper bushing.

Tool

Depending upon the application, cone, chisel, blunt ormoil tool can be used.

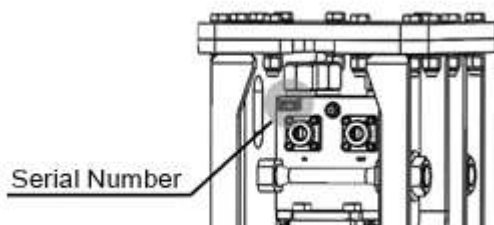
OPERATION

1. Serial Number

Identification of the product and part serial number is important when claiming warranty or ordering spare parts.

Product serial number

The product serial number is stamped on the back head.



♦ Tool pin



♦ Tool bushing



Parts serial number

♦ Tool



♦ Piston



♦ Cylinder

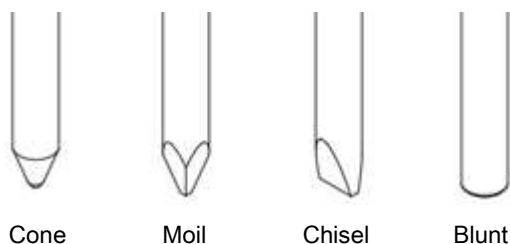


♦ Front head



2. Guide to Tool Choice

The correct choice of the most suitable tool is crucial not only for increasing hydraulic breaker productivity but also for the life of the tool itself



Cone, moil or chisel tools are suitable for most jobs. In trenching, benching and demolition applications, the material is broken by a combination of impact energy and a wedging effect that forces the material to separate as the tool penetrates. Cone is used for general demolition work where penetrative breaking is required. Moil is used where increased breakout forces are required. Chisel is preferred where a cutting action is required.

Blunt tool is suitable for secondary breaking, boulder reduction applications and scaling in mines or tunnels. The tool breaks the material with stress waves generated by the hammer, passing through the tool and into the material. Blunt provides an excellent combination of productivity and resistance to wear.

3. Installation and Removal of the Hammer

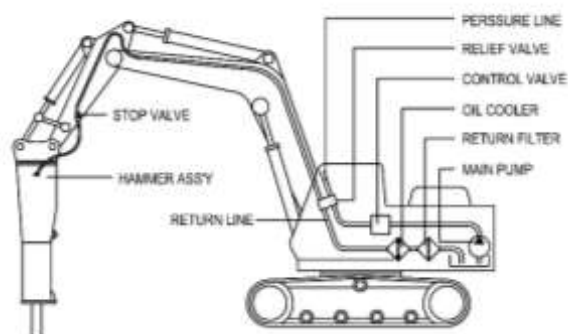
Installation

1. Before connecting the hammer, make sure to carry out flushing first to prevent hammer from being contaminated external particles from hoses and etc.
2. Check and record the carrier pump performance as described in the Hammer Installation Card.
3. Position the hammer horizontally on the floor and install arm pin first and then link pin.
4. Connect hoses. Hammer inlet port is marked with "IN" and outlet port with "OUT".
5. Open the stop valves of carrier pressure and return lines.

Removal from carrier

1. Position the hammer horizontally.
2. Stop the carrier engine. Close the stop valves of carrier pressure and return lines.
3. Disconnect hoses. Protect environment from oil spills. Plug the hoses and the hammer inlet and outlet ports.
4. Remove link pin first and then arm pin.

4. Setting of Relief Pressure

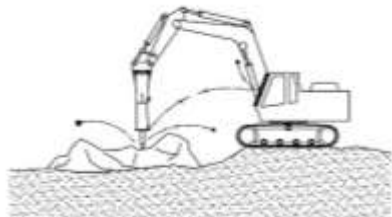


Relief valve

- ◆ The relief valve is a safety device which is used to protect the breaker when the pressure rises in hydraulic circuit.
- ◆ The relief pressure is measured from the carrier pressure line while closing the stop valve.
- ◆ The relief valve setting should be acceptable as per the specification of each model. Adjust if necessary.

5. Operating Precautions

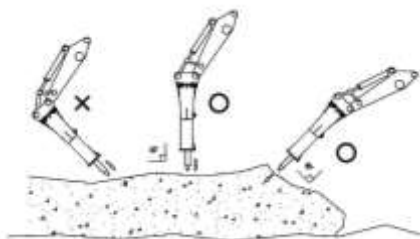
- ◆ Keep the cabin windows and doors closed during operation



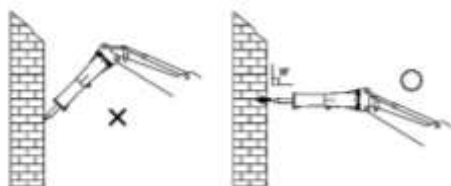
- ◆ Use the excavator boom to press the hammer firmly against the object.



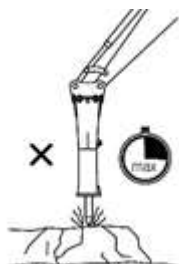
- ◆ Place the tool against the object at a 90 degree angle. Listen to the hammer's sound when you are using it. If the sound becomes thinner and the impact less efficient, the tool is misaligned with the material and/or there is not enough down force on the tool. Realign the tool and press the tool firmly against the material if necessary.



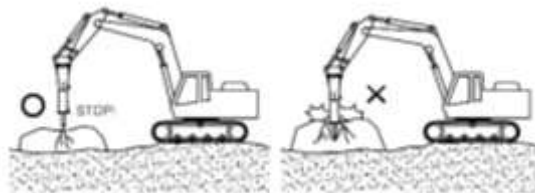
- ◆ When demolishing vertical structures, place the tool against the wall at a 90 degree angle.



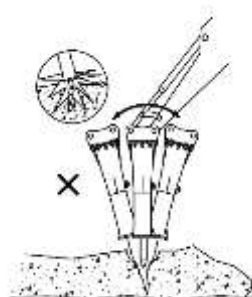
- ◆ Do not strike in one spot for more than 15 seconds at a time. If the object does not break, or if the tool does not penetrate, stop the hammer and change the position of the tool



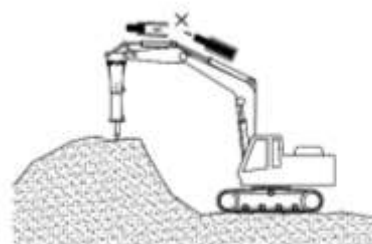
- ◆ When the object starts to break, stop the hammer immediately. Do not allow the hammer to fall down and make idle strokes. Frequent idle strokes would lead deteriorating effect on the hammer components.



