Q11193	2020. 10

OPERATION MANUAL

Soosan Hydraulic Breaker

SQ Series

SOOSAN
HEAVY INDUSTRIES

Contents

OPERATION MANUAL

PART LIST

OPERATION MANUAL

Soosan Hydraulic Breaker

⚠ DANGER

SERIOUS INJURY OR DEATH COULD RESULT FROM THE
IMPROPER REPAIR OR SERIVICE OF THIS HYDRAULIC BREAKER.
REPAIRS AND / OR SERVICE TO THIS HYDRAULIC BREAKER
MUST ONLY BE DONE BY AN AUTHORIZED AND CERTIFIED DEALER.

Model	
Serial Number	
Year of Construction	

SOOSAN
HEAVY INDUSTRIES

CE

EC Declaration of Incorporation
according to EC Machinery Directive 2006/42/EC

We herewith declare, Soosan Heavy Ind. Co., Ltd.
of
260, Jeongmunsongsan-ro, Yanggam-Myeon,
Hwaseong-Si, Gyunggi-Do,
Korea

that the following machine complies with the appropriate basic safety and health requirements of the EC Directive(2006/42/EC) based on its design and type, as brought into circulation by us. In case of alteration of the machine, not agreed upon by us, this declaration will lose its validity.
The machinery is incomplete and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

Technical documentation for the machinery is maked by :
Place : Soosan Heavy Ind. Co., Ltd
260, Jeongmunsongsan-ro, Yanggam-Myeon, Hwaseong-Si, Gyunggi-Do, Korea
Position : Manager, R&D team
Name :

The technical documentation for the machinery is available from :
Name : SOOSAN HEAVY INDUSTRIES CO., LTD EUROPE
Adress : Ohmweg 18,3208 ke, Spijkenisse, Netherlands

Description : Construction Machinery (not appendix IV)
(Hydraulic Breaker)

Machine Type :

Serial Number :

Applicable EC Directive : EC Machinery Directive (2006/42/EC)

Applicable Harmonized
Standards : EN ISO 12100-2010
EN474-1:2006/A4:2013

Applicable National Technical Standards And Specifications :
Weight(kg) :
Length(mm) :
Oil flow(ℓ/min) :
Operation Pressure(kg/㎠):
Blows(bpm) :

Date/ Authorized Signature :

Title of Signatory :

⚠ DANGER

DO NOT OPERATE THE HYDRAULIC BREAKER UNLESS THE FOLLOWING SAFETY INSTRUCTIONS HAVE BEEN THOROUGHLY READ AND UNDERSTOOD!

READ THIS MANUAL BEFORE INSTALLING, OPERATING OR MAINTAINING THIS EQUIPMENT.

> Flying debris form the hydraulic breaker or other material may cause serious or fatal injury to the operator. Personal protection equipment must be used.

> Flying debris hydraulic breaker or other materials may cause serious or fatal injury to bystanders. Never operate the grab when bystanders are in the working area.

> On machines/carriers, the hydraulic breaker can enter the operator's compartment under specific hydraulic breaker position. Make sure that suitable impact shields are used when operating the hydraulic breaker with this type of equipment.

> Do not operate the breaker unless all safety decals described in this manual are in place. The decals must be inspected periodically to ensure that all wording is legible. The decals must be replaced if illegible. Replacement decals can be obtained from your authorized Soosan Distributor.

> The hydraulic breaker will become very hot during operation. Allow time for hydraulic breaker to cool down before touching hydraulic breaker parts.

If this machine is transferred, be sure to attach this manual to the machine.

For safety, common items are described "SAFETY PRECATUIONS", and others are mentioned in the succeeding pages.

SOOSAN
HEAVY INDUSTRIES

FOREWORD

We appreciate your purchasing a Soosan Hydraulic Breaker.
The Hydraulic Breaker, designed and built to provide durable operation under any working conditions, has been developed by Soosan's excellent engineering techniques with accumulated experiences for many years. Without proper handling, regular inspection and maintenance, however, the machine fails to display its full capacity, resulting in various troubles of machine parts.
This publication should be carefully read prior to installation and operation in order to prevent any mishandling of hydraulic breaker.
We guarantee that a faithful compliance of the instruction will contribute to the best operation condition.
Customers are, therefore, required to keep in mind that the company is not responsible for troubles caused by not following our guidelines or not using genuine parts.

Soosan Heavy Industries Co., Ltd.

01. Safety Precautions

1.1 Safety Precautions

This manual contains safety, operation, and routine maintenance instructions. It doesn't contain service disassembly and service assembly instructions. If needed, complete service disassembly and service assembly instructions are contained in manual which can be ordered from your Soosan Hydraulic Breaker authorized and certified dealer.

Please read the following warning.

⚠ DANGER

Serious injury or death could result from the improper repair or service of this breaker. Repairs or service to this breaker must only be done by an authorized and certified dealer.

Most of the accidents are caused by disregarding the basic rules of operation inspection or repair, or by neglecting the inspection before operation. Many accidentscan often be avoided by recognizing potentially hazardous situations before an accident occurs. Before operating, inspecting or repairing this machine, be sure to read and fully understand the preventive methods and warnings described on the machine or in this manual. If not, never operate, inspect or repair this machine

Safety labels and messages are classified as follows so that the users can understand the warnings on the machine or in this manual.

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, It may also be used to alert against unsafe practices.
NOTICE	Signs used to indicate a statement of company policy directly or indirectly related to the safety of personal or protection of property.

The safety messages including the preventive measures to avoid danger.

For safety, common items are described in "SAFETY PRECAUTIONS", and others are mentioned in the succeeding pages.

Soosan cannot anticipate every possible circumstance that might involve a potential hazard on operation, inspection or repair. Therefore the warnings in this manual are not all inclusive. If an operation, inspection or repair not described in this manual is used, you must take measures for safety by yourself.

⚠ DANGER

Observe the cautions and take a preventive measure for safety

The Soosan Hydraulic Breaker will provide safe and dependable service if operated in accordance with the instructions given in this manual. Read and understand this manual, any decals and tags attached to the breaker before operation. Failure to do so could result in personal injury or equipment damage

The Soosan Hydraulic Breaker will provide safe and dependable service if operated in accordance with the instructions given in this manual. Read and understand this manual, any decals and tags attached to the breaker before operation. Failure to do so could result in personal injury or equipment damage

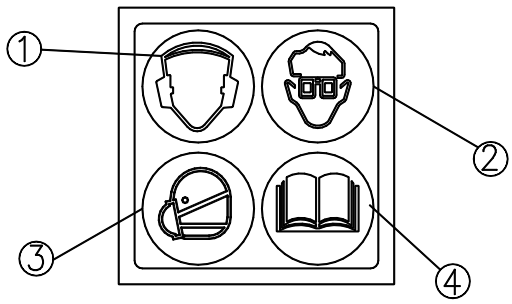
- Operate the breaker in accordance with all laws and regulations which affect you, your equipment, and the worksite.
- Do not operate the breaker until you have read this manual and thoroughly understood all safety, operation and maintenance instructions.
- Do not operate the breaker until you have read the carrier equipment manual and thoroughly understood backhoe or excavator or similar equipment used to operate the breaker. The word "carrier", as used in this manual, means a backhoe or excavator or similar equipment used to operate the breaker.
- Ensure that all maintenance procedures recommended in this manual are completed before using the equipment.
- The operator must not operate the breaker or carrier if any people are within the area where they may be injured by flying debris or movement of the equipment.
- Know the limits of your equipment.
- Before starting a work, Check the prohibitions, cautions and working processes in a working site with the field overseer, Observe all of them strictly.
- Wear such protective tools as a helmet, safety shoes, etc. to perform a work.
  Make use of the protective glasses, earplugs, gloves and other protective tools if necessary.
- Establish a training program for all operators to ensure safe operation. Do not operate the breaker unless thoroughly trained or under the supervision of an instructor. Become familiar with the carrier controls before operating carrier and breaker. While learning operate the breaker and carrier, do so at a slow pace. If necessary, set the carrier to the slow position.
- Make sure all controls(levers and pedals) are in the neutral position before starting the carrier.
- Before leaving the carrier, always lower the boom and insure the carrier is stable. Never leave the machine with the engine running. Always engage the parking brake.
- Stop the engine before attempting to make any repairs, adjustments or servicing to either the carrier or the breaker.

- Do not operate the breaker at oil temperature above 175°F/80℃. Operation at higher temperature can damage the internal components of the breaker and carrier and will result in reduced breaker performance.
- Do not operate a damaged, leaking, improperly adjusted, or incompletely assembled breaker.
- Do not modify this breaker in any manner.
- Use only breaker parts manufactured by Soosan. Usage of breaker rod produced by another manufacturer may damage the breaker and will void the warranty.
- To avoid personal injury or equipment damage, all breaker repair, maintenance and service must only be performed by authorized and properly trained personnel.
- If you do not understand how to operate safely your breaker, contact an authorized Soosan Dealer for assistance.
- Keep this manual with the breaker.
- Do not operate this equipment if you are taking medication which may affect your mental judgement or physical performance.
- Do not operate this equipment if you are under the influence of drug or alcohol.
- Remove breaker form carrier during transportation.

1.2 Stickers & Tags

■ Warning sticker

1) Use ear protection
2) Use eye protection
3) Use breathing protection
4) Read the manual before use

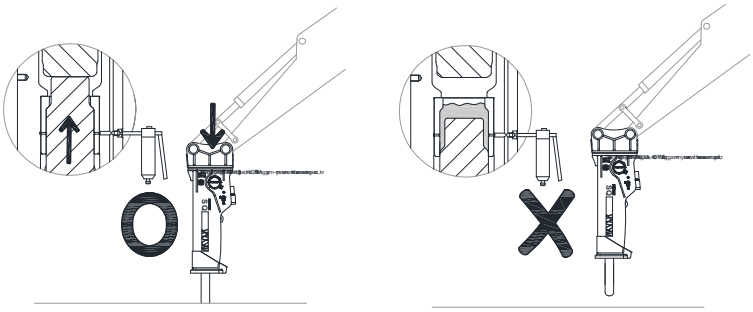


■ Greasing Sticker

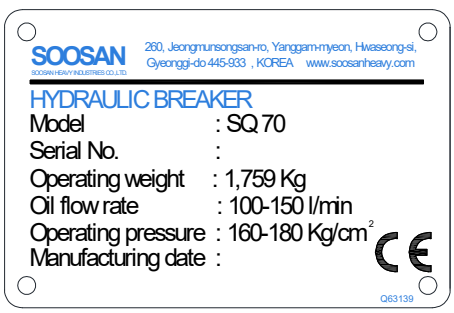
Correct Greasing

1) Position the Breaker standing upright resting on the rod on firm surface.
2) Stop carrier engine and wait 10 minutes for oil pressure to drop inside Breaker.
3) Apply Rod grease from grease gun to greasing points marked with the following sticker.

Note : The Breaker must stand upright resting on the tool to ensure that the grease will penetrate downwards between the tool and the bushing.
Do not fill the space between the piston and the rod with grease. A lower piston seal failure can result and the Breaker will subsequently leak oil.

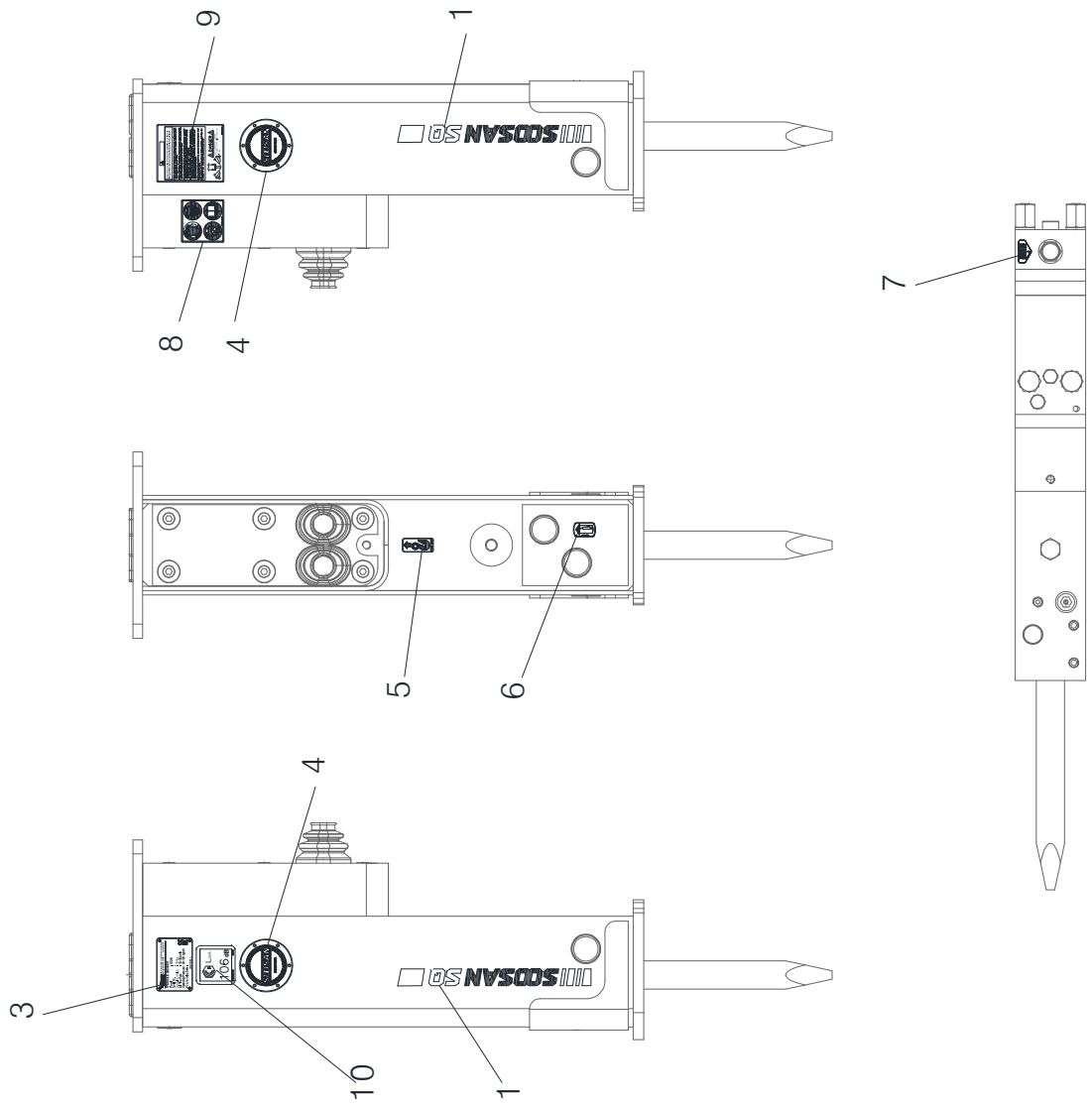


■ Specification plate (For Example SQ70)



■ SQ10 ~ SQ50

NO. / MODEL	Sticker Ass'y	1	3	4	5	6	7	8	9	10
		BI STICKER	NAME PLATE	EMBLEM	LIFTING STICKER	GREASE STICKER	BACK HEAD STICKER	WARNING STICKER	DANGER STICKER	NOISE STICKER
SQ10	B0003557	B0003627	B0003635	B0003440	C23344	D83168	E83144	E83211	E83210	B0003643
SQ20	B0003558	B0003628	B0003636	B0003440	C23344	D83168	E83144	E83211	E83210	B0003644
SQ30	B0003559	B0003629	B0003637	B0003440	C23344	D83168	C02135	E83211	E83210	B0003645
SQ35	B0003560	B0003630	B0003638	B0003441	C23344	D83168	C02135	E83211	E83210	B0003646
SQ40	B0003561	B0003631	B0003639	B0003441	C23344	D83168	C02135	E83211	E83210	B0003647
SQ43	B0003562	B0003632	B0003640	B0003441	C23344	D83168	C02135	E83211	E83210	B0003648
SQ45	B0003563	B0003633	B0003641	B0003441	C23344	D83168	C02135	E83211	E83210	B0003649
SQ50	B0003564	B0003634	B0003642	B0003441	C23344	D83168	C02135	E83211	E83210	B0003650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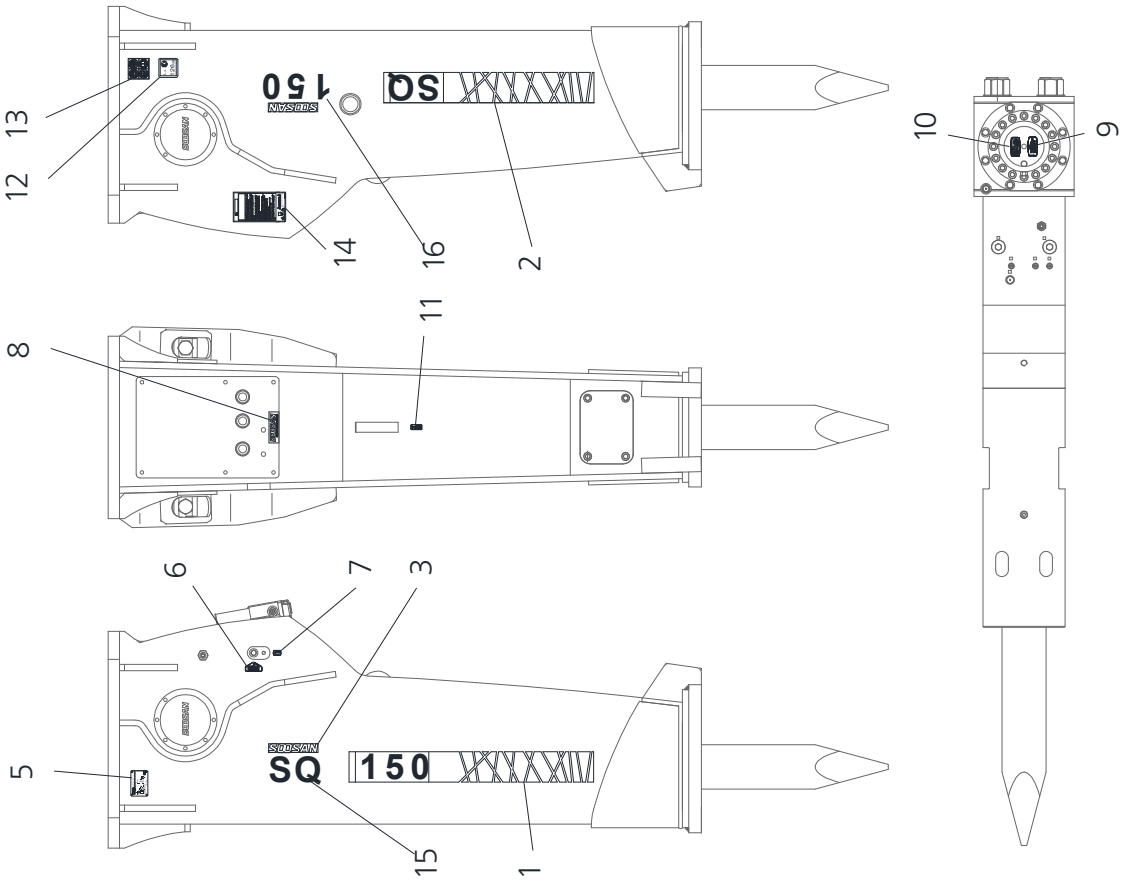
■ SQ60 ~ SQ181

NO. / MODEL	Sticker Ass'y	1	2	3	5	6	7	8	9	10	11	12	13	14	15	16
		BI STICKER (L)	BI STICKER (R)	SOOSAN LOGO	NAME STICKER	BACK HEAD STICKER	GREASE STICKER	LOGO STICKER	ACC STICKER (A)	ACC STICKER (B)	LIFTING STICKER	NOISE STICKER	WARNING STICKER	DANGER STICKER	BI STICKER	BI STICKER
SQ60	Q53145	Q53146	Q53147	Q53148	Q53149	C02135	D83168	Q53150	C62212	C62213	C23344	Q53139	D83166	Q53134	Q53131	Q53132
SQ70	Q63146	Q63147	D53147	D53148	Q63148	C02135	D83168	Q53150	C62212	C62213	C23344	Q63140	D83166	Q53134	Q53131	Q63138
SQ80	Q23148	Q23149	Q53147	Q53148	Q23150	C02135	D83168	Q53150	C62212	C62213	C23344	Q23144	D83166	Q53134	Q53131	Q23142
SQ100	Q73148	Q73149	Q73150	Q53148	Q73151	C02135	D83168	Q53150	C62212	C62213	C23344	Q73143	D83166	Q53134	Q53131	Q73141
SQ120	Q83143	Q83144	Q73150	Q53148	Q83145	C02135	D83168	Q53150	C62212	C62213	C23344	Q83139	D83166	Q53134	Q53131	Q83137
SQ130	Q43150	Q43151	Q43152	Q43153	Q43154	C02135	D83168	Q53150	C62212	C62213	C23344	Q43147	D83166	Q53134	Q43143	Q43144
SQ140	Q03179	Q03180	Q43152	Q43153	Q03181	C02135	D83168	Q53150	C62212	C62213	C23344	Q03135	D83166	Q53134	Q43143	Q03133
SQ150	Q33150	Q33151	Q33152	Q43153	Q33153	C02135	D83168	Q53150	C62212	C62213	C23344	Q33146	D83166	Q53134	Q43143	Q33144
SQ181	Q13222	Q13223	Q13224	–	Q13225	C02135	D83168	Q53150	C62212	C62213	C23344	Q13174	D83166	Q53134	–	–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SQ 150

Local safety regulations.

Enter any local safety regulation here, keep these instructions in an area accessible to the operator and maintenance personnel.

02. Standard Specification(1/2)

DESCRIPTION		UNIT	MODEL							
			SQ10	SQ20	SQ30	SQ35	SQ40	SQ43	SQ45	SQ50
Body Weight (Including rod)		kg	54	68	90	130	155	215	292	469
		lbs	119	150	199	287	342	474	644	1035
Operating Weight		kg	104	130	156	231	299	379	566	845
		lbs	229	287	344	510	660	836	1249	1864
Length		mm	1135	1237	1317	1472	1620	1899	2161	2348
		in	45	49	52	58	64	75	85	92
Width		mm	264	264	264	324	324	324	420	420
		in	10	10	10	13	13	13	17	17
Required Oil Flow		ℓ /min	15~35	20~45	25~55	30~65	40~75	50~90	60~110	80~120
		gal/min	4~9	5.3~11.9	6.6~14.5	7.9~17.2	13.2~23.8	13.2~23.8	15.9~29.1	21.1~31.7
Operating Pressure		kg/㎠ (≒bar)	90~120	90~120	90~120	100~130	110~140	120~150	130~160	150~170
		psi	1280 ~1707	1280 ~1707	1280 ~1707	1422 ~1849	1565 ~1991	1707 ~2134	1849 ~2276	2134 ~2418
Impact Rate	Low	BPM	–	–	–	960 ~1690	900 ~1650	800 ~1330	740 ~1195	650 ~1020
	Middle	BPM	–	–	–	800 ~1290	790 ~1220	700 ~1130	670 ~1030	590~880
	High	BPM	800 ~1530	700 ~1320	600 ~1250	620 ~1040	570 ~1020	540~800	525~850	455~730
Hose Diameter		in	3/8,1/2	3/8,1/2	1/2	1/2	1/2	1/2	3/4	3/4
Rod Diameter		mm	40	45	53	60	68	75	85	100
		in	1.6	1.8	2.1	2.4	2.7	3.0	3.3	3.9
Applicable Carrier		㎥	~0.07	0.03~0.1	0.06~0.2	0.1~0.25	0.15~0.3	0.2~0.35	0.25~0.5	0.4~0.6
		ton	0.8~2.5	1.2~3.0	2.0~4.5	3.0~6.0	4.0~9.0	5~12	7~15	9~16
		lbs	1760 ~5510	2645 ~6615	4410 ~9920	6615 ~13220	8820 ~19840	11020 ~26455	15430 ~33070	19840 ~35275
Noise Level		dB(A)	105.5	106.8	108.5	116.9	108.7	114.5	112.0	113.5

* Operating weight include Cap, Rod weight by AEM regulation.
(Except for pin, hose, fitting and tubing)
* The above specifications are subject to change without prior notice for the quality enhancement..
* Rod is long type standard.

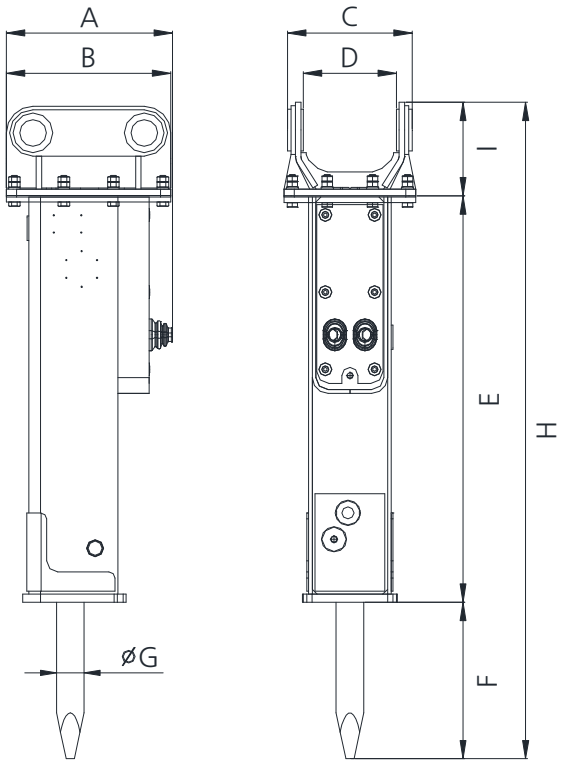
02. Standard Specification(2/2)

DESCRIPTION		UNIT	MODEL								
			SQ60	SQ70	SQ80	SQ100	SQ120	SQ130	SQ140	SQ150	SQ181
Body Weight (Including rod)		kg	737	862	1084	1116	1425	1605	1806	1945	3096
		lbs	1625	1900	2389	2460	3142	3538	3982	4288	6825
Operating Weight		kg	1607	1759	2053	2185	2671	3033	3169	3950	5889
		lbs	3543	3878	4526	4817	5889	6687	6986	8708	12983
Length		mm	2561	2666	2806	2924	3168	3360	3441	3677	4112
		in	101	105	110	115	125	132	135	145	162
Width		mm	620	620	669	694	760	756	761	793	891
		in	24	24	26	27	30	30	30	31	35
Required Oil Flow		ℓ /min	90~120	100~150	120~180	150~210	180~240	200~260	200~260	210~290	350~450
		gal/min	23.8~31.7	26.4~39.6	31.7~47.6	39.6~55.5	47.6~63.4	52.8~68.7	52.8~68.7	55.5~76.6	93~119
Operating Pressure		kg/㎠ (≒bar)	160~180	160~180	160~180	160~180	160~180	160~180	160~180	160~180	180~200
		psi	2276 ~2560	2276 ~2560	2276 ~2560	2276 ~2560	2276 ~2560	2276 ~2560	2276 ~2560	2276 ~2560	2560 ~2845
Impact Rate	Low	BPM	350~650	350~600	350~500	300~450	300~450	250~400	200~350	200~350	200~300
	High	BPM	600~850	500~850	500~700	430~580	430~580	380~550	300~500	320~470	300~400
Hose Diameter		in	1	1	1	1	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4
Rod Diameter		mm	125	135	140	150	155	165	165	175	200
		in	4.9	5.3	5.5	5.9	6.1	6.5	6.5	6.9	7.9
Applicable Carrier		㎥	0.5~0.7	0.6~0.8	0.7~0.9	0.9~1.2	1.1~1.4	1.2~1.7	1.2~1.7	1.4~2.0	2.0~5.0
		ton	15~18	16~21	18~26	25~30	28~35	30~45	30~45	40~55	50~90
		lbs	33000~ 40000	40000~ 46000	40000~ 58000	55000~ 66000	62000~ 77000	66000~ 100000	71000~ 110000	88000~ 121000	110000~ 200000
Noise Level		dB(A)	115	120	118	120	123	124	124	125	125

* Operating weight include Cap, Rod weight by AEM regulation.
  (Except for pin, hose, fitting and tubing)
* The above specifications are subject to change without prior notice for the quality enhancement..
* Rod is long type standard.

03. External Dimension

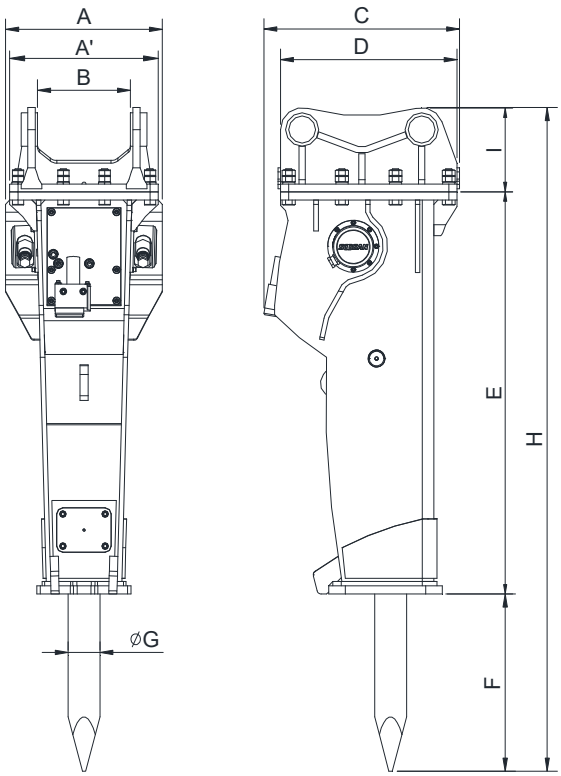
3.1 Small range (1/2)



MODEL	UNIT	A	B	C	D	E	F	G	H	I
SQ10	mm	307	272	264	152	724	267	40	1135	144
	in	12.1	10.7	10.4	6.0	28.5	10.5	1.6	44.7	5.7
SQ20	mm	314	272	264	162	797	286	45	1237	154
	in	12.4	10.7	10.4	6.4	31.4	11.3	1.8	48.7	6.1
SQ30	mm	327	272	264	162	868	295	53	1317	154
	in	12.8	10.7	10.3	6.3	34.1	11.6	2.0	51.8	6.0
SQ35	mm	408	404	324	165	933	339	60	1472	200
	in	16.0	15.9	12.7	6.4	36.7	13.3	2.3	57.9	7.8
SQ40	mm	408	404	324	220	1016	385	68	1620	219
	in	16.0	15.9	12.7	8.6	40.0	15.1	2.6	63.7	8.6
SQ43	mm	412	404	324	220	1203	467	75	1899	229
	in	12.8	10.7	10.3	6.3	34.1	11.6	2.0	51.8	6.0
SQ45	mm	570	570	420	267	1336	556	85	2161	269
	in	22.4	22.4	16.5	10.5	52.5	21.8	3.3	85.0	10.5
SQ50	mm	570	570	420	330	1476	540	100	2348	332
	in	22.4	22.4	16.5	12.9	58.1	21.2	3.9	92.4	13.0

** D, I, H : The dimension is for reference only and may vary depending on the required mounting bracket (Top Cap).

3.2 Medium & Heavy-duty range (2/2)

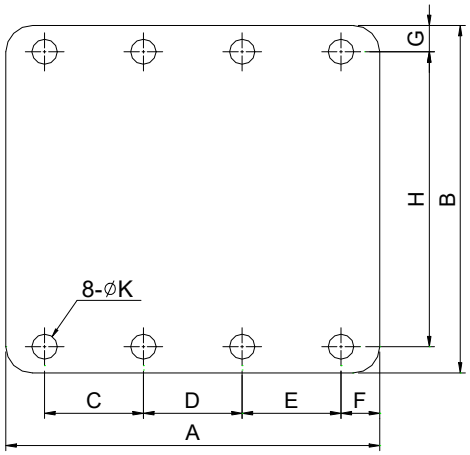


MODEL	UNIT	A' Upper Plate	A	B	C	D	E	F	G	H	I
SQ60	mm	620	620	360	766	700	1615	589	125	2561	357
	in	24.4	24.4	14.1	30.1	27.5	63.5	23.1	4.9	100.8	14.0
SQ70	mm	620	620	360	765	700	1659	650	135	2666	357
	in	24.4	24.4	14.1	30.1	27.5	65.3	25.5	5.3	104.9	14.0
SQ80	mm	620	669	360	833	760	1744	705	140	2806	357
	in	24.4	26.3	14.1	32.7	29.9	68.6	27.7	5.5	110.4	14.0
SQ100	mm	620	694	430	904	760	1849	692	150	2924	383
	in	24.4	27.3	16.9	35.5	29.9	72.7	27.2	5.9	115.1	15.0
SQ120	mm	720	760	450	948	856	1920	846	155	3168	402
	in	28.3	29.9	17.7	37.3	33.7	75.5	33.3	6.1	124.7	15.8
SQ130	mm	720	756	450	951	856	2086	872	165	3360	402
	in	28.3	29.7	17.7	37.4	33.7	82.1	34.3	6.4	132.2	15.8
SQ140	mm	720	761	450	965	856	2167	872	165	3441	402
	in	28.3	29.9	17.7	37.9	33.7	85.3	34.3	6.4	135.4	15.8
SQ150	mm	720	793	495	992	856	2343	839	175	3677	495
	in	28.3	31.2	19.4	39.0	33.7	92.2	33.0	6.8	144.7	19.4
SQ181	mm	850	891	675	1081	950	2671	912	200	4112	529
	in	33.4	35.0	26.5	42.5	37.4	105.1	35.9	7.8	161.8	20.8