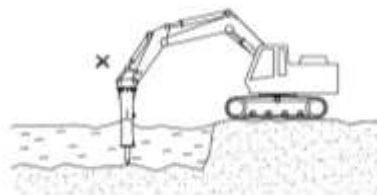
- ◆ When breaking concrete, hard or frozen ground, never strike and pry with the tool at the same time. The tool may snap off. Bending may be caused by stones inside hard or frozen ground. Be careful and stop striking if you find sudden resistance under the tool.



- ◆ Do not operate the hammer with the carrier's boom stick or bucket cylinders at the end of their stroke (either fully extended or fully retracted). This may result in damage of the carrier cylinder.



- ◆ The breaker as a standard assembly, must not be used under water. Please always contact Dealer or Customer Support in case of underwater application.

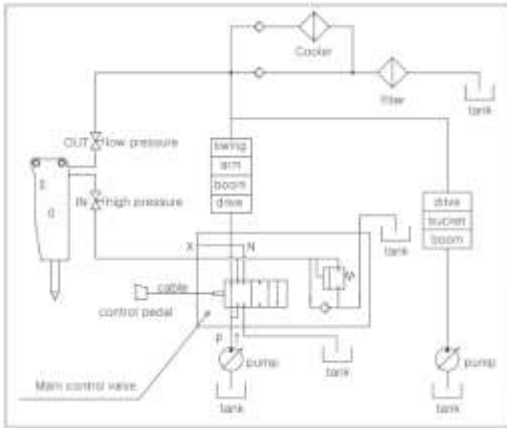


OPERATION

6. Operating Temperature

The optimized operating temperature of the hammer is $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$ ($-4^{\circ}\text{F} \sim +176^{\circ}\text{F}$). If the temperature is lower than -20°C (-4°F), the breaker and tool must be preheated before starting the operation in order to avoid damage of the tool. They will remain warm during operation they will remain warm.

7. Hydraulic Circuit



8. Hydraulic Oil

General requirements for hydraulic oil

In general, the hydraulic oil originally intended for the carrier can be used with this product. However, the temperature of the oil must be monitored. If the temperature of the hydraulic oil exceeds $+80^{\circ}\text{C}$, an auxiliary oil cooler is needed.

When the breaker is used continuously, the temperature of the hydraulic oil converges at a certain level depending on conditions of environment and the carrier. At this temperature, the viscosity of the hydraulic oil should be 20-40 cSt (2.90-5.35°E). The hammer should not start if the viscosity of the hydraulic oil is above 1000cSt (131 °E) or below 15cSt (2.35°E).

When the oil is too thick, the following problems may occur:

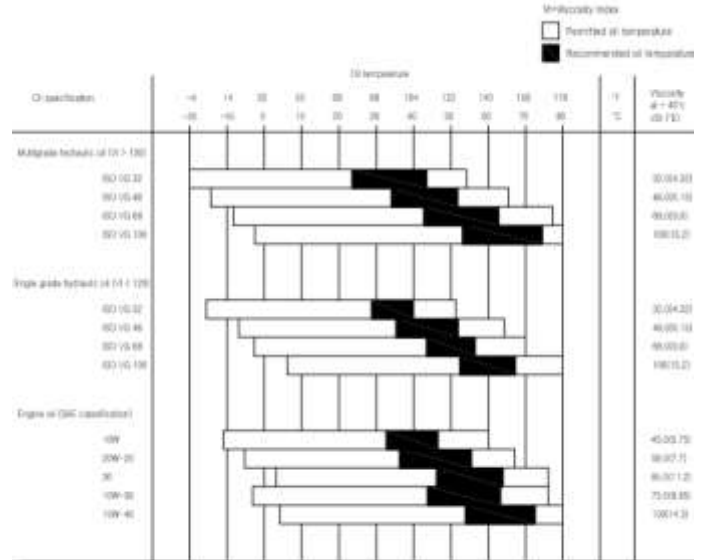
- ◆ Difficult start up
- ◆ Stiff operation
- ◆ Irregular and slow strike
- ◆ Danger of cavitation in the pumps and hydraulic breaker.
- ◆ Sticky valves
- ◆ Filter bypass, remaining of impurities in oil

When the oil is thin, the following problems may occur:

- ◆ Low efficiency (internal leaks)
- ◆ Leakage
- ◆ Accelerated component wearing due to decreased lubrication efficiency

Oil specifications

Table below shows hydraulic oils recommended for hammer use. The most suitable oil can be selected in such a way that the temperature of the hydraulic oil in continuous use is in the ideal of the recommended oil temperature area on the chart.



Special oils

When considering use of special oils (e.g. biological oils and non-flammable oil), check if the viscosity range of the special oil is in the range of 15~1,000cSt. (2.35~131°E).

9. Oil Filter

The purpose of the oil filter is to remove impurities from the hydraulic oil. Impurities normally enter the carrier hydraulic system in case of repairing components, installing the hammer on the carrier.

Oil filter specifications

- ◆ The oil filter must allow maximum particle size of 25 microns.
- ◆ The oil filter material must be man-made fiber cloth or very fine gauge metallic mesh to withstand pressure fluctuations.
- ◆ The oil filter must have a nominal flow capacity of at least twice the hammer's max. flow
- ◆ In general, oil companies guarantee new oils to have a particle count of 40 microns maximum. Filter the oil when filling the tank.

Damage caused by hydraulic oil impurities

- ◆ Reduced working life of the pumps and other components
- ◆ Cavitation
- ◆ Oil leakage
- ◆ Oil overheating
- ◆ Oil quality deteriorates
- ◆ Electro-chemical changes in hydraulic oil
- ◆ Accelerated wear of moving parts and seals
- ◆ Reduced hammer efficiency
- ◆ Improper function of valves
- ◆ Piston seizing up
- ◆ Spools binding

10. Oil Cooler

The correct place to connect the hammer return line is between the oil cooler and the main filters. The hammer return line should not be connected before the oil cooler. Routing the hammer flow through the cooler, might damage either the cooler, due to pulsating flow, or the hammer, due to increased back pressure.

The carrier hydraulic system must be able to maintain the temperature within an acceptable level during the hammer operation because seals, wipers, membrane can normally withstand temperature up to 80°C and the higher the temperature is, the less oil viscosity becomes.

11. Lubrication

Proper hammer maintenance requires a sufficient supply of the correct grease to the tool.