** B, I, H : The dimension is for reference only and may vary depending on the required mounting plate (Top Cap).

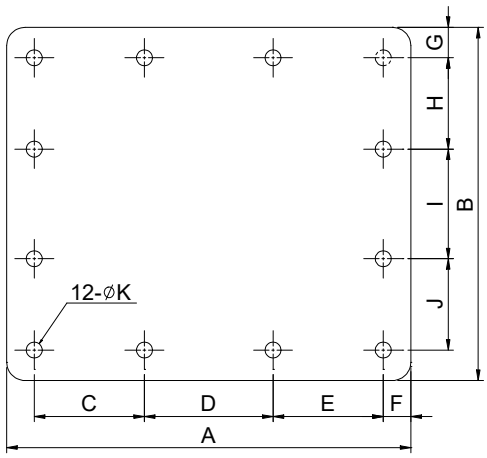
3.3 Cover Plate

■ SQ10～43



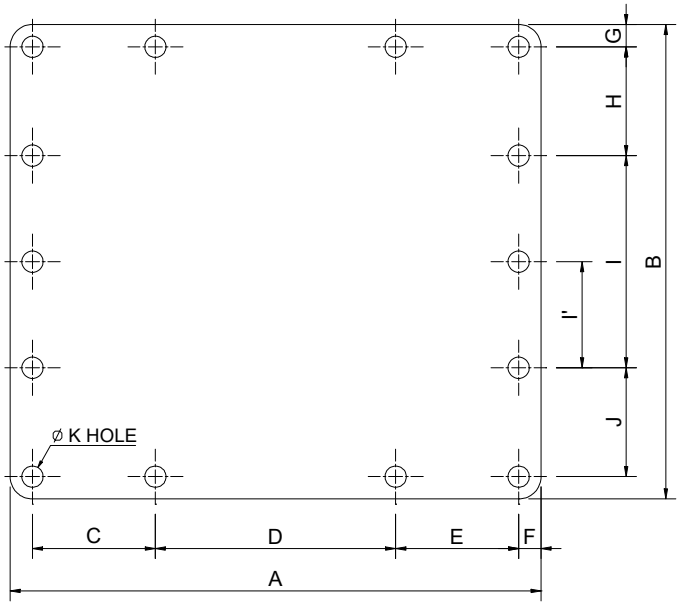
MODEL	HOLE (EA)	UNIT	A	B	C	D	E	F	G	H	K
SQ10 ~SQ30	8	mm	272	264	74	74	74	25	20	224	19
		in	10.70	10.39	2.91	2.91	2.91	0.98	0.78	8.81	0.74
SQ35 ~SQ43	8	mm	404	324	115	124	115	25	25	274	21
		in	15.90	12.75	4.52	4.88	4.52	0.98	0.98	10.78	0.82

■ SQ45～50



MODEL	HOLE (EA)	UNIT	A	B	C	D	E	F	G	H	I
SQ45 ~SQ50	12	mm	570	420	170	180	170	25	25	120	130
		in	22.44	16.53	6.69	7.08	6.69	0.98	0.98	4.72	5.11

■ SQ60~181



MODEL	HOLE (EA)	UNIT	A	B	C	D	E	F	G	H	I	I'	J	K
SQ60	12	mm	760	620	225	240	225	35	35	175	200	–	175	26
		in	29.92	24.40	8.85	9.44	8.85	1.37	1.37	6.88	7.87	–	6.88	1.02
SQ70	12	mm	760	620	225	240	225	35	35	175	200	–	175	26
		in	29.92	24.40	8.85	9.44	8.85	1.37	1.37	6.88	7.87	–	6.88	1.02
SQ80	12	mm	760	620	225	240	225	35	35	175	200	–	175	26
		in	29.92	24.40	8.85	9.44	8.85	1.37	1.37	6.88	7.87	–	6.88	1.02
SQ100	12	mm	760	620	225	240	225	35	35	175	200	–	175	26
		in	29.92	24.40	8.85	9.44	8.85	1.37	1.37	6.88	7.87	–	6.88	1.02
SQ120	12	mm	856	720	258	260	258	40	40	220	200	–	220	38
		in	33.70	28.34	10.15	10.23	10.15	1.57	1.57	8.66	7.87	–	8.66	1.49
SQ130	12	mm	856	720	258	260	258	40	40	220	200	–	220	38
		in	33.70	28.34	10.15	10.23	10.15	1.57	1.57	8.66	7.87	–	8.66	1.49
SQ140	12	mm	856	720	258	260	258	40	40	220	200	–	220	38
		in	33.70	28.34	10.15	10.23	10.15	1.57	1.57	8.66	7.87	–	8.66	1.49
SQ150	12	mm	856	720	258	260	258	40	40	220	200	–	220	38
		in	33.70	28.34	10.15	10.23	10.15	1.57	1.57	8.66	7.87	–	8.66	1.49
SQ181	14	mm	950	850	220	430	220	40	40	195	380	190	195	38
		in	37.40	33.46	8.66	16.92	8.66	1.57	1.57	7.67	14.96	7.48	7.67	1.49

04. Preparation for Installation and Operation

4.1 Checking before installation

⚠ CAUTION

CHECK THE "SPECIFICATIONS" SECTION OF THIS MANUAL TO DETERMINE CORRECT EXCAVATOR SIZES AND HYDRAULIC PRESSURE, AND HYDRAULIC FLOW IF HYDRAULIC PRESSURE, HYDRAULIC FLOW IS EXCEEDED, THE HYDRAULIC BREAKER WARRANTY IS VOID

⚠ CAUTION

BE SURE THE FLUID IN THE HYDRAULIC SYSTEM IS CLEAN.
CHECK THE HYDRAULIC FILTER, REPLACE THE FILTER IF DIRTY OR DETERIORATED.
CHECK THE GAS PRESSURE IN ACCUMULATOR AND BACK HEAD.
SEE INSPECTION AND CHARGING OF NITROGEN GAS AT BACK HEAD, ACCUMULATOR, HOSE AND FLUSHING.

⚠ CAUTION

CONTAMINATED PARTS MUST BE CLEANED WITH NO DELAY.
HYDRAULIC OIL OR LIGHT OIL IS HIGHLY RECOMMENDABLE.

⚠ CAUTION

THE CIRCUIT RELIEF SETTING PRESSURE IS NOT FIXED
BUT IT WILL BE ADJUSTED BY PUMP CAPACITY.

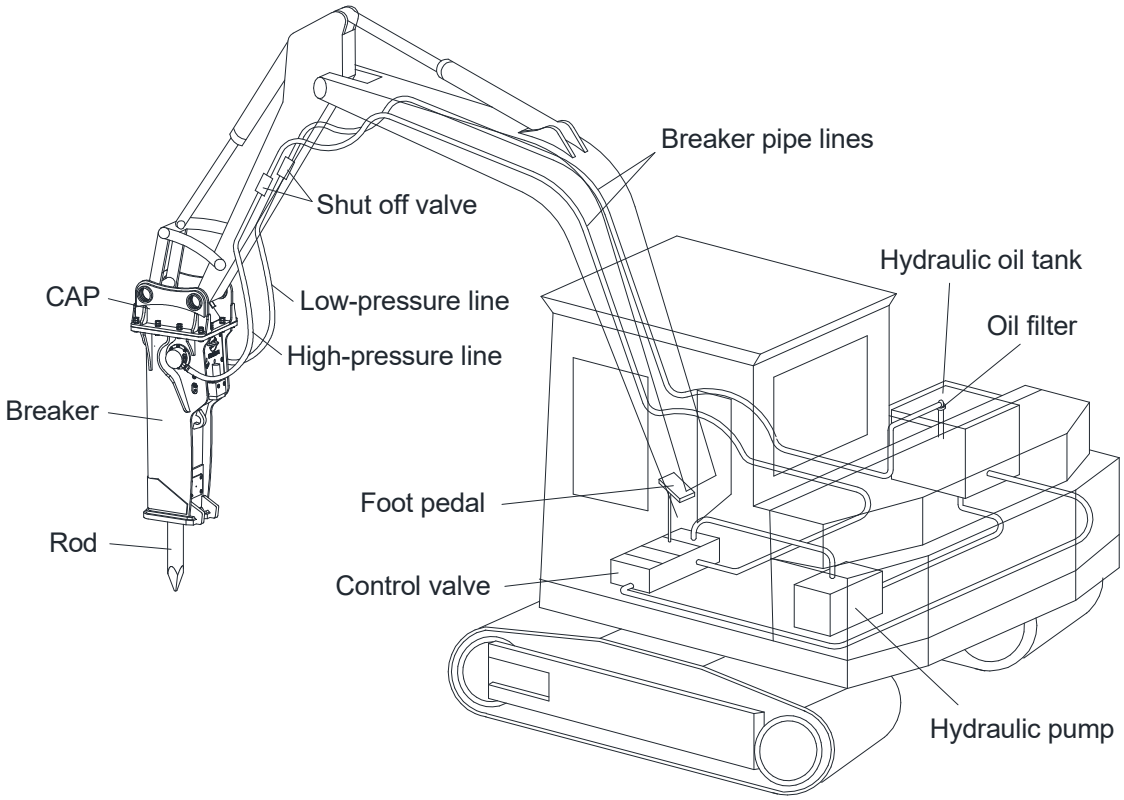
■ Recommended circuit relief setting pressure and back pressure

MODEL	UNIT	SQ10	SQ20	SQ30	SQ35	SQ40	SQ43	SQ45	SQ50
Relief Setting Pressure	kg/㎠	150	150	160	160	170	180	190	200
	psi	2134	2134	2276	2276	2418	2560	2702	2845
Back Pressure	kg/㎠	10	10	10	10	10	10	10	10
	psi	142	142	142	142	142	142	142	142

MODEL	UNIT	SQ60	SQ70	SQ80	SQ100	SQ120	SQ130	SQ140	SQ150	SQ181
Relief Setting Pressure	kg/㎠	200	210	210	210	210	210	210	210	230
	psi	2845	2987	2987	2987	2987	2987	2987	2987	3271
Back Pressure	kg/㎠	10	10	10	10	10	10	10	10	10
	psi	142	142	142	142	142	142	142	142	142

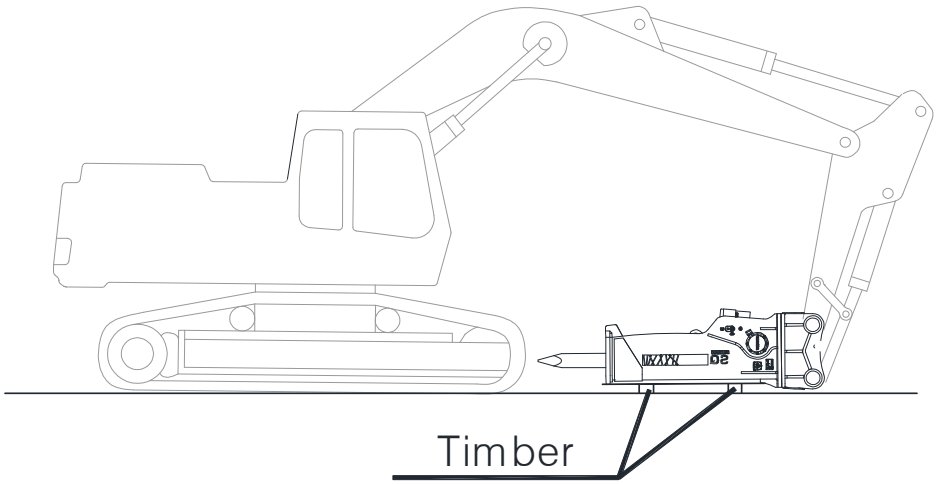
4.2 Installation and Removal

■ Basic set up

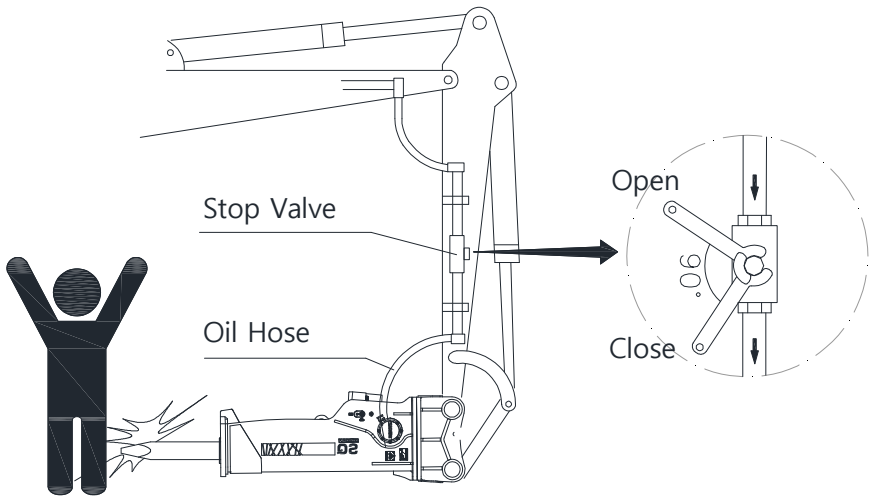


■ Removal of the Hydraulic Breaker

When the bucket and breaker operate alternately, the bucket and breaker can be easily exchanged by the hydraulic hoses and two mounting pins. However, there is a risk of hydraulic contamination accordingly. Do installation and removal as follows.



(1) Move the carrier to stable ground, free from mud, dust and dirt.
(2) Place the hydraulic breaker on timber.
(3) Stop the engine, turn off the main switch and deflate air from oil tank if it is
(4) Turn 90° the shut off valve installed to the end of arm to prevent hydraulic from flowing out.

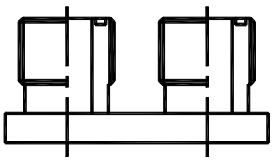


(5) Loosen the hose plug on the breaker arm. Collect a small amount of oil flowing out at this time and put into a container.
(6) Be careful to prevent mud or dust from entering oil hoses and pipe lines. Plug oil hoses with hose plug and pipe lines with union caps. Bind high and low-pressure hoses with a wire to prevent them from getting on the ground.

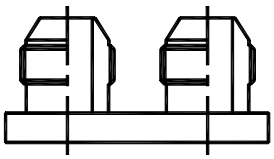
■ Oil hose plug

The oil hose plug is used to plug the hose attached to the hydraulic breaker. It prevents contamination of the hose when the hydraulic breaker is removed from the carrier for bucket operation.

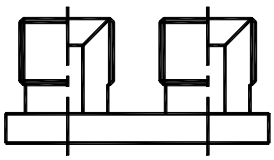
#3



#4



#5



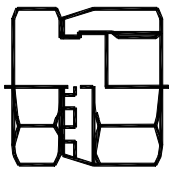
MODEL	TYPE	P/ N	TYPE	P/ N	TYPE	P/ N	O-RING (#3)
SQ10	–	–	# 4	2715302	# 5	2715306	–
SQ20	–	–	# 4	2715302	# 5	2715306	–
SQ30	–	–	# 4	2715302	# 5	2715306	–
SQ35	–	–	# 4	2715302	# 5	2715306	–
SQ40	–	–	# 4	2715302	# 5	2715306	–
SQ43	–	–	# 4	2715302	# 5	2715306	–
SQ45	–	–	# 4	2715303	#5	2715307	–
SQ50	–	–	# 4	2715303	#5	2715307	–
SQ60	# 3	2715300	# 4	2715304	# 5	2715308	2856004
SQ70	# 3	2715300	# 4	2715304	# 5	2715308	2715308
SQ80	# 3	2715300	# 4	2715304	# 5	2715308	2715308
SQ100	# 3	2715300	# 4	2715304	# 5	2715308	2715308
SQ120	# 3	2715301	# 4	2715305	# 5	2715309	2715309
SQ130	# 3	2715301	# 4	2715305	# 5	2715309	2715309
SQ140	# 3	2715301	# 4	2715305	# 5	2715309	2715309
SQ150	# 3	2715301	# 4	2715305	# 5	2715309	2715309
SQ181	# 3	2715301	# 4	2715305	# 5	2715309	2715309

* O-Ring(#3) use only TYPE #3

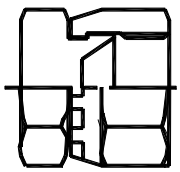
■ Union cap

The union cap is used to cap the piping bracket attached to the carrier for prevention of the piping bracket from contamination during bucket operation.