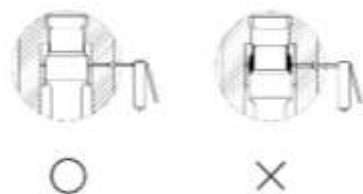
Recommended is a lithium soap base NLGI grade 2 grease with Molybdenum Disulfide or other surface protecting additives and drop point of 260°C.

Greasing interval

- ◆ Tool shank must be well lubricated before installing tool.
- ◆ 5~10 strokes from grease gun to upper and lower bushings until grease comes out between the tool and the lower bushing.
- ◆ This should be done every 2 hours of operation.
- ◆ If the grease schedule cannot be controlled, then grease the hammer more often than required, for example, once every hour. It is far cheaper than replacing prematurely worn out tool or tool bushings.
- ◆ Insufficient greasing or use of improper grease may cause breakage of tool or abnormal wear of tool or tool bushings.

Correct greasing

When greasing, the hammer must be standing upright resting on the tool to ensure that the grease penetrates downwards between the tool and the tool bushing. This prevents grease from entering piston impact area and ensures proper distribution of grease between the tool and bushings.



The greasing points on the hammer are marked with the sticker.

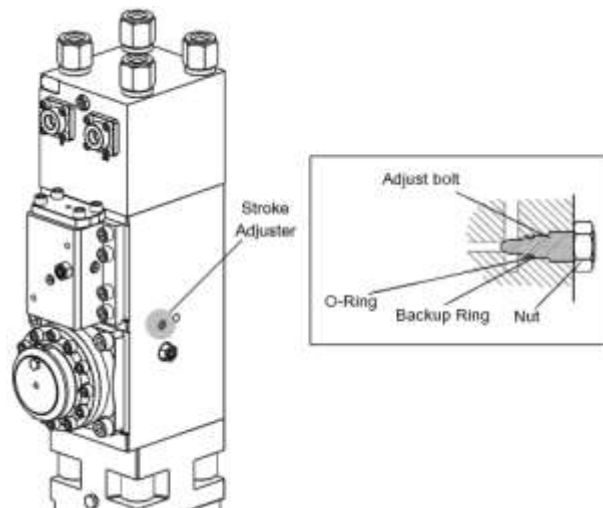
Automatic lubrication

Lubrication of the hammer can be made automatically by equipping the carrier with a lubrication pump. The tool grease is supplied from the pump into the hammer by hose. This is recommended for longer service life of wear parts.

12. Stroke Adjuster (SAGA180~610)

Depending on the working condition, adjustment of number of blows while keeping the oil consumption of the hammer constant is available by adjusting the stroke adjuster.

The stroke adjuster is on the right side of the cylinder.



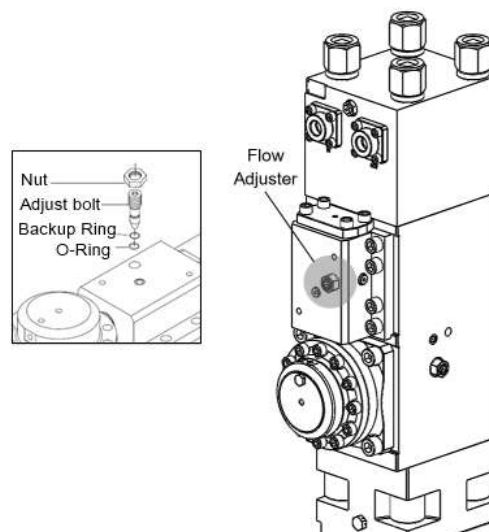
To make an adjustment on the stroke adjuster, slightly loosen the nut and tighten or untighten the adjust bolt while holding the nut, and retighten the nut after changing adjust bolt turns to securely fix the adjust bolt.

With the stroke adjuster fully tightened, the piston makes the longest stroke with the minimum number of blows (bpm). With the stroke adjuster two-turn open, the piston makes the shortest stroke with the maximum number of blows (bpm). The standard factory setting is fully tightened position.

13. Flow Adjuster (SAGA120~610)

When the hydraulic oil supply from the carrier is not sufficient or too much, adjustment of oil consumption of the hammer is available by adjusting the flow adjuster.

The flow adjuster is on the valve block (SAGA180~510) or on the cylinder (SAGA120).



To make an adjustment on the flow adjuster, slightly loosen the nut and tighten or untighten the adjust bolt while holding the nut, and retighten the nut after changing adjust bolt turns to securely fix the adjust bolt.

Tightening of the flow adjuster will decrease oil consumption and the number of blows (bpm), while untightening of the flow adjuster will increase oil consumption and the number of blows (bpm). Make sure not to turn the flow adjuster more than four revolutions counterclockwise from fully closed position.

The standard factory setting of each model is as follows:

Model	Number of turns open
SAGA120	2.5
SAGA180	2.5
SAGA200	2.5
SAGA220	2.5
SAGA250	2.5
SAGA310	4
SAGA350	4
SAGA400	4
SAGA510	4
SAGA610	4

14. Auto Shut-Off Adjuster (SAGA120~610)

One of the most potentially damaging events in a breaker's life is blank firing. The "blank firing", that is, when the piston slams down to the bottom of its stroke without contacting the tool, the energy which should have been transmitted to the workpiece is absorbed in the breaker body. This can cause so much damage to the inside of a breaker. To lessen the effect of blank firing, Auto Shut-Off (ASO) system is available.

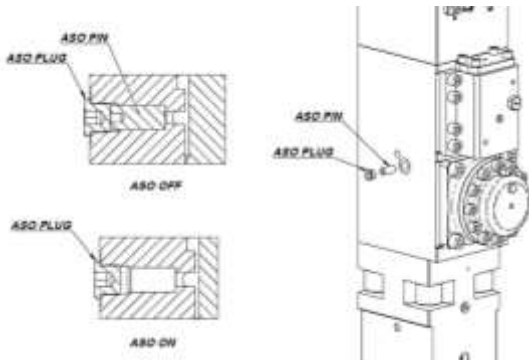
The operator can selectively adjust On & Off Modes of Auto Shut-Off function according to the given working condition.

The Auto Shut-Off PLUG is on the right side of the cylinder.

In ASO On Mode, the hammer automatically stops when the tool tip is no longer in contact with the material. It reveals its benefits in a work condition where visibility is poor (e.g. underwater). This reduces the strain on breaker, and ultimately increases the hammer lifespan.

In ASO Off Mode, the breaker starts without load applied to the tool, thus simplifying handling by saving time to position the breaker. This provides great productivity through increased efficiency of hammer operation.