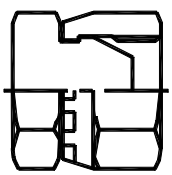
#3



#4

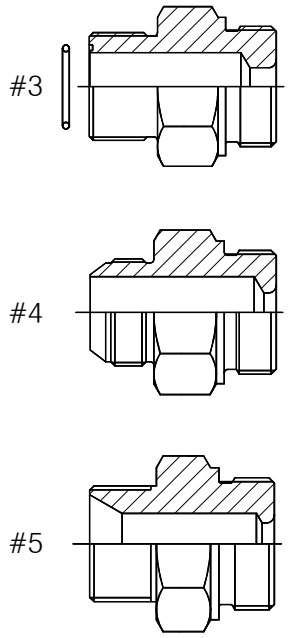


#5



MODEL	TYPE	P/ N	TYPE	P/ N	TYPE	P/ N
SQ10	# 3	–	# 4	C01202	# 5	2715002
SQ20	# 3	–	# 4	C01202	# 5	2715002
SQ30	# 3	–	# 4	C01202	# 5	2715002
SQ35	# 3	–	# 4	C01202	# 5	2715002
SQ40	# 3	–	# 4	C01202	# 5	2715002
SQ43	# 3	–	# 4	C01202	# 5	2715002
SQ45	# 3	–	# 4	C11149	# 5	2715003
SQ50	# 3		# 4	C11149	# 5	2715003
SQ60	# 3	2715063	# 4	C21132	# 5	2715004
SQ70	# 3	2715063	# 4	C21132	# 5	2715004
SQ80	# 3	2715063	# 4	C21132	# 5	2715004
SQ100	# 3	2715063	# 4	C21132	# 5	2715004
SQ120	# 3	2715064	# 4	C31175	# 5	2715005
SQ130	# 3	2715064	# 4	C31175	# 5	2715005
SQ140	# 3	2715064	# 4	C31175	# 5	2715005
SQ150	# 3	2715064	# 4	C31175	# 5	2715005
SQ181	# 3	2715064	# 4	C31175	# 5	2715005

■ Adapter
This parts connect to BREAKER IN/OUT port with hydraulic hose.



MODEL	TYPE	P / N	TYPE	P / N	TYPE	P / N	O-RING (#3)
SQ10	# 3	–	# 4	C01201	# 5	C91120	–
SQ20	# 3	–	# 4	C01201	# 5	C91120	–
SQ30	# 3	–	# 4	C01201	# 5	C91120	–
SQ35	# 3	–	# 4	C01201	# 5	C91120	–
SQ40	# 3	–	# 4	C01201	# 5	C91120	–
SQ43	# 3	–	# 4	C01201	# 5	C91120	–
SQ45	# 3	–	# 4	C11121	# 5	2710311	–
SQ50	# 3		# 4	C11121	# 5	2710311	–
SQ60	# 3	C21124	# 4	C21131	# 5	2710315	2856004
SQ70	# 3	C21124	# 4	C21131	# 5	2710315	2856004
SQ80	# 3	C21124	# 4	C21131	# 5	2710315	2856004
SQ100	# 3	C31115	# 4	C31201	# 5	C31193	2856004
SQ120	# 3	B0003996	# 4	C31117	# 5	2710318	2856005
SQ130	# 3	B0003996	# 4	C31117	# 5	2710318	2856005
SQ140	# 3	B0003996	# 4	C31117	# 5	2710318	2856005
SQ150	# 3	B0003996	# 4	C31117	# 5	2710318	2856005
SQ181	# 3	C61150	# 4	C61152	# 5	2710319	2856005

4.3 Hydraulic pipe lines for exclusive use

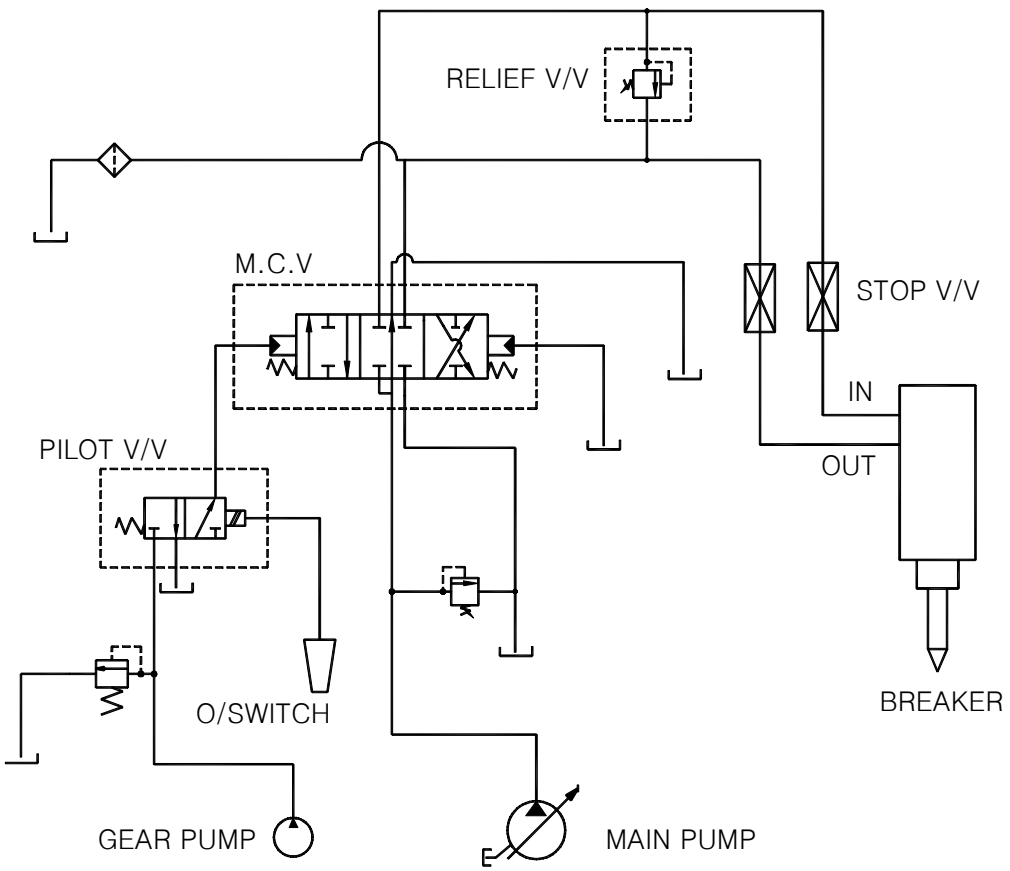
Operation of the hydraulic breaker requires installation of hydraulic pipe lines for exclusive use of the hydraulic breaker. As hydraulic pipe lines vary depending on base machines, our service engineer must first check hydraulic pressure, oil capacity, pressure loss and other conditions of the base machine before installing hydraulic pipe lines. Use only genuine parts in case of replacement because hydraulic pipe lines (hoses, pipes and fittings) are made of materials carefully selected in consideration of durability.

⚠ WARNING

THE HYDRAULIC SYSTEM TO THE BASE MACHINE MUST BE CHECKED BY AN AUTHORIZED SOOSAN SERVICE ENGINEER BEFORE FIRST USE AND AFTER ANY MODIFICATIONS.

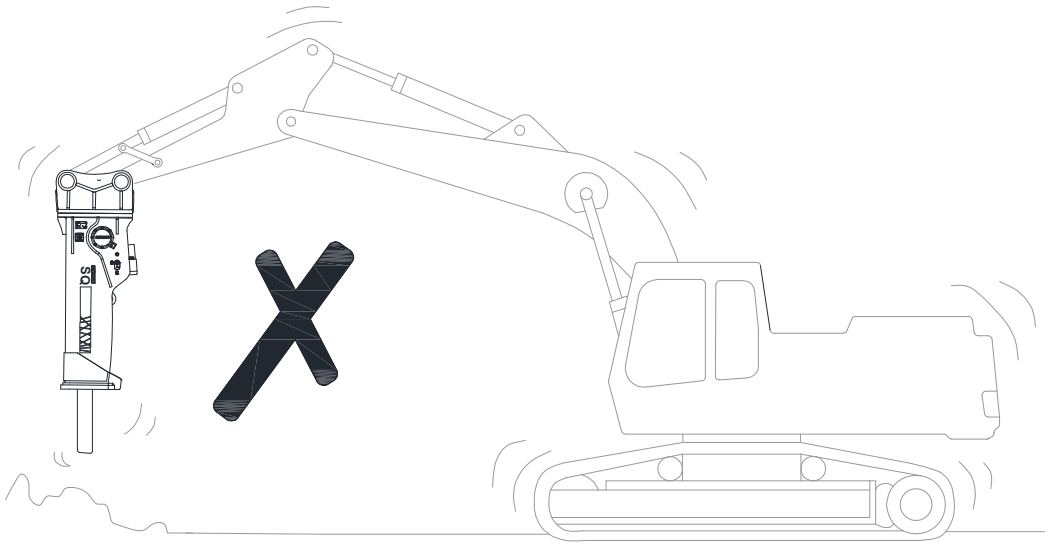
⚠ WARNING

MAKE SURE THAT THE HYDRAULIC BREAKER VALVE OF HYDRAULIC SYSTEM IS PROPERLY SET.

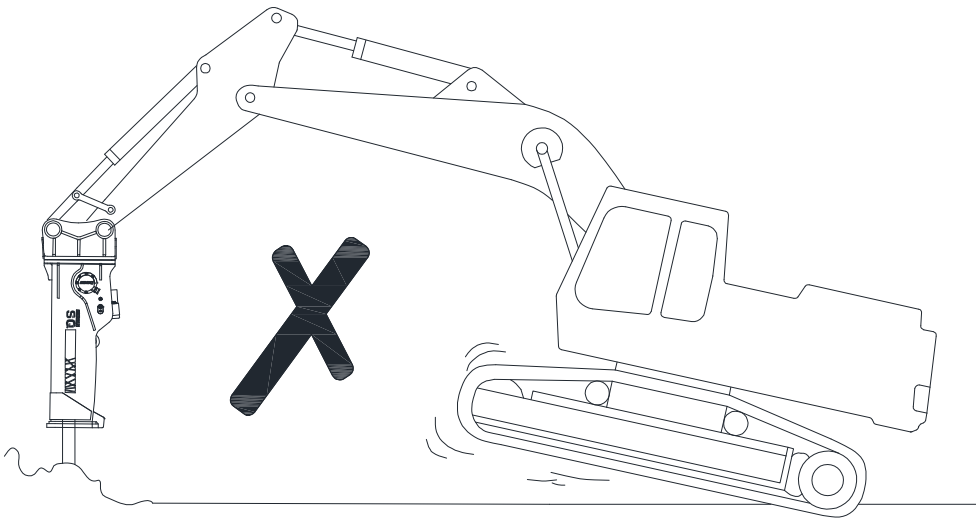


05. Precautions for safe operation.

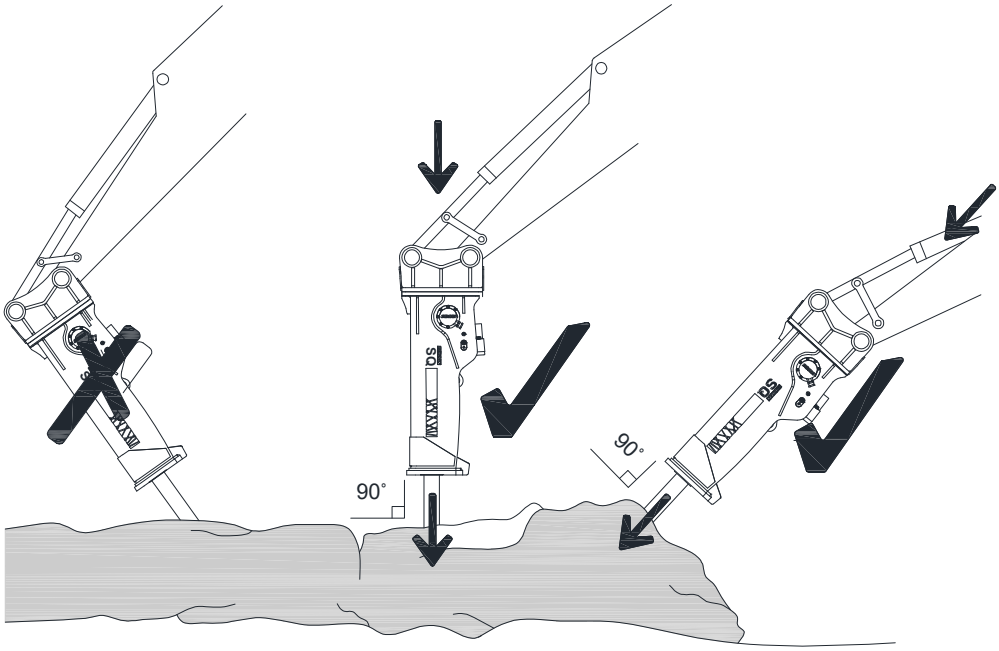
[1] Proper position must be applied for an effective usage of breaking force.
When position is incorrect, hammering energy of the piston is too weak to break rocks,



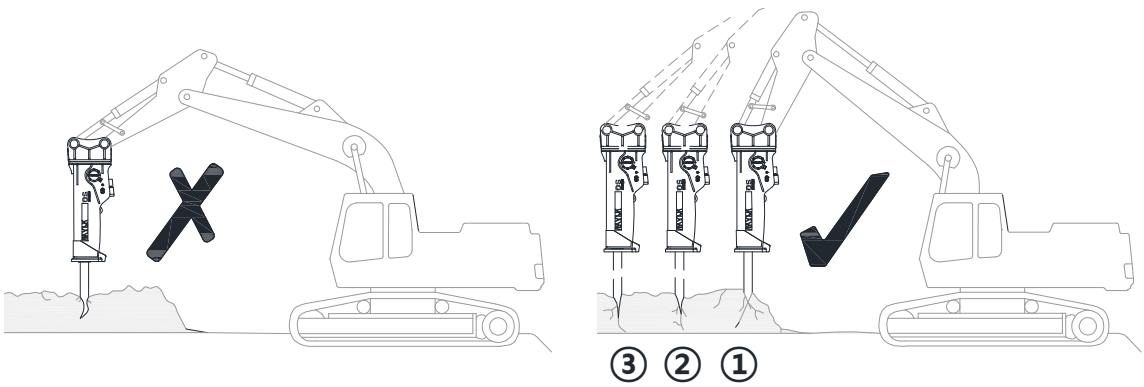
[2] On the contrary, when position is excessive enough to break rocks with front of the base machine raised, the machine may suddenly tilt forward the moment rocks are broken. Then, the breaker body or the end of bracket may violently hit against rocks and result in damage.



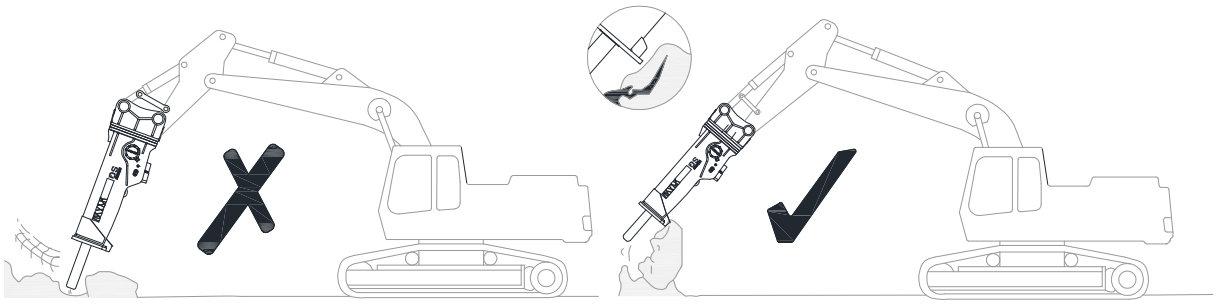
[3] It is undesirable to carry out hammering under the below condition, because vibrations during hammering may be transmitted to tracks of the base machine.
During hammering, however, proper position must be always applied to the breaker.
Special care must be taken not to hammer under abnormal condition.



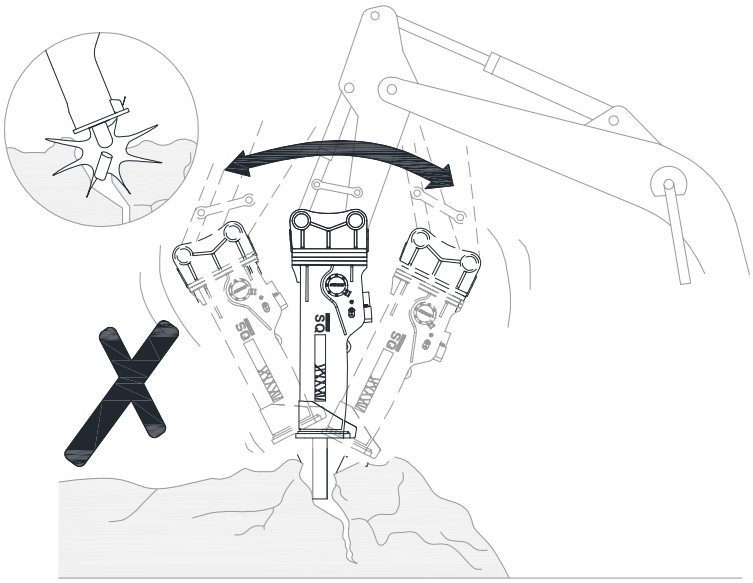
[4] Apply same direction of boom force in line with the rod and place the rod in the rock with hammering surface as vertical as possible. If hammering surface is oblique, the rod may slip during hammering. This causes the rod to seize and to be broken and piston to be damaged. When breaking, fully stabilize the rod first and then select the point of a rock on which hammering can be performed in a stable condition.