Standard factory setting is ASO On mode which preventing no-load stroke.



Adjusting of the modes

(1) Switching to ASO Off Mode

- ① Untighten ASO Plug.
- ② Install ASO PIN (You can find ASO Pin in the toolbox).
- ③ Retighten ASO Plug.

(2) Switching to ASO On Mode

- ① Untighten ASO Plug.
- ② Remove ASO PIN (Keep the ASO PIN well for reuse).
- ③ Retighten ASO Plug.

MAINTENANCE

1. Periodical Inspection & Schedule

Parts	Inspection	Period				
		Every two hours	Once a week	Once a month	once every six months	Once a year
Greasing		○				
Tool	* Condition of wear			○		●
Tool Bush	* Condition of wear			○		●
Tool Pin	* Condition of wear			○		●
Thrust Ring	* Condition of wear			○		●
Upper Bush	* Condition of wear			○		●
Hydraulic Hose & Adapter	Leakage		○	△		
Back Head Gas Pressure	Leakage		○	△		
Accumulator Bolts	Loosening		○	△		
Accumulator Pressure	Leakage		○	△		
Membrane	Breakage		○			●
Side Rods Bolts	Loosening		○		△	○
Valve Block Bolts	Loosening		○		△	
Adjust Bolt on Valve Block	Loosening		○		△	
Housing	Abrasion		○			△
Wear Plate	* Condition of wear				○	●
Housing Joint Bolts	Loosening		○		△	
Top Cover Bolts	Loosening		○		△	
Snap Ring	Breakage		○			●
Seal	Leakage		○			●
Oil Condition	Contamination					○
Oil Filter	Contamination				○	●
Main Carrier	Pressure / Oil Flow				○	

* Condition of wear: Determined according the wear limit

○: Checking

△: Re-tightening / Reinforcement / Recharge

●: Replacement

MAINTENANCE

2. General Precautions

Maintenance instructions should be followed to ensure the breaker operating in best condition. Check every components of the machine before and after operating the breaker and repair or replace the related items if necessary for maximum durability.

Clean the machine before inspection

Breaker housing should be cleaned for removing dirt before inspection to ensure proper detection of damage of the breaker.

Keep away from the heat

Excavator, breaker body, hydraulic oil still have high level of temperature after certain operation. Due to the reason, do not touch any parts which has high temperature and wait until they are cooled down, otherwise it may cause serious injury.

Release pressure in the hydraulic system

Before disassembling hydraulic parts (e.g. hydraulic hose, plug, adjust bolt), make sure that stop valves on both hydraulic lines are fully closed and wait until the pressure in the hydraulic system of the machine are lowered to prevent hydraulic oil from popping out.

Keep record inspection history

Inspect the machine regularly and record the inspection result for future maintenance.

3. Periodical Inspection & Schedule

All the times below refer to the machine hours measured while the breaker is being installed.

Every 2 hours

- ◆ Grease the tool and the tool bushing

Every 10 hours or at least once a day

- ◆ Check the wear conditions of the tool and the tool pin. Grind off if necessary.
- ◆ Check if the tool has sufficient greasing. Grease if necessary.
- ◆ Check if the housing bolts and the top bracket bolts are loosened. Retighten if necessary.

Every 50 hours or at least once a week

- ◆ Remove the tool, the tool bushing, and the bushing pin, and check the wear conditions thereof.
- ◆ Check the hydraulic hoses. Replace if damaged. Do not let dirt get into the hammer or the hoses.

- ◆ Check if the housing joint bolts and the top cover bolts are loosened. Replace or retighten if necessary.
- ◆ Check the gas pressure in the back head. Recharge if necessary.
- ◆ Check the hydraulic oil condition. Replace or refill if necessary.

Every 100 hours or at least once a month

- ◆ Check all the connection of hydraulic pipe line and in/out hoses.
- ◆ Check the operating pressure and the oil flow setting. Adjust if necessary.
- ◆ Check the relief pressure of the hydraulic system from the main carrier.

Every 600 hours or at least once a 6 month

- ◆ Make a regular exterior inspection (crack, loosening, oil leakage, etc.) of the breaker and the main carrier.
- ◆ Check every part of the power cell, the housing, and the bracket.
- ◆ Change all the seals including the membrane in the accumulator.
- ◆ Check if the side rod bolts have cracks on the threads.
- ◆ Check all the hydraulic connections.
- ◆ Replace and inspect the hydraulic oil filters of the main carrier.

4. Storage

Short term storage

For short term storage between works, place the hammer horizontal on wooden blocks. Make sure that the tool is lubricated and the hydraulic hoses are securely capped. Cover the hammer with a waterproof tarp.

Long term storage

Check the followings for safe long term storage of the hammer to prevent rust and to make the hammer ready to be used.

- ◆ Hammer must be stored in upright position.
- ◆ Discharge the gas pressure on the back head.
- ◆ Remove the tool and push the piston all the way in.
- ◆ Grease the exposed front end of the piston.
- ◆ Plug the hydraulic hoses.
- ◆ Cover the hammer with a waterproof tarp

5. Precautions for Delivery

When the breaker is dispatched from the factory, back head is not charged with N₂ gas so that the piston is pushed back for rust prevention. Charge the back head before using the breaker.

6. Back Head Gas Charging

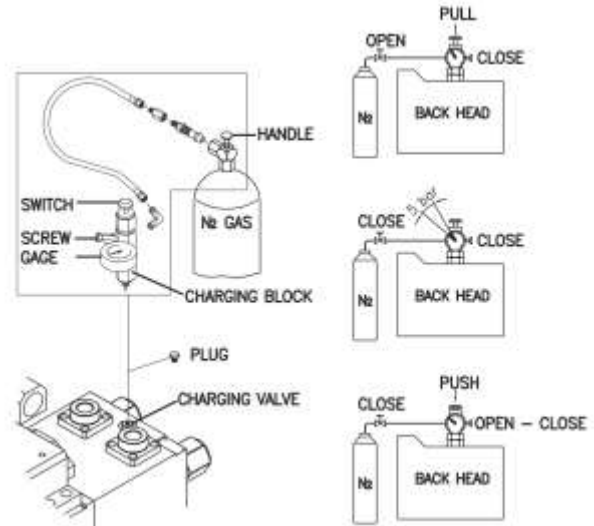
Never use other than Nitrogen gas for charging the back head.

Inspection of back head gas pressure

1. Install the gas pressure gauge on the charging block.
2. Close the screw of the charging block by turning it counterclockwise.
3. Remove plug from the charging valve of the back head and install the charging block.
4. Check the gas pressure while pushing the switch of the charging block.
5. Release the switch.
6. Open the screw of the charging block to discharge N₂ gas remaining in the gas hose.
7. Remove the charging block from the back head.
8. Install the plug of the back head.

Charging back head gas pressure

1. Install gas pressure gauge on charging block.
2. Connect gas hose to the charging block and N₂ gas tank.
3. Close the screw of the charging block by turning it counterclockwise.
4. Remove plug from the charging valve of the back head and install the charging block.
5. Open the handle of N₂ gas tank by turning it counterclockwise to charge the back head. Charge until the gas pressure level is about 5 bar above the specified gas pressure level.
6. Close the handle of N₂ gas tank by turning it clockwise.
7. While pushing the switch of the charging block, slightly open the screw of the charging block and drop the pressure level to the specified gas pressure level.
8. Close the screw of the charging block and release the switch.
9. Open the screw of the charging block to discharge N₂ gas remaining in the gas hose.
10. Remove the charging block from the back head.
11. Install the plug of the back head.



7. Accumulator Gas Charging

Never use other than Nitrogen gas for charging the back head.

Inspection of accumulator gas pressure

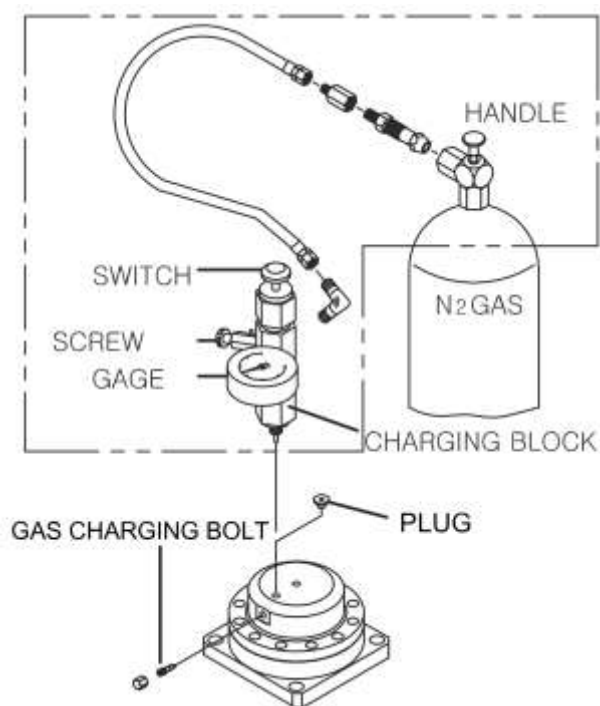
1. Install the gas pressure gauge on the charging block.
2. Close the screw of the charging block by turning it counterclockwise.
3. Remove plug of the accumulator and install the charging block.
4. Open the gas charging bolt of the accumulator by turning it half revolution counterclockwise.
5. Check the gas pressure while pushing the switch of the charging block.
6. Release the switch.
7. Close the gas charging bolt of the accumulator by fully tighten it clockwise.
8. Open the screw of the charging block to discharge N₂ gas remaining in the gas hose.
9. Remove the charging block from the accumulator.
10. Install the plug of the accumulator.

Charging accumulator gas pressure

1. Install gas pressure gauge on charging block.
2. Connect gas hose to the charging block and N₂ gas tank.
3. Close the screw of the charging block by turning it counterclockwise.
4. Remove plug of the accumulator and install the charging block.
5. Open the gas charging bolt of the accumulator by turning it half revolution counterclockwise.

MAINTENANCE

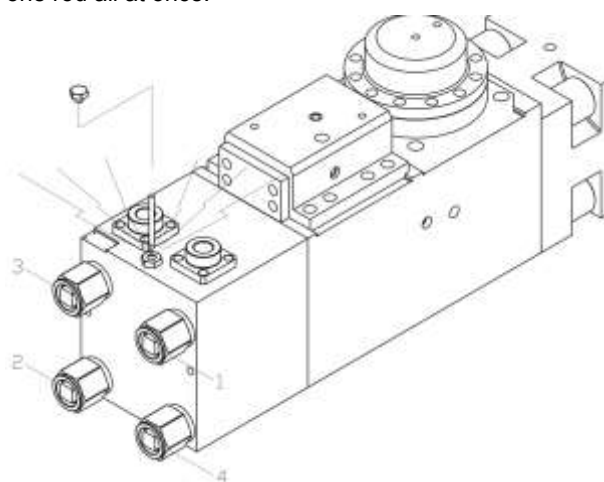
6. Open the handle of N2 gas tank by turning it counterclockwise to charge the accumulator. Charge until the gas pressure level is about 5 bar above the specified gas pressure level.
7. Close the handle of N2 gas tank by turning it clockwise.
8. While pushing the switch of the charging block, slightly open the screw of the charging block and drop the pressure level to the specified gas pressure level.
9. Close the screw of the charging block and release the switch.
10. Close the gas charging bolt of the accumulator by fully tighten it clockwise.
11. Open the screw of the charging block to discharge N2 gas remaining in the gas hose.
12. Remove the charging block from the accumulator.
13. Install the plug of the accumulator.



8. Side Rod Inspection & Replacement

Be sure to completely release back head gas pressure before loosening the side rods.

1. Discharge N2 gas of the back head completely.
2. Remove the side rod nut and washer.
3. Remove the side rod, and inspect for any cracks and damages on the thread and shank.
4. Install the new side rod if necessary and tighten it using torque wrench with specified torque value as shown below.
5. When installing the side rods, tighten each rod one turn at a time in diagonal sequence. Do not make complete turn on one rod all at once.



Model	FREE TORQUE	TORQUE 2nd
SAGA10	45	90
SAGA20	175	350
SAGA30	175	350
SAGA40	175	350
SAGA50	300	600
SAGA55	300	600
SAGA81	450	900
SAGA100	750	1,500
SAGA120	950	1,900
SAGA180	1,350	2,700
SAGA200	1,500	3,000
SAGA220	1,150	2,300
SAGA250	1,500	3,000
SAGA310	1,750	3,500
SAGA350	2,125	4,250
SAGA400	2,125	4,250
SAGA510	3,000	6,000
SAGA610	3,000	6,000

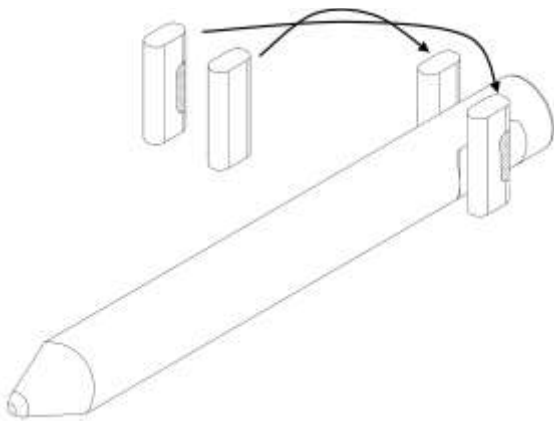
9. Consumable Parts

When damaged or worn, your attention is highly recommended to replace the consumable items below. Stocking of consumable items are highly recommended for proper maintenance.