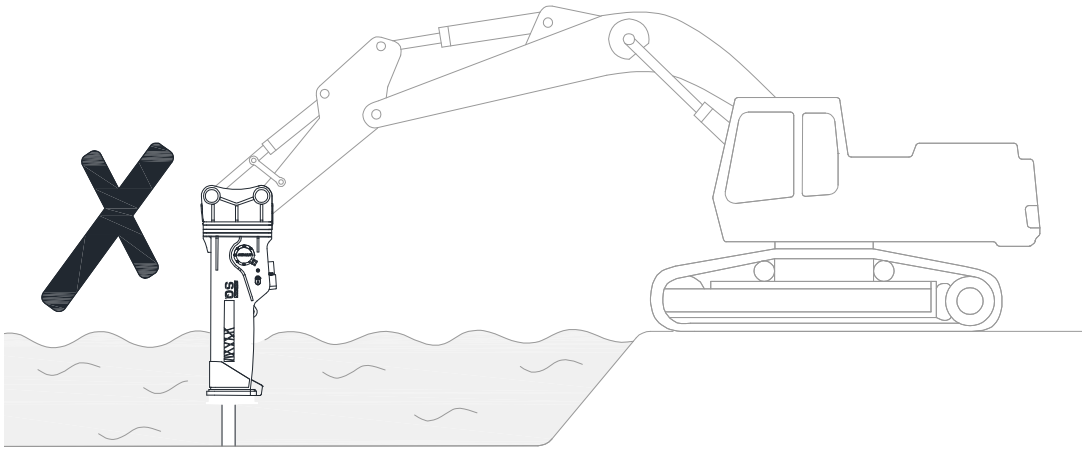
[5] Do not use the breaker rod to move rocks. The stone claws are designed for this purposes.



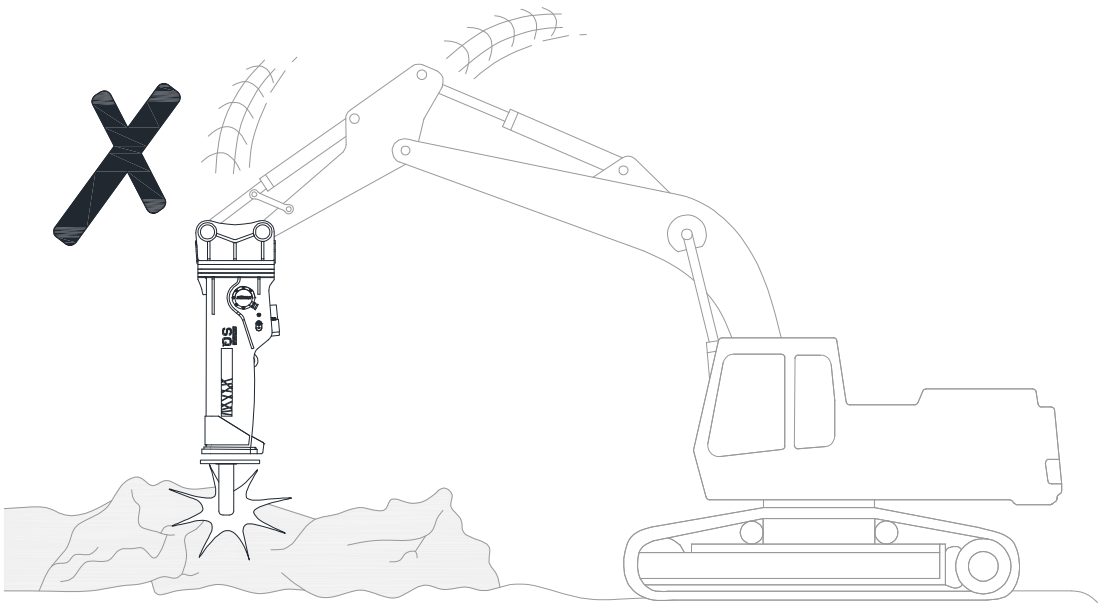
[6] Do not use the breaker to sweep the ground of debris.
This may damage the breaker and the housing will wear out more quickly



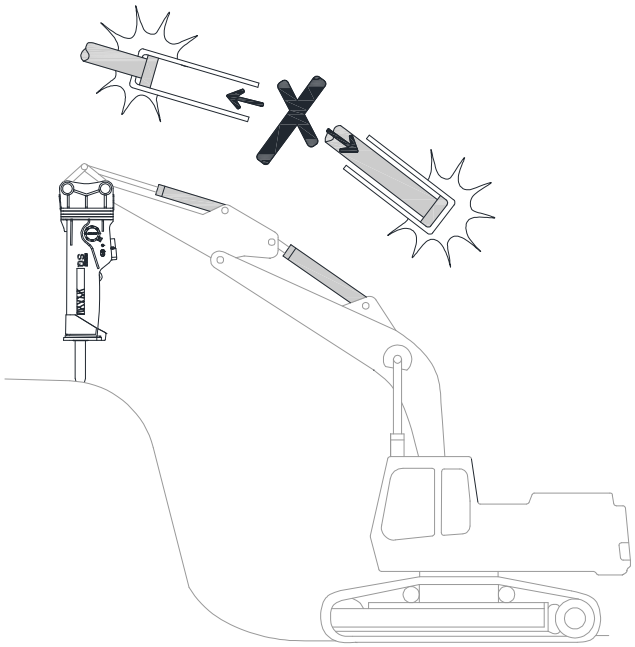
[7] Do not operate breaker when all components except rod are immersed in water and mud.
Underwater usage of the breaker will cause internal damage to the breaker.
Consult Soosan for modifications if you have an underwater requirement.



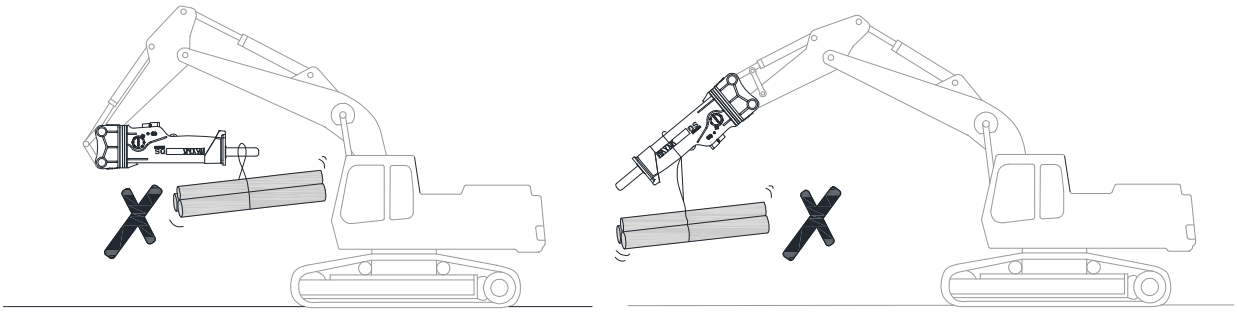
[8] Do not allow the breaker to fall to a rock.
Falling down the breaker will apply excessive force to the breaker or the carrier, causing damage to the parts of the breaker and carrier.



[9] Do not operate the breaker with the carrier's boom, stick or bucket cylinders at the end of their stroke (either fully extended or fully retracted). Damage to the carrier may result



[10] Do not use the breaker or breaker rods for lifting.
Lifting eyes on the breaker are for storage and maintenance purposes only.



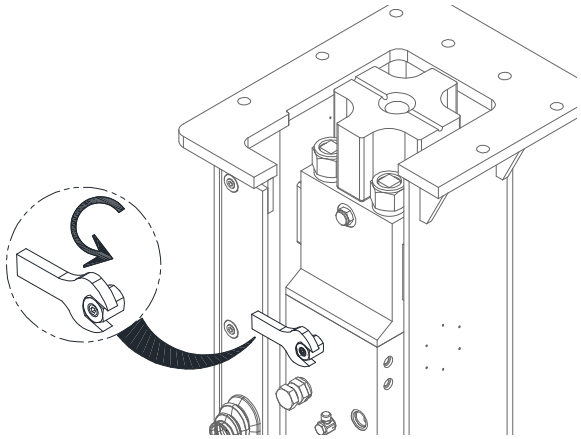
[11] Warm-up of machine prior to operation
- Do not operate the machine right after starting the engine. Idle the machine for warm-up. Warm the hydraulic oil sufficiently especially in winter or in the cold place.
- Especially in winter, the carrier's engine should be warmed up for 5 to 10 minutes 30~40℃(86～105°F) before breaker operation.
- When operating the hydraulic breaker, idle the engine and operate the hydraulic breaker with a light load.

[12] Stop operation when hoses are vibrating abnormally.
Check the hoses on the high pressure and low pressure sides of the breaker for abnormal vibration. If they are vibrating abnormally, contact the nearest Soosan dealer.

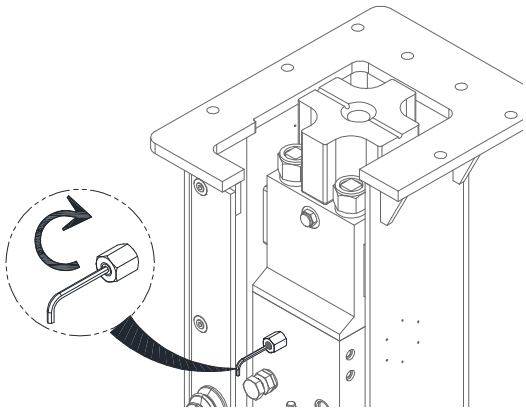
[13] Avoid blank hammering.
Blank hammering accelerates wear and tear on breaker and carrier components and may result in failure of one or more components. Excessive blank hammering may be considered equipment abuse and may result in voiding warranties. In case of blank hammering, hammering sound changes.

[14] Operate the breaker at proper engine speed.
Break rocks at the specified engine speed. Raising engine speed more than necessary does not strengthen hammering force but increase oil temperature to the detriment of piston and valve.

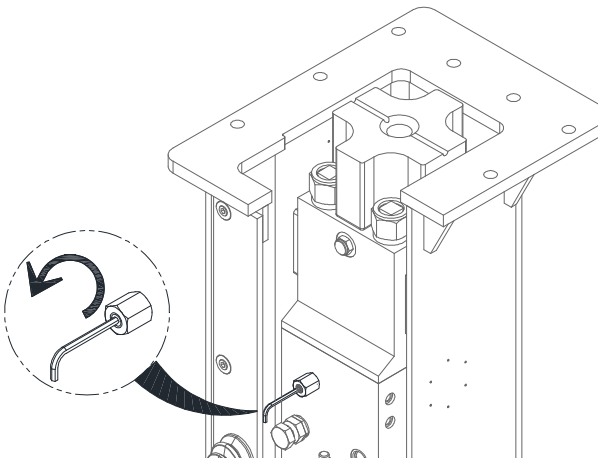
[15-1] **Piston Stroke Adjuster** (SQ35~50)



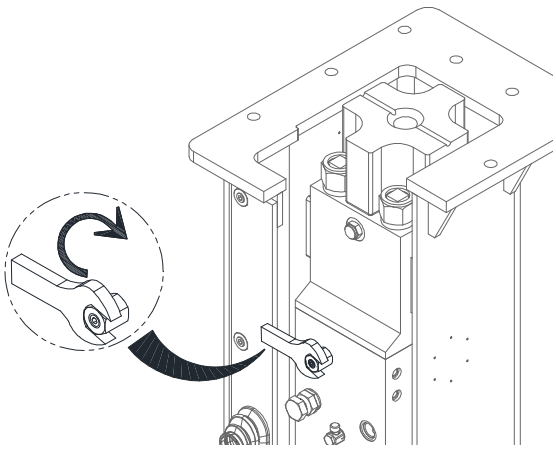
STEP1. Release the Nut using 24mm(0.9inch) Spanner



STEP2. Close the Adjuster using
5mm(0.2inch) L-Wrench



STEP3. Set the released turns using
5mm(0.2inch) L-Wrench

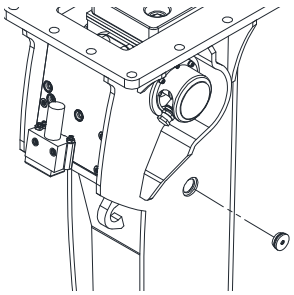


STEP4. Fasten the Nut using
24mm(0.9inch) Spanner

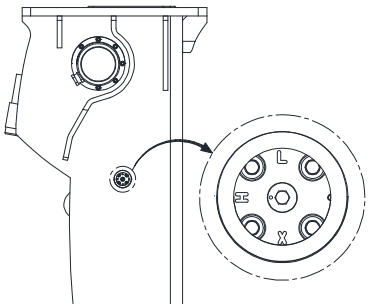
(Released turns setting)

Short Stroke	Release 3~3.5 rev. from fully closed
Middle Stroke	Release 1-1/4~2 rev. from fully closed
Standard Stroke	Fully closed (standard factory setting)

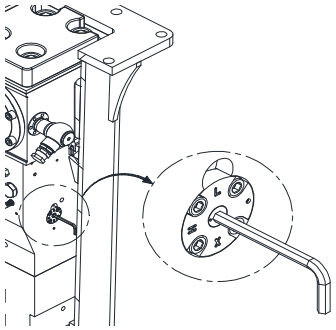
[15-2] IPC (Integrated Power Control) & ABH (Anti Blank Hammering) (SQ60~181)



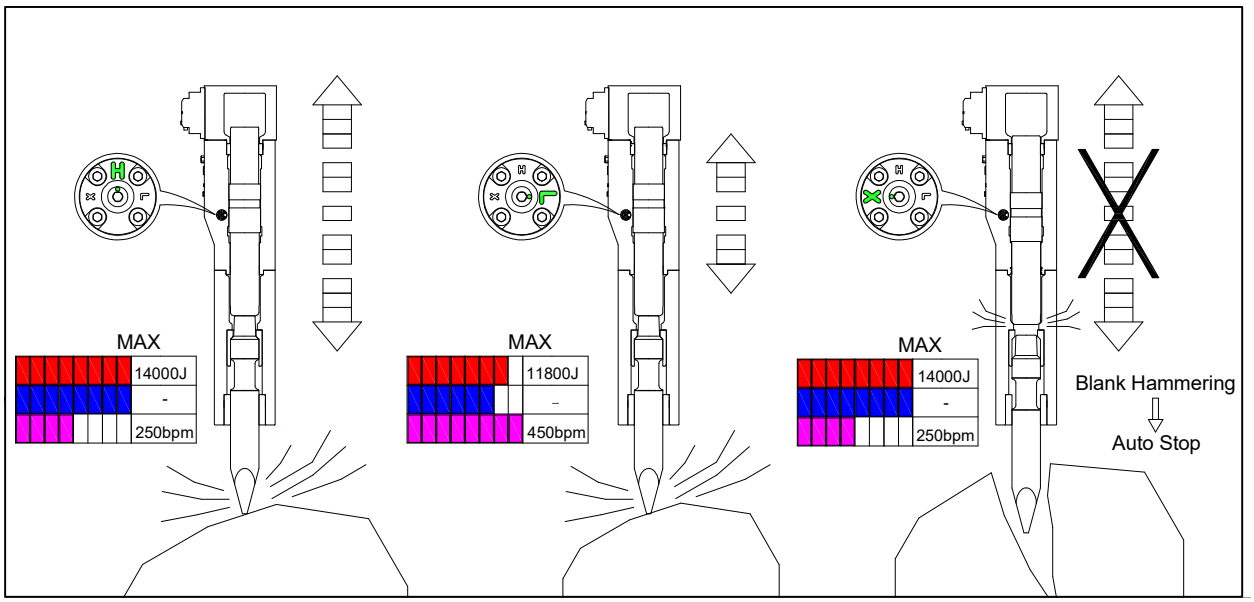
STEP1. Remove the Sound Plug



STEP2. Check the Selected Mode



STEP3. Change the Mode
using 8mm(0.3inch) L-Wrench



Long stroke & extra Power. ABH System is OFF.	Short stroke & Normal Power. ABH System is OFF.	Long stroke & extra Power. ABH System is ON

06. Maintenance

■ Regular Hydraulic breaker Inspection and Maintenance

⚠ CAUTION

Regular inspection is essential for keeping hydraulic breaker operating in the best condition consult with the Soosan service station for regular inspection and maintenance. Customers are recommended to contact the service station for inspection within six months after delivery.