- ◆ Tool
- ◆ Tool pins
- ◆ Tool bushing & upper bushing
- ◆ Stop pins & bushing pins
- ◆ Side rods
- ◆ Seals & O-rings
- ◆ Hydraulic hoses

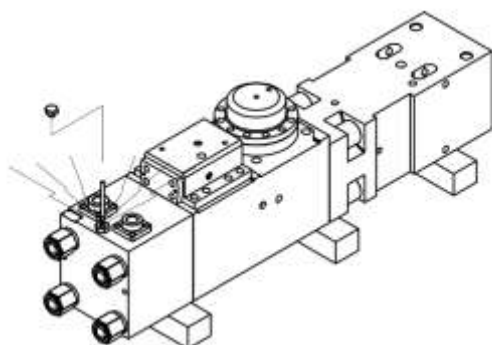
※ Replace hydraulic seals every 600 hours of operation.

※ When the tool pins are excessively worn out and deformed due to prolonged use, it is difficult to replace them. Every 100 to 150 hours of operation, change the face which comes in contact with the tool so that the wear is equally distributed.



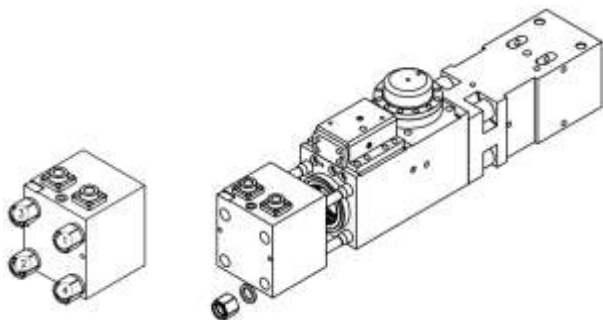
10. Disassembly and Assembly

Do not attempt to disassemble or assemble the hammer before reading this chapter of the manual.

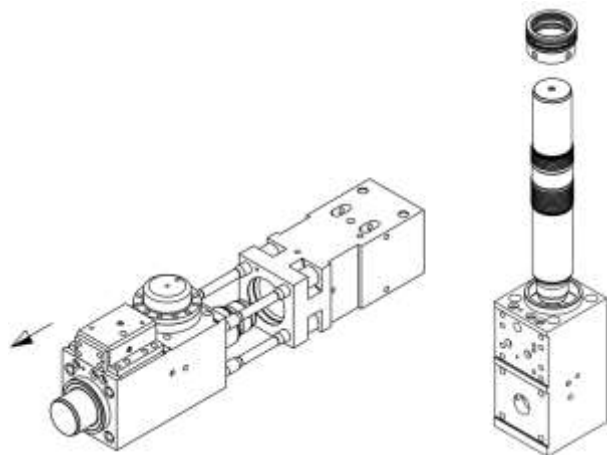


Disassembly

1. Put hammer on wooden supports.
2. Before dismantling the hammer, it is essential that N2 gas from back head is bled off.
3. Disassemble nuts of side rod from the hammer.
4. Disassemble back head by using eye bolts and hoist/chain block.



5. Disassemble cylinder by using eye bolts and hoist/chain block.



6. Disassemble piston by using eye bolt and hoist/chain block
7. Loosen and remove the side rods by rotating them counterclockwise. Use wrench or spanner to loosen them.

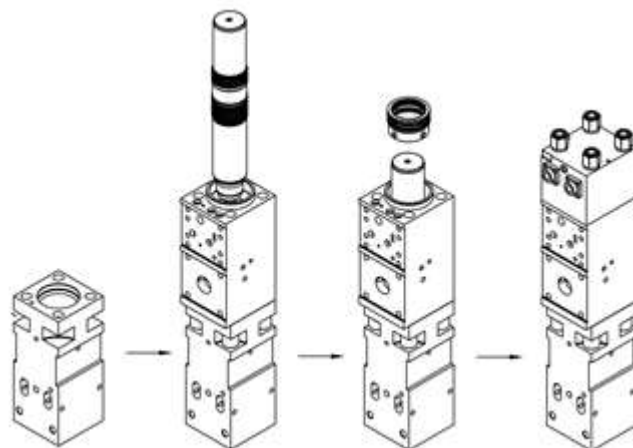
Assembly

◆ Seal assembly

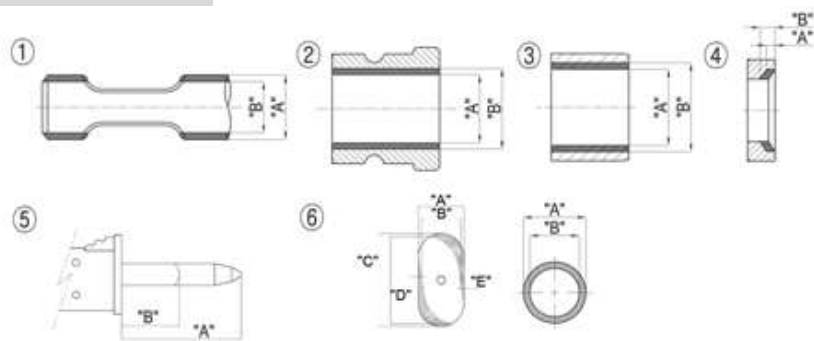
Using a brush, lubricating oil should be applied to seal grooves before assembly. Handle seals with care.

◆ General assembly

1. Set the front head upright.
2. Assemble cylinder on the front head.
3. Lubricate piston thoroughly and slowly assemble piston.
4. Using a rubber hammer, assemble seal housing into the cylinder.
5. Assemble back head.
6. Assemble side rods and tighten them nuts to the specified torque.