■ Maintenance of Hydraulic breaker

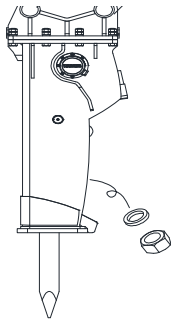
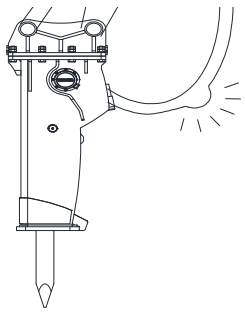
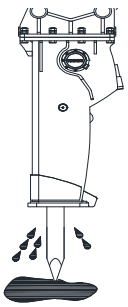
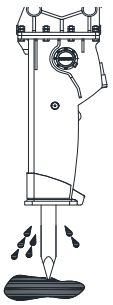
Check cycle	Check Item	Location
Ordinary check items before and after operating breaker	● Confirm the state of setting breaker and carrier * Damage and assembled state of bracket pin * Fastened state of pin assembled bolts * State of quick-clamp setting and bolts/pins assembled * State of cap mounting bolt	
	● Assembling state of breaker and bracket * State of side-bolt and all kinds of bolt * Whether all kinds fixing part and anti-shock parts (cushion & wear plate)are damaged * State of bracket-crack, breakage, welded area	
	● Fastening state of breaker main-body parts - Fastening and breakage state of pins, blocks, bolts * Fastened through bolt state * Front head pin and Rubber plugs * Stop pin and Rubber plugs * Air check valve * Back head charging valve * Valve adjuster * Accumulator mounting bolt * Accumulator cover fastening bolt * Accumulator charging valve * Hose adapter * Hex Head Plug	
	● Damage of safety/warning sticker	
	● Loss or fastening state of bracket assembled parts * Sound plug * Window cover	
	● Leakage, interference and assembling state of carrier hoses and pipes * Interference and assembling state of hoses and pipes * Fixing state of control valve * Welding state of clamps * Leakage and fastening state of pipes/hoses connected * Whether hose are twisted/damaged/aged	
	● Oil tank and working fluid quality * Quantity of working fluid * Contamination of working fluid	
	● Breaker on/off switch and electric wire	
	● Examine worsen state of consumable parts * Inside diameter of front cover * Worsen state of rod	

Check cycle	Check Item	Location
Any time check items during operating breaker	● Temperature of working fluid(below 80℃/176℉)	
	● Loss and damage of parts	
	● Leakage of breaker hoses – A little leakage could be run on the rod (as much as it does not affect operating, performance and efficiency)	
	● Efficiency and abnormal working of breaker * Irregular blowing is occurred * Abnormal blowing sound is occurred * Pipes and hoses are shaken extremely	
After 1Hr operating	● Grease pumping(about 20cc after 1hr operating) – About 5~10 times pumping with grease gun * Rod friction area : Ring bush, Front cover, Rod pin	
Every week (Every 50hr operating)	● Quantity and contamination degree of working fluid(Refill or replace) * Contamination limit : 20~40cst	
	● Examining wear of consumable parts (Grind the area deformed if necessary) * Rod pin * Ring bush * Front cover	
	● Remove strange material inside of front head	
	● Check the gas pressure and refill * Back head * Accumulator	
	● Whether all kinds of bolts are fastened by regulated torque	
Every month (Every 200 Hr operating)	● Operating pressure of breaker	
	● Relief setting pressure of hydraulic circuit	
	● Supply flow	
	● Replace oil filter of carrier	
Every 3month (Every 500 ~ 1000operating)	● Replace seal kit	
	● Replace diaphragm of accumulator	
	● Examine if piston is pressed or deformed	
	● Examine if hydraulic parts are scratched if necessary grind and repair them	
Hold breaker over 1month	● Sufficient greasing * Rod, Rod pin, Front cover, Ring bush	
	● Lubricate piston surface	
	● Remove N_2 Gas * Back head * Accumulator	
	● Paint area fallen off	
After under water operating	● Clean and grease after dissemble all parts of main body	

* The maintenance related with carrier follows carrier manufacturer rule

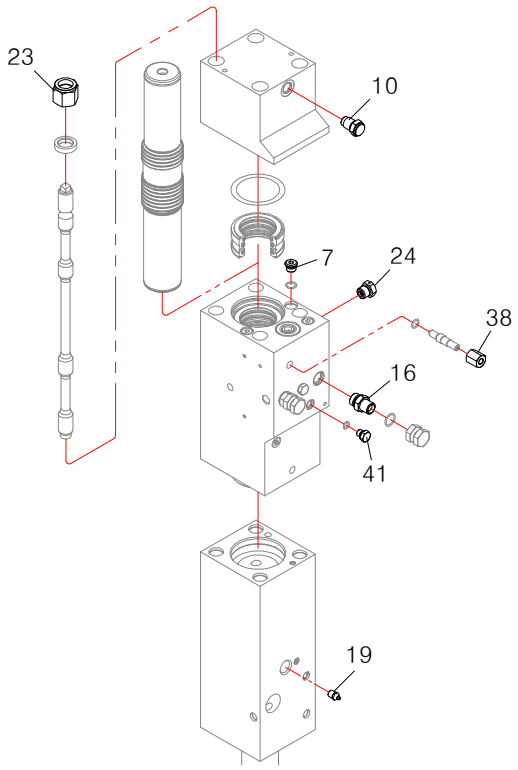
■ Daily Inspection before opearting

Be fore starting operation, be sure to inspect the breaker referring to the following table.

Inspection Item	Inspection Point	Remedy
– Looseness, missing and damage to bolts and nuts 	– Through bolt – Bracket mounting bolt	– Check looseness. – Retighten to correct Tightening torque.
– Looseness of hose fittings, visible damage to hoses & oil leakage 	– Hydraulic piping for breaker – Oil hose	– Retighten sufficiently. – Replace when damaged.
– Abnormal oil leakage 	– Connection of back head and cylinder – Gap between front head and rod ※ But small leakage is normal.	– Consult with Soosan for further inspection.
– Abnormal wear and cracks rod. 	– rod	– If the rod is deformed, burred and worn out, be repaired. – If the rod is excessively worn out, be replaced. – If the rod is cracked, be replaced.

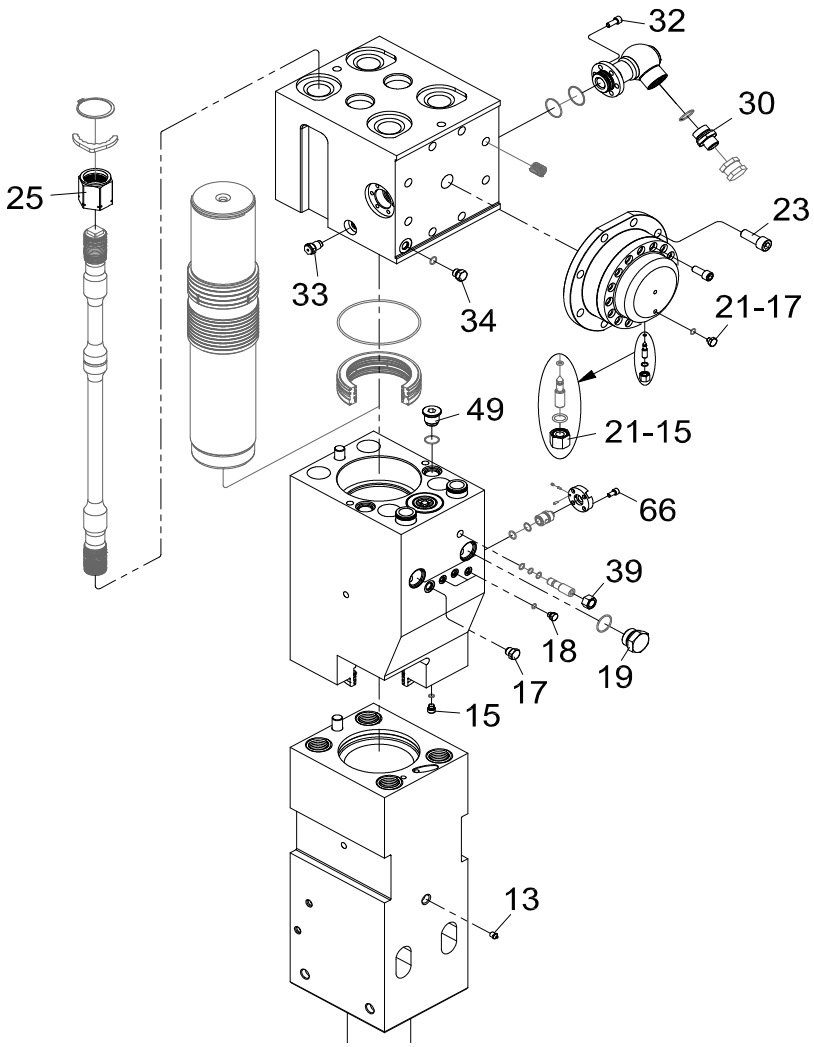
■ Tightening Torque (SQ10~50)

ITEM \ MODEL	Part No	UNIT	SQ10	SQ20	SQ30	SQ35	SQ40	SQ43	SQ45	SQ50
Socket Bolt	7	kg-m	–	–	–	–	30~35	30~35	38~40	38~40
		ft-lb	–	–	–	–	217~253	217~253	275~289	275~289
Charging V/V	10	kg-m	35~40	35~40	35~40	35~40	35~40	35~40	35~40	35~40
		ft-lb	253~289	253~289	253~289	253~289	253~289	253~289	253~289	253~289
Connector	16	kg-m	16~18	16~18	16~18	16~18	16~18	16~18	24~26	24~26
		ft-lb	116~130	116~130	116~130	116~130	116~130	116~130	174~188	174~188
Grease Nipple	19	kg-m	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2
		ft-lb	11~15	11~15	11~15	11~15	11~15	11~15	11~15	11~15
Hex Nut	23	kg-m	25~30	25~30	25~30	30~35	38~42	60~70	96~105	140~155
		ft-lb	181~217	181~217	181~217	217~253	275~304	434~506	694~760	1013~1121
Hex Head Plug	41	kg-m	3~4	3~4	3~4	3~4	3~4	3~4	3~4	3~4
		ft-lb	22~29	22~29	22~29	22~29	22~29	22~29	22~29	22~29
Air Check V/V	24	kg-m	16~18	16~18	16~18	16~18	16~18	16~18	16~18	16~18
		ft-lb	116~130	116~130	116~130	116~130	116~130	116~130	116~130	116~130
ADJ' Hex Nut	38	kg-m	–	–	–	25~30	25~30	25~30	25~30	25~30
		ft-lb	–	–	–	181~217	181~217	181~217	181~217	181~217



■ Tightening Torque (SQ60~181)

ITEM \ MODEL	Part No.	UNIT	SQ60	SQ70	SQ80	SQ100	SQ120	SQ130	SQ140	SQ150	SQ181
Grease Nipple	13	kg-m	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2	1.5~2
		ft-lb	11~15	11~15	11~15	11~15	11~15	11~15	11~15	11~15	11~15
Socket Plug	15	kg-m	3~4	3~4	3~4	3~4	3~4	3~4	3~4	3~4	3~4
		ft-lb	22~29	22~29	22~29	22~29	22~29	22~29	22~29	22~29	22~29
Air Check VV	17	kg-m	16~18	16~18	16~18	16~18	16~18	16~18	16~18	16~18	16~18
		ft-lb	116~130	116~130	116~130	116~130	116~130	116~130	116~130	116~130	116~130
Hex Head Plug	18	kg-m	3~4	3~4	3~4	3~4	3~4	3~4	3~4	3~4	3~4
		ft-lb	22~29	22~29	22~29	22~29	22~29	22~29	22~29	22~29	22~29
Hex Head Plug	19	kg-m	35~40	35~40	40~45	40~45	70~80	70~80	70~80	70~80	70~80
		ft-lb	253~289	253~289	289~326	289~326	506~579	506~579	506~579	506~579	506~579
Cap & Nut	21-15	kg-m	6~8	6~8	6~8	6~8	6~8	6~8	6~8	6~8	6~8
	21-17	ft-lb	43~58	43~58	43~58	43~58	43~58	43~58	43~58	43~58	43~58
Socket Bolt	23	kg-m	35~40	35~40	40~45	40~45	75~80	75~80	75~80	90~95	90~95
		ft-lb	253~289	253~289	289~326	289~326	542~579	542~579	542~579	651~687	651~687
Hex Nut	25	kg-m	190~200	270~280	290~300	440~450	440~450	440~450	470~480	470~480	550~600
		ft-lb	1374~1447	1953~2025	2098~2170	3183~3255	3183~3255	3183~3255	3400~3472	3400~3472	3978~4340
H/Adapter-01	30	kg-m	32~35	32~35	32~35	32~35	32~35	32~35	32~35	32~35	35~40
		ft-lb	232~253	232~253	232~253	232~253	232~253	232~253	232~253	232~253	253~289
Socket Bolt	32	kg-m	20~25	20~25	20~25	20~25	20~25	20~25	20~25	20~25	30~35
		ft-lb	145~181	145~181	145~181	145~181	145~181	145~181	145~181	145~181	217~253
Charging VV	34	kg-m	35~40	35~40	35~40	35~40	35~40	35~40	35~40	35~40	35~40
		ft-lb	253~290	253~290	253~290	253~290	253~290	253~290	253~290	253~290	253~290
Hex Head Plug	33	kg-m	8~10	8~10	8~10	8~10	8~10	8~10	8~10	8~10	8~10
		ft-lb	58~72	58~72	58~72	58~72	58~72	58~72	58~72	58~72	58~72
Hex Nut	39	kg-m	25~30	30~35	30~35	30~35	50~55	50~55	50~55	50~55	60~65
		ft-lb	181~217	217~253	217~253	217~253	362~398	362~398	362~398	362~398	434~470
Socket Plug	49	Kg-m	38~40	38~40	40~45	40~45	40~45	40~45	40~45	45~50	45~50
		ft-lb	275~289	275~289	289~326	289~326	289~326	289~326	289~326	289~326	289~326
Socket Bolt	66	kg-m	7~8	7~8	7~8	7~8	7~8	7~8	7~8	7~8	7~8
		ft-lb	51~58	51~58	51~58	51~58	51~58	51~58	51~58	51~58	51~58


32
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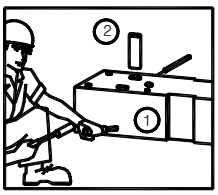
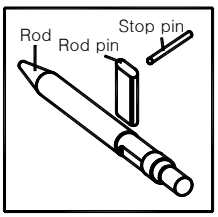
■ Replacement & Breakage of Rod

- Rod is deformed of burrs produced in a long term use.
- If the rod tip is worn out, rod is liable to slip. Grind the rod tip to sharpen the edge.
- If the rod tip is sharpened many times, the hardened surface layer will disappear and the rod will be worn out rapidly. In this case, replace with a new rod.
- If the gap between rod and front cover is large, the piston failure to fit in rod to cause damage to the piston or the rod.



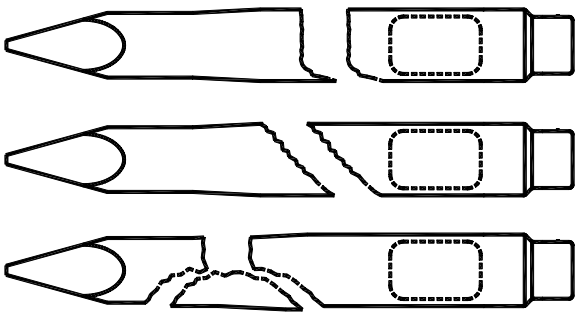


● Replacement

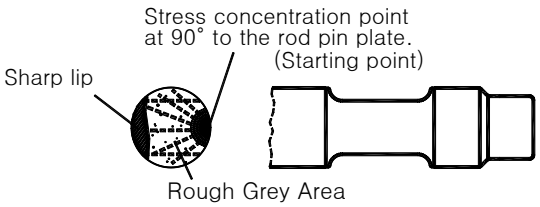
① Put the breaker horizontally on the timber.
② Remove rubber plug using a pliers.
③ Set round bar on the opposite side, and push the stop pin with a hammer.
④ Remove the rod pin. In removing the rod pin, be careful falling of rod and rod pin.
⑤ Wind rope or nylon sling around the rod and remove from the main body.
⑥ Before installing a new rod, check wear, breakage and score.
Remove burrs and swelling from the disassembled rod pin with a grinder. Excessively deformed rod pin will make replacement of rod difficult. Rod pin is required to be checked every 100 to 150 hours of operation
⑦ Grease sufficiently to inserting part of front head.

● Breakage of Rod

The service life of the rods depends on the manner of handling them. The rod can sufficiently withstand the vertically acting load, but is weak to the perpendicularly acting load. Especially, the rod is affected by the negative conditions such as force by craning operation, tilted blowing, wrenching and idle strokes etc.
There are several ways of breakage of the rod. Each cause of the breakage can be inferred by observing the breakage section. Further, the breakage case which is not caused by low quality materials or insufficient heat-treatment but by wrong way of handling which the manufacturer is not responsible for the breakage.
The breakage section has the origin on the outer surface, the narrow area of fatigue breakage and the wide area of rough grey area, and final breakage part has the share-lip form. Such as undulation on the breakage section and its inclination to the right and left witness that the breakage is caused by excessive force which excessive force which exceeds the toughness of the rod. Such the breakage is supposed to occur owing to careless handling of the rod. To avoid such the breakage more carefulness and attention is required in handling the breaker.



Typical fractures caused by excessive bending of the rod. Warranty claims rejected.



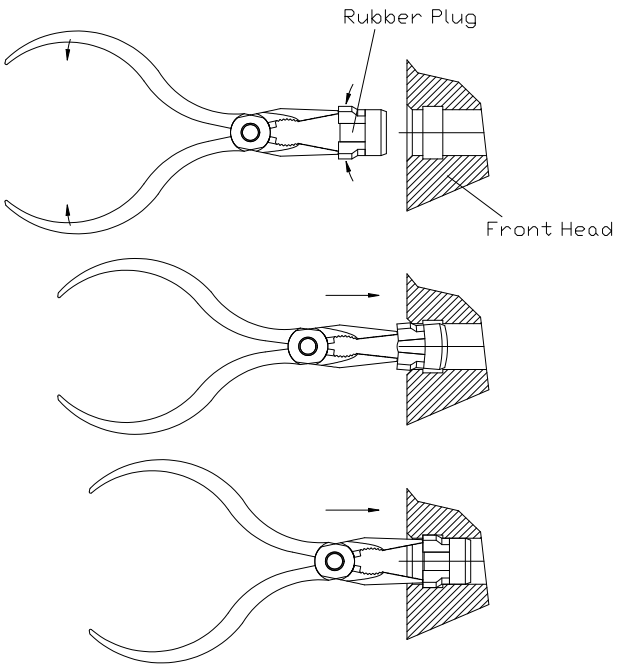
Typical fractures caused by levering tool while buried in the burden. Warranty claims rejected.

Flat type rod worn more than 45mm or moil type and wedge,universal type rods worn back more than 75mm of working end classed as reasionable life. Warranty claims rejected.

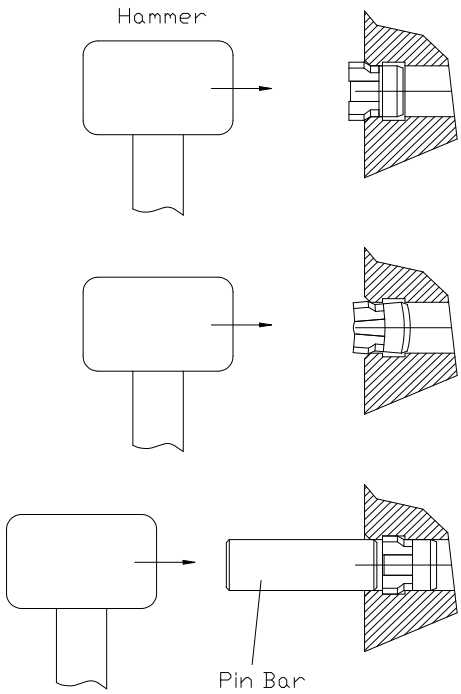
■ Assembly and Disassembly of Rubber Plug
In disassembling the front head pin and stop pin, assemble or disassemble with following method.

1) Assembling the rubber

● Method #1

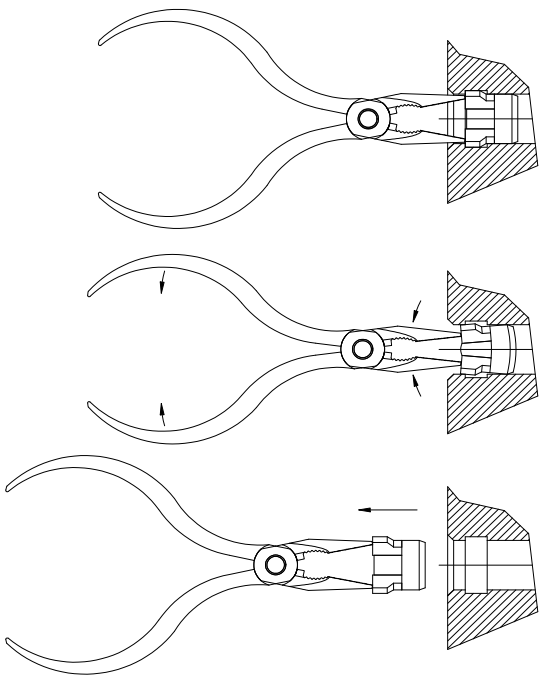


● Method #2

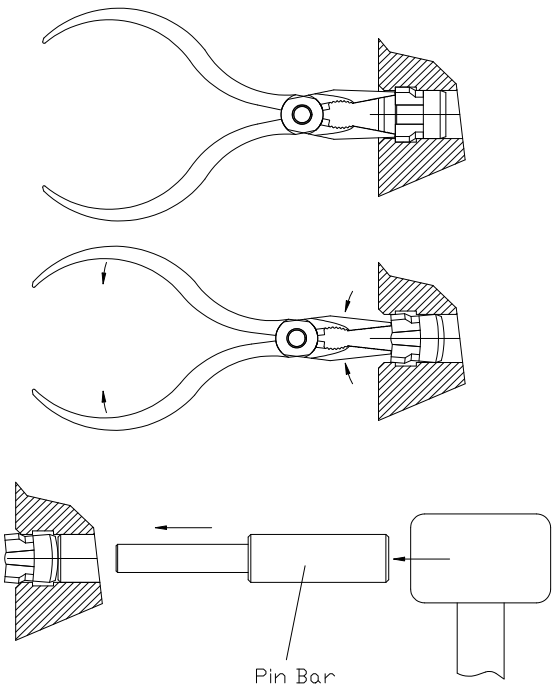


2) Disassembling the rubber plug

● Method #1



● Method #2



07. Wear Tolerance

Wear tolerance of each kind expendable parts come to decide. The usage of exceeding the wear tolerance causes fatal damage to breaker. Prevent the damage through the regular inspection and exchange of expendable parts including seals and all kinds of bushes. Our company is not responsible for the flaw using in exceeding the wear tolerance of the expendable parts.

7.1 Seal & O-Ring

Quality Guaranteed Period : 6 months

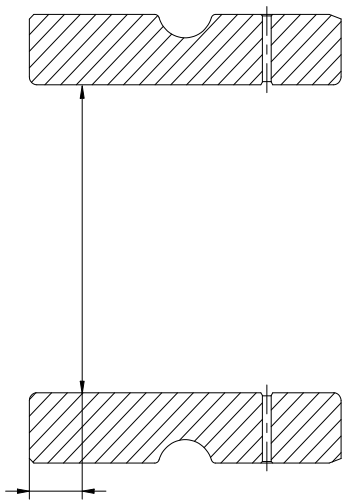
Since hydraulic breaker operates at high-pressure and high-temperature, leakage or scratch could be occurred by friction, wear and breakage of seals. Considering pressure, temperature, viscosity of oil, a little leakage is accepted to be normal. But in case of abnormal leakage, replace as a new ones. To prevent fatal defect periodical replacement is carried out every 6months without external leakage of breaker.

Although the breaker is not operated in a long time, replace seals periodically to prevent rust, corrosion of oil and transformation of seals.

7.2 THRUST BUSH & FRONT COVER

	MODEL	UNIT	New Inside Dia.	Reject Inside Dia.
THRUST BUSH	SQ10	mm	40	42
		in	1.6	1.7
	SQ20	mm	45	47
		in	1.8	1.9
	SQ30	mm	53	55
		in	2.1	2.2
	SQ35	mm	60	62
		in	2.4	2.4
	SQ40	mm	68	71
		in	2.7	2.8
	SQ43	mm	75	49
		in	3.0	1.9
FRONT COVER	SQ45	mm	85	89
		in	3.3	3.5
	SQ50	mm	100	105
		in	3.9	4.1
	SQ60	mm	125	130
		in	4.9	5.1
	SQ70	mm	135	140
		in	5.3	5.5
	SQ80	mm	140	146
		in	5.5	5.7
	SQ100	mm	150	156
		in	5.9	6.1
	SQ120	mm	155	161
		in	6.1	6.3
	SQ130	mm	165	171
		in	6.5	6.7
	SQ140	mm	165	171
		in	6.5	6.7
	SQ150	mm	175	181
		in	6.9	7.1
	SQ181	mm	197	203
		in	7.8	8.0

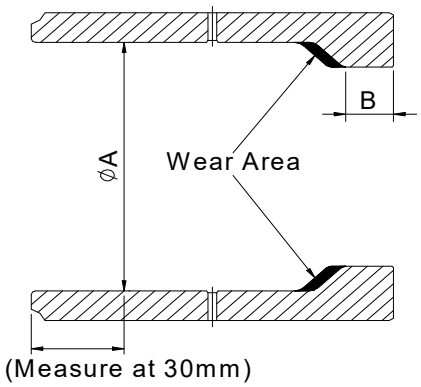
THRUST BUSH
(Measure at center)



(Measure at 10mm)

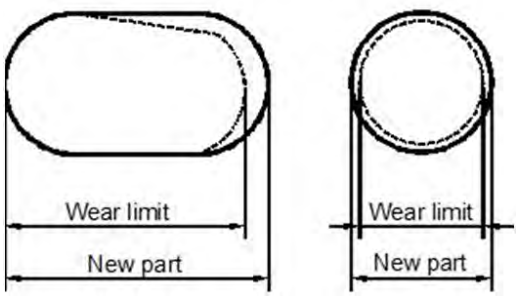
7.3 Ring bush

MODEL	UNIT	New Inside Dia.	Reject Inside Dia.	New B	Reject B
SQ10	mm	40	42	8.75	7
	in	1.6	1.7	0.3	0.3
SQ20	mm	45	47	10.25	8
	in	1.8	1.9	0.4	0.3
SQ30	mm	53	55	8.5	6
	in	2.1	2.2	0.3	0.2
SQ35	mm	60	62	10.5	7.5
	in	2.4	2.4	0.4	0.3
SQ40	mm	68	71	10.5	7.5
	in	2.7	2.8	0.4	0.3
SQ43	mm	75	78	15	12
	in	3.0	3.1	0.6	0.5
SQ45	mm	85	89	24	21
	in	3.3	3.5	0.9	0.8
SQ50	mm	100	105	17	14
	in	3.9	4.1	0.7	0.6
SQ60	mm	125	130	31	28
	in	4.9	5.1	1.2	1.1
SQ70	mm	135	140	32.5	29.5
	in	5.3	5.5	1.3	1.2
SQ80	mm	140	146	40	37
	in	5.5	5.7	1.6	1.5
SQ10	mm	150	156	38	35
	in	5.9	6.1	1.5	1.4
SQ120	mm	155	161	46	43
	in	6.1	6.3	1.8	1.7
SQ130	mm	165	171	41	38
	in	6.5	6.7	1.6	1.5
SQ140	mm	165	171	41	38
	in	6.5	6.7	1.6	1.5
SQ150	mm	175	181	53.5	50.5
	in	6.9	7.1	2.1	2.0
SQ181	mm	197	203	45	42
	in	7.8	8.0	1.8	1.7



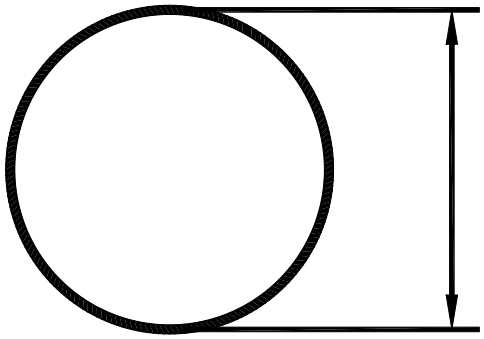
7.4 Rod pin

MODEL	UNIT	New Length	Reject Length
SQ10	mm	28	26
	in	1.1	1.0
SQ20	mm	28	26
	in	1.1	1.0
SQ30	mm	32	30
	in	1.3	1.2
SQ35	mm	36	34
	in	1.4	1.3
SQ40	mm	38	36
	in	1.5	1.4
SQ43	mm	42	40
	in	1.7	1.6
SQ45	mm	54	51
	in	2.1	2.0
SQ50	mm	60	57
	in	2.4	2.2
SQ60	mm	75	72
	in	3.0	2.8
SQ70	mm	82	79
	in	3.2	3.1
SQ80	mm	88.5	85.5
	in	3.5	3.4
SQ100	mm	94	91
	in	3.7	3.6
SQ120	mm	96	93
	in	3.8	3.7
SQ130	mm	96	93
	in	3.8	3.7
SQ140	mm	96	93
	in	3.8	3.7
SQ150	mm	99	95
	in	3.9	3.7
SQ181	mm	110	106
	in	4.3	4.2



7.5 Stop pin

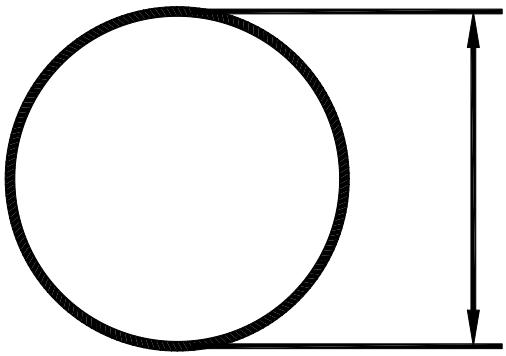
MODEL	UNIT	New Outside Dia	Reject Outside Dia
SQ10	mm	13	11
	in	0.5	0.4
SQ20	mm	13	10
	in	0.5	0.4
SQ30	mm	13	10
	in	0.5	0.4
SQ35	mm	13	10
	in	0.5	0.4
SQ40	mm	16	14
	in	0.6	0.6
SQ43	mm	16	14
	in	0.6	0.6
SQ45	mm	17.5	15.5
	in	0.7	0.6
SQ50	mm	17.5	15.5
	in	0.7	0.6



Measure Diamete

7.6 Front head pin

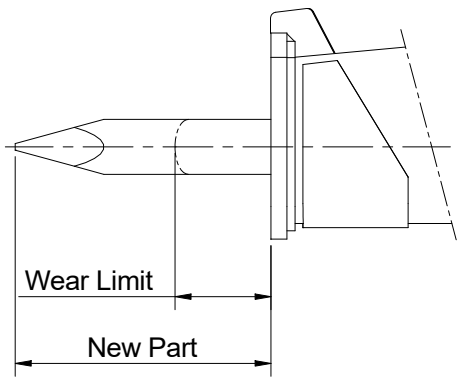
MODEL	UNIT	New Outside Dia	Reject Outside Dia
SQ45	mm	20	18
	in	0.8	0.7
SQ50	mm	26	24
	in	1.0	0.9
SQ60	mm	26	24
	in	1.0	0.9
SQ70	mm	26	24
	in	1.0	0.9
SQ80	mm	30	28
	in	1.2	1.1
SQ100	mm	26	24
	in	1.0	0.9
SQ120	mm	26	24
	in	1.0	0.9
SQ130	mm	26	24
	in	1.0	0.9
SQ140	mm	26	24
	in	1.0	0.9
SQ150	mm	36	34
	in	1.4	1.3
SQ181	mm	36	34
	in	1.4	1.3



Measure Diamet

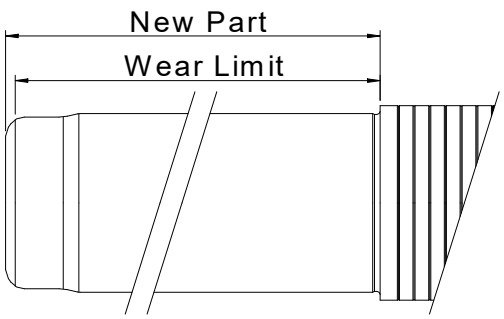
7.7 Rod

MODEL	UNIT	New Part (LONG Type)	New Part (SHORT Type)
SQ10	mm	272	222
	in	10.7	8.7
SQ20	mm	291	241
	in	11.5	9.5
SQ30	mm	295	245
	in	11.6	9.6
SQ35	mm	344	294
	in	13.5	11.6
SQ40	mm	390	290
	in	15.4	11.4
SQ43	mm	472	372
	in	18.6	14.6
SQ45	mm	561	461
	in	22.1	18.1
SQ50	mm	545	445
	in	21.5	17.5
SQ60	mm	589	489
	in	23.2	19.3
SQ70	mm	640	540
	in	25.2	21.3
SQ80	mm	705	605
	in	27.8	23.8
SQ100	mm	692	592
	in	27.2	23.3
SQ120	mm	846	746
	in	33.3	29.4
SQ130	mm	872	772
	in	34.3	30.4
SQ140	mm	872	772
	in	34.3	30.4
SQ150	mm	839	739
	in	33.0	29.1
SQ181	mm	912	812
	in	35.9	32



7.8 Piston

MODEL	UNIT	New Length	Wear Limit
SQ10	mm	159	158
	in	6.3	6.2
SQ20	mm	169	168
	in	6.7	6.6
SQ30	mm	168	167
	in	6.6	6.6
SQ35	mm	196	195
	in	7.7	7.7
SQ40	mm	189	188
	in	7.4	7.4
SQ43	mm	251	250
	in	9.9	9.8
SQ45	mm	285	284
	in	11.2	11.2
SQ50	mm	284	283
	in	11.2	11.1
SQ60	mm	340	338
	in	13.4	13.3
SQ70	mm	318	316
	in	12.5	12.4
SQ80	mm	324	322
	in	12.8	12.7
SQ100	mm	357	355
	in	14.1	14
SQ120	mm	385	383
	in	15.2	15.1
SQ130	mm	413	411
	in	16.3	16.2
SQ140	mm	433	431
	in	17	17
SQ150	mm	518	516
	in	20.4	20.3
SQ181	mm	620	618
	in	24.4	24.3



08. Inspection and Charging of N_2 Gas at Back head

⚠ WARNING

Charging gas pressure changes according to the rod condition.
Lay down the hammer and let the rod extend fully to charge gas.
Stay clear of the rod while charging the breaker with gas.
The rod may be impacted by the piston and forced out abruptly, when the through bolts are changed or the breaker body is disassembled. Discharge N_2 gas before work.
Take special care to handle and store the N_2 gas cylinder as it is high pressurized container.
Use nitrogen gas only.
Back head gas pressure 16.5kg/㎠ (85.5psi) on the back head surface temperature at 20℃(68℉)
See "CONVERSION TABLE FOR CHARGING N_2 GAS PRESSURE TO BACK HEAD"

■ Inspection of N2 Gas Back Head

1) Make sure if the cap and valve of the 3-way valve assembly⑤are fully tightened.
   Screw the 3-way valve assembly⑤ into the charging valve of the back head after removing the plug.
2) At this time the handle must stand up to prevent the gas from coming out.
3) Push the handle into the charging valve fully, so the gas pressure inside the back head is indicated on the pressure gauge.
4) When the gas pressure is normal, unscrew the 3-way valve assembly after discharging gas inside the 3-way valve assembly.
5) When the gas pressure is higher or lower, charge it as described below.