11. Wear Limit of Consumable Parts



Model	① Tool		② Tool Bushing		③ Upper Bushing		④ Thrust Ring		⑤ Tool		⑥ Tool Pin				
	New (A)	Reject (B)	New (A)	Reject (B)	New (A)	Reject (B)	New (A)	Reject (B)	New (A)	Reject (B)	New (A)	Reject (B)	New (C)	Reject (D)	E
SAGA10	38	36	38	40					222	172	25.5	22.5			
SAGA20	44.5	42.5	44.5	46.5	-	-	-	-	188	150	25.5	22.5	-	-	-
SAGA30	53	51	53	55	-	-	-	-	275	210	24	21	-	-	-
SAGA40	59.5	57.5	61.5	63.5	-	-	-	-	310	210	30	27	-	-	-
SAGA50	68	66	68	70	68	70	-	-	310	210	30	27	-	-	-
SAGA55	68	66	68	70	68	70	-	-	310	210	30	27	-	-	-
SAGA81	74.5	72.5	75	77	75	77	74.5	76.5	416	250	30	27	-	-	-
SAGA100	85	82	85	87	85	87	-	-	542	350	30	27	-	-	-
SAGA120	98	95	98	100.5	98	100.5	-	-	528	350	30	27	-	-	-
SAGA180	120	117	120	123	120	123	4	7	707	400	32	29	62	65	1.5
SAGA200	135	132	135	138	135	138	5.1	8.1	750	400	40	37	69	72	1.5
SAGA220	135	132	135	138	135	138	5.1	8.1	750	400	40	37	77	80	1.5
SAGA250	140	137	140	143	140	143	6.1	8.1	750	400	40	37	77	80	1.5
SAGA310	150	147	150	153	150	153	6.2	9.2	800	450	40	37	77	80	1.5
SAGA350	153	150	153	156	153	156	-	-	735	450	45	42	87	90	1.5
SAGA400	160	157	160	163	160	163	-	-	785	500	50	47	97	100	1.5
SAGA510	180	177	180	183	180	183	-	-	757	500	50	47	97	100	1.5
SAGA610	195	192	195	198	195	198	-	-	905	500	60	57	117	120	1.5

12. Tightening Torque Specifications

Item	Unit	SAGA10	SAGA20	SAGA30	SAGA40	SAGA50	SAGA55	SAGA81	SAGA100	SAGA120
Side Rod	N.m	90	350	350	350	600	600	900	1500	1900
Housing Joint Bolt		350	350	350	350	800	800	800	1700	1700
Top Cover Bolt		100	300	300	300	300	300	300	650	650
Acc. Cover Bolt		-	-	-	-	-	-	-	-	150
Acc. Bottom Bolt		-	-	-	-	-	-	-	-	550
Valve Block Bolt		-	-	-	-	-	-	-	-	-
Valve Block Cover Bolt		-	-	-	-	-	-	-	-	-

Item	Unit	SAGA180	SAGA200	SAGA220	SAGA250	SAGA310		SAGA350	SAGA400	SAGA510	SAGA610
						OPEN	BOX				
Side Rod	N.m	1700	3000	3000	3000	3500	3500	4250	4250	6000	6000
Housing Joint Bolt		1900	2500	2500	2500	2500	2500	3050	3050	3500	3500
Top Cover Bolt		650	650	650	2300	2300	2300	2300	2300	2300	2300
Acc. Cover Bolt		250	400	400	400	550	550	550	550	550	550
Acc. Bottom Bolt		950	950	950	950	950	950	950	950	2000	2000

Valve Block Bolt		500	500	500	500	500	500	500	500	800	800
Valve Block Cover Bolt		-	200	200	200	500	500	500	500	800	800

1. Oil Leakage

- ◆ Between the tool and tool bushing
 - ▶ Small amount of oil coming from the area is for lubrication purposes and is normal. In case of large amount oil coming out, replace the damaged seals.
- ◆ Surface of breaker
 - ▶ Check the hydraulic hoses or bolts, side rods and retighten if necessary.

2. No Impact

- ◆ Oil temperature too low
 - ▶ Increase the oil temperature up to min 30°C.
- ◆ Back head gas pressure too low
 - ▶ Check the gas pressure and recharge if necessary.
- ◆ Relief valve pressure setting too low
 - ▶ Set the relief valve to the correct pressure setting.
- ◆ Poor performance of the carrier hydraulic pump
 - ▶ Contact the carrier manufacturer and check the carrier hydraulic pump performance and repair if necessary.
- ◆ Back pressure in return line too high
 - ▶ Check the cause of increased back pressure and remove.

3. Irregular Blows after Normal Operation

- ◆ Oil temperature too high
 - ▶ Check the oil cooler and oil level.
- ◆ Back head gas pressure too high
 - ▶ Check the gas pressure and adjust if necessary.
- ◆ Not enough down pressure on tool
 - ▶ Reposition the hammer and apply enough down pressure from the carrier.
- ◆ Clearance between the tool and tool bushing too large.
 - ▶ Check the clearance and replace the worn out parts.
- ◆ Too much grease in the impact chamber
 - ▶ Remove tool and clean out excess grease.
- ◆ Wear on the impact surface of the tool
 - ▶ Check the tool and replace if necessary.
- ◆ Seizure of piston and cylinder
 - ▶ Overhaul the hammer.

4. Lack of Blows

- ◆ Back head gas pressure too high
 - ▶ Check the gas pressure and adjust if necessary.
- ◆ Not enough down pressure on tool
 - ▶ Reposition the hammer and apply enough down pressure from the carrier.
- ◆ Relief valve pressure setting too low
 - ▶ Set the relief valve to the correct pressure setting.
- ◆ Poor performance of the carrier hydraulic pump
 - ▶ Contact the carrier manufacturer and check the carrier hydraulic pump performance and repair if necessary.
- ◆ Back pressure in return line too high
 - ▶ Check the cause of increased back pressure and remove.

ACCESSORY TOOLS

Model	Spec	SAGA10		SAGA20		SAG30		SAGA40		SAGA50	
		open	box	open	box	open	box	open	box	open	box
SINGLE SPANNER	19	2	2	-	-	-	-	-	-	-	-
	25	1	1	-	-	-	-	-	-	-	-
	27	2	1	2	2	2	2	2	2	2	2
	30			2	2	1	1	1	1	1	1
	32	-	-	-	-	-	-	-	-	-	-
	36	-	-	-	-	-	-	-	-	2	-
	38	-	-	-	-	-	-	-	-	-	-
	41	-	-	-	-	-	-	-	-	-	-
	46	-	-	-	-	-	-	-	-	-	-
	55	-	-	-	-	-	-	-	-	-	-
HAMMER SPANNER	60	-	-	-	-	-	-	-	-	-	-
	41	-	-	-	-	-	-	-	-	1	1
	46	-	-	-	-	-	-	-	-	-	-
	50	-	-	-	-	-	-	-	-	-	-
L-WRENCH	55	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-
	8	-	-	-	-	1	1	1	1	1	1
	10	-	-	-	-	-	-	-	-	-	-
T-WRENCH	12	-	-	-	-	-	-	-	-	-	-
EYE BOLT	5	1	1	1	1	1	1	1	1	1	1
	M6	-	-	-	-	-	-	-	-	-	-
-PIN BAR	M8	-	-	-	-	-	-	-	-	-	-
	D8	1	1	1	1	-	-	-	-	-	-
	D10	-	-	-	-	1	1	-	-	-	-
SNAP RING FLYER	D15	-	-	-	-	-	-	1	1	1	1
GREASE GUN	12 ~ 65	-	-	-	-	-	-	-	-	-	-
DRIVER (-)	500cc	1	1	1	1	1	1	1	1	1	1
	6x150	-	-	-	1	-	1	-	1	-	-

ACCESSORY TOOLS

Model	Spec	SAGA55	SAGA81		SAGA100		SAGA120		SAGA180	
		backhoe	open	box	open	box	open	box	open	box
SINGLE SPANNER	19	-	-	-	-	-	-	1	-	1
	24	-	-	-	-	-	1	1	1	1
	27	2	2	2	2	2	1	1	1	1
	30	1	-	-	-	-	-	-	-	-
	32	-	-	-	-	-	1	1	1	1
	36	2	-	-	-	-	2	2	2	2
	38	-	1	1	1	1	1	1	-	-
	41	-	-	-	-	-	-	-	1	1
	46	-	1	-	-	-	-	-	-	-
	55	-	-	-	1	-	-	-	-	-
HAMMER SPANNER	60	-	-	-	-	-	-	-	1	-
	41	1	-	-	-	-	-	-	-	-
	46	-	1	1	-	-	-	-	-	-
	50	-	-	-	1	1	-	-	-	-
L-WRENCH	55	-	-	-	-	-	1	1	1	1
	5	-	-	-	-	-	1	1	1	1
	8	1	-	-	1	1	1	1	1	1
	10	-	1	1	-	-	1	1	1	1
T-WRENCH	12	-	-	-	-	-	1	1	1	1
	5	1	1	1	1	1	1	1	-	-
EYE BOLT	M6	-	-	-	-	-	1	1	-	-
	M8	-	-	-	-	-	-	-	1	1
-PIN BAR	D8	-	-	-	-	-	-	-	-	-
	D10	-	-	-	-	-	-	-	-	-
	D15	1	1	1	1	1	1	1	1	1
SNAP RING FLYER	12 ~ 65	-	-	-	1	1	1	1	1	1
GREASE GUN	500cc	1	1	1	1	1	1	1	1	1
DRIVER (-)	6x150	-	-	-	-	1	-	1	-	1

ACCESSORY TOOLS

Model	Spec	SAGA200		SAGA220		SAGA250		SAGA310		SAGA350	
		open	box	open	box	open	box	open	box	open	box
SINGLE SPANNER	27	1	1	1	1	1	1	1	1	1	1
	32	1	1	1	1	1	1	1	1	1	1
	36	2	2	2	2	2	2	-	-	-	-
	41	1	1	1	1	1	1	1	1	1	1
	46	-	-	-	-	-	-	2	2	-	-
	50	-	-	-	-	-	-	-	-	-	-
	55	-	-	-	-	-	-	-	-	2	2
HAMMER SPANNER	65	1	1	1	1	1	1	-	-	-	-
	70	-	-	-	-	-	-	1	1	-	-
	75	1	-	1	-	1	-	1	-	-	-
	85	-	-	-	-	-	-	-	-	1	1
	90	-	-	-	-	-	-	-	-	-	-
DOUBLE SPANNER	17x19	-	1	-	1	-	1	-	1	-	1
L-WRENCH	5	1	1	1	1	1	1	1	1	1	1
	8	1	1	1	1	1	1	1	1	1	1
	10	1	1	1	1	1	1	1	1	1	1
	12	1	1	1	1	1	1	1	1	1	1
T-WRENCH	5	1	1	1	1	1	1	1	1	1	1
EYE BOLT	M8	1	1	1	1	1	1	1	1	1	1
PIN BAR	D8	1	1	1	1	1	1	1	1	1	1
SNAP RING FLYER	12 ~ 65	1	1	1	1	1	1	1	1	1	1
GREASE GUN	500cc	1	1	1	1	1	1	1	1	1	1
DRIVER (-)	6x150	-	1	-	1	-	1	-	1	-	1

ACCESSORY TOOLS

Model	Spec	SAGA400		SAGA510		SAGA610	
		open	box	open	box	open	box
SINGLE SPANNER	27	1	1	1	1		
	32	1	1	1	1		
	36	-	-	-	-		
	41	1	1	-	-		
	46	-	-	-	-		
	50	-	-	1	1		
	55	2	2	2	2		
HAMMER SPANNER	65	-	-	-	-		
	70	-	-	-	-		
	75	-	-	-	-		
	85	1	1	-	-		
	90	-	-	1	1		
DOUBLE SPANNER	17x19	-	1	-	1		
L-WRENCH	5	1	1	1	1		
	8	1	1	1	1		
	10	1	1	1	1		
	12	1	1	1	1		
T-WRENCH	5	1	1	1	1		
EYE BOLT	M8	1	1	1	1		
PIN BAR	D8	1	1	1	1		
SNAP RING FLYER	12 ~ 65	1	1	1	1		
GREASE GUN	500cc	1	1	1	1		
DRIVER (-)	6x150	-	1	-	1		

WARRANTY REPORT

Document No.

(Leave this area blank - to be filled out by the manufacturer)

1. PRODUCT INFO.

Serial number		Installation date	
<i>Note: If the installation card has not been submitted previously, it shall be sent along with this warranty report.</i>			

2. FAILURE INFO.

Failure date			
Symptom / Concern			
Repair / Action taken			
Status			
Image		Description	

3. PART REQUIRED

No.	Part number	Part name	Q'ty

4. DEALER INFO.

REQUESTED BY (Corporate name) _____

WRITTEN BY (Warranty report writer) _____

REPORTING DATE _____



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