■ Charging of N2 gas into Back Head

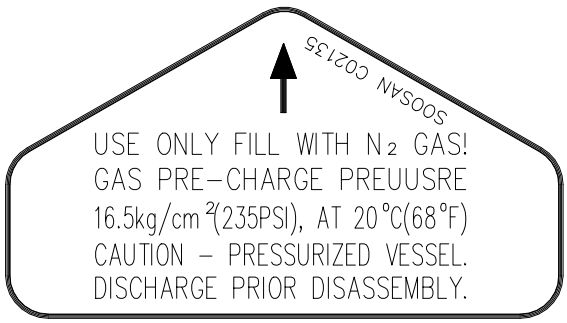
1) Connect the charging hose④ to N2 gas cylinder① after screwing the bombe adapter③ onto adapter nut ② and installing them to the N2 gas cylinder.
2) Connect the 3-way valve assembly ⑤ to the charging hose ④after unscrewing the cap on the 3-way valve.
3) Install the 3-way valve assembly⑤ to the charging valve of the Back Head. At this time the handle of the 3-way valve assembly must be up position to prevent the gas from coming out.
4) Push the handle of the 3-way valve assembly fully and turn the handle of the N2 gas cylinder counterclockwise gradually to charge gas.
5) When the gas pressure exceeds 10% higher than the specified pressure, close the N2 gas cylinder by turning the handle clockwise.
6) Leave the handle of 3-way valve assembly up. Generated pressure makes it return back to original position naturally.
7) In order to discharge N2 gas in the charging hose④and the 3-way valve assembly turn the relief valve counterclockwise.
8) Remove the charging hose ④ from the N2 gas cylinder①and the 3-way valve assembly⑤, and screw the cap into the 3-way valve assembly.
9) Push the handle of the 3-way valve assembly fully, and the gas pressure inside the Back Head is indicated on the pressure gauge. When the pressure is higher, discharge a small amount of gas from the Back Head by repeatedly opening and closing the valve and then gas pressure falls to the specified pressure.
10) When the gas pressure reaches to the specified pressure, close the valve and release the handle.
11) Open the valve completely and discharge gas inside the 3-way valve assembly.
    Remove the 3-way valve assembly from the charging valve of Back Head and install the plug to the charging valve. At this time prevent contamination from entering the breaker.

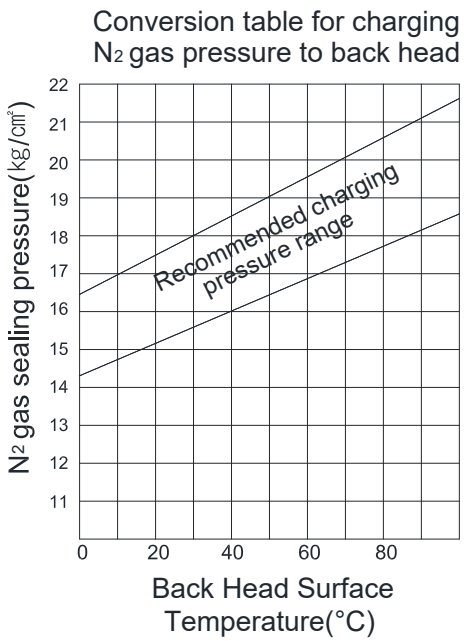
■ Conversion Table for charging nitrogen gas pressure to Back Head

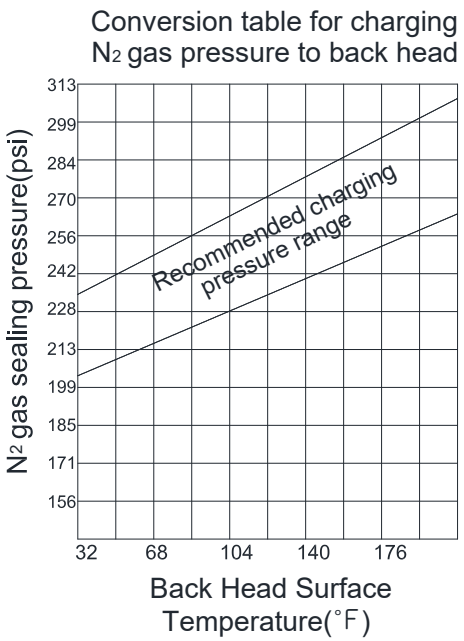
(Depends on the temperature of Back Head surface)

Back Head Surface Temperature (℃ / ℉)	0 / 32	10 / 50	20 / 68	30 / 86	40 / 104
Back Head Gas Pressure (kg/㎠ / psi)	15.5 / 220	16 / 228	16.5 / 235	17 / 242	17.5 / 249

■ Back Head Sticker (C02135)
(Appears on the Back Head charging valve)



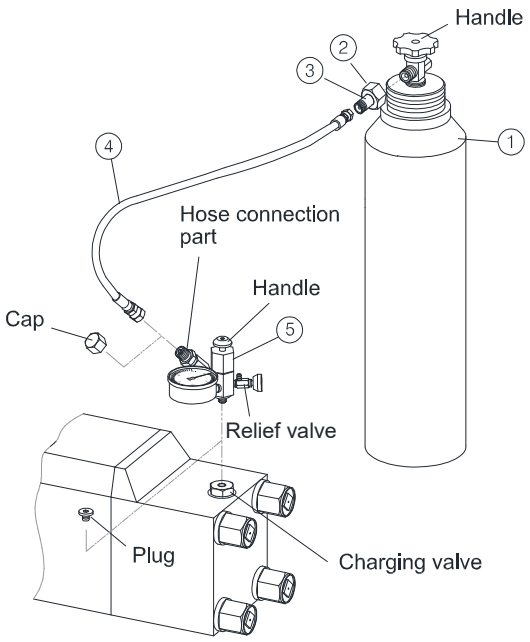




■ N_2 Gas charging tools to Back Head

ITEM	PART No.	Q'ty	PART NAME
ASSY	C61204	1 SET	N_2 Gas Charging Set
1	2900003	1	N_2 Gas Cylinder
2	C91121	1	Bombe Adapter Nut
3	C91122	1	Bombe Adapter
4	2651001	1	Synflex Hose
5	C01244	1	B-3way Valve Assembly

[SQ10~50]



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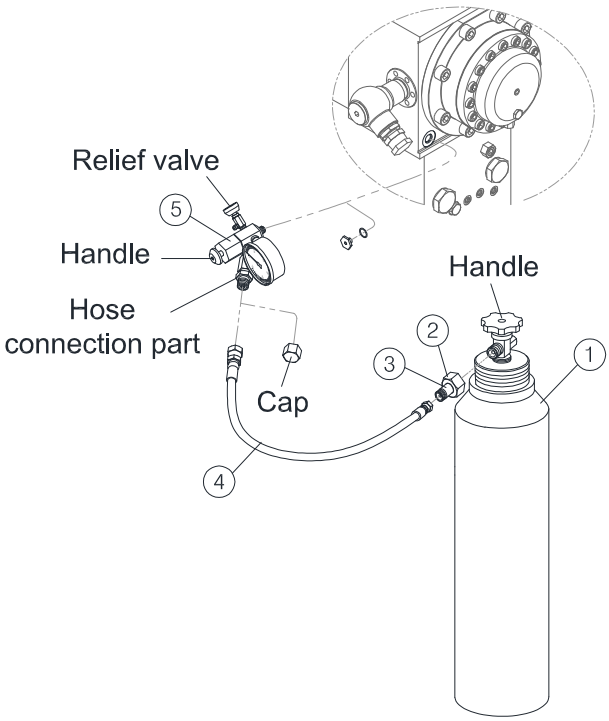
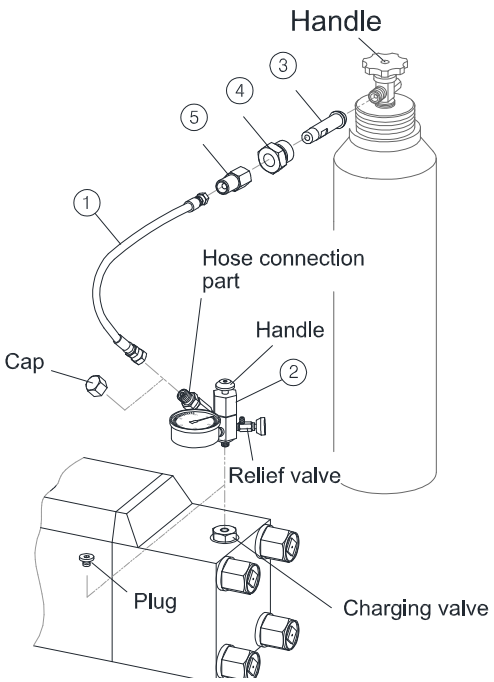


■ N_2 Gas charging tools to Back Head (Option - USA)

ITEM	PART No.	Q'ty	PART NAME
ASSY	B0006847	1 SET	N_2 Gas Charging Set
1	2651001	1	Synflex Hose
2	C01244	1	B-3way Valve Assembly
3	B0006842	1	Bombe Adapter
4	B0006843	1	Bombe Adapter plug
5	B0006844	1	Bombe Adapter bushing

[SQ10~50]



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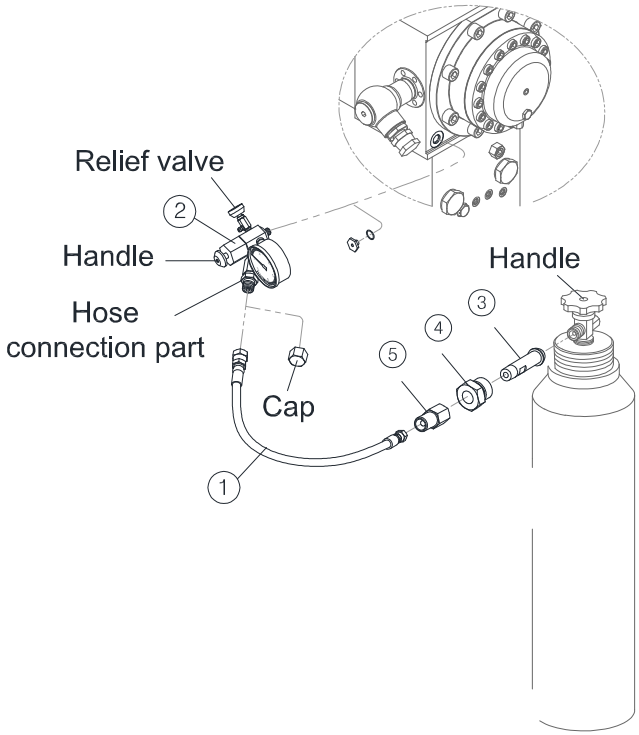


09. Inspection and Charging of N_2 gas in Accumulator

⚠ WARNING

Take special care to handle and store the N_2 gas cylinder as it is high pressurized
Use nitrogen gas only.
When disassemble the accumulator, must discharge N_2 gas before working.
Do not touch on the accumulator surface when working.
Be sure to use the 3 way valve assembly for charging the N_2 gas if charging gas leaks directly from the cylinder, diaphragm may be broken off.
If charging for handling N_2 gas to only the accumulator, make sure that the accumulator body and cover are tightened fully.
Standard accumulator gas pressure 55㎏/㎠ (783psi) on the accumulator surface temperature at 20℃(68℉)
See "CONVERSION TABLE FOR CHARGING N_2 GAS PRESSURE TO BACK HEAD"

■ Inspection of N2 gas Accumulator.

1) Make sure if the cap and valve of the 3-way valve assembly⑤ are fully tightened.
2) Remove the cap from the accumulator and tighten the charging valve fully.
3) Check if O-rings ⑧ are installed to the bushing ⑦. Remove the plug ⑨ and screw the bushing.
4) Install the bushing⑦ to the 3-way valve assembly⑤.
5) Loosen the charging valve gradually. The charging pressure is indicated on the pressure gauge.
6) Close the valve clockwise when the gas pressure is normal. If the gas pressure is higher, repeat loosening and tightening the relief valve of 3-way valve assembly. The pressure is lowered gradually.
7) Loosen the relief valve of the 3-way valve assembly to discharge the N2 gas in the 3-way valve assembly⑤.
8) Remove the 3-way valve assembly⑤ and tighten the plug⑨ and cap.

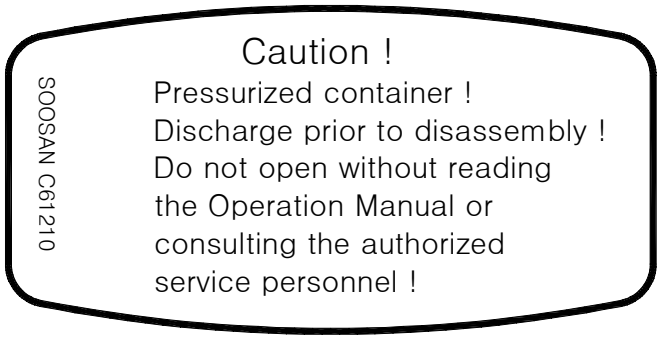
■ Charging of N2 gas into Accumulator

1) Connect the charging hose④ to N2 gas cylinder ① after screwing the bombe adapter③ onto adapter, nut ② and installing to the N2 gas cylinder.
2) Connect the 3-way valve assembly⑤ to the charging hose④ after unscrewing the cap on the 3-way valve assembly.
3) Remove the cap form the accumulator and tighten the charging valve fully.
4) Check if O-rings ⑥ ⑧ are installed to the bushing⑦. Remove the plug⑨ and screw the bushing.
5) Loosen the accumulator charging valve after checking if bushing⑦ is installed to the 3-way valve assembly.
6) Turn the handle of the N2 gas cylinder counter clockwise slowly to charge gas.
7) Charge gas in accordance with the conversion table for charging N2 gas pressure to accumulator.
8) Turn the handle of the N2 gas cylinder clockwise to close the cock.
9) Close the accumulator charging valve.
10) Loosen the relief valve of the 3-way valve assembly to discharge the N2 gas remaining in the charging hose.
11) Remove the charging hose, 3-way valve assembly and bushing and tighten the plug⑨ and cap.

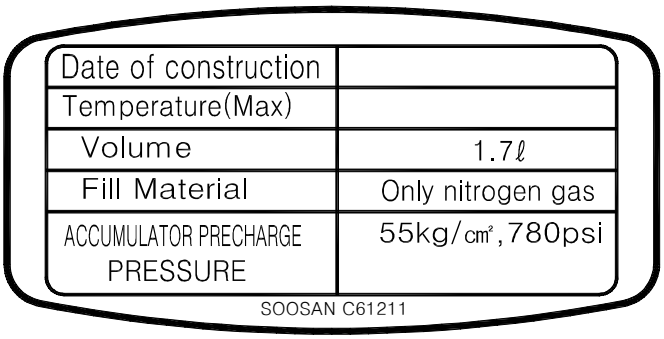
■ Conversion Table for charging nitrogen gas pressure to Accumulator

Accumulator Surface Temperature (℃ / ℉)	0 / 32	10 / 50	20 / 68	30 / 86	40 / 104
Accumulator Gas Pressure (㎏/㎠ / psi)	51 / 730	53 / 755	55 / 780	57 / 815	59 / 830

■ Accumulator(A) Sticker (C61210)
- appears on the accumulator body
-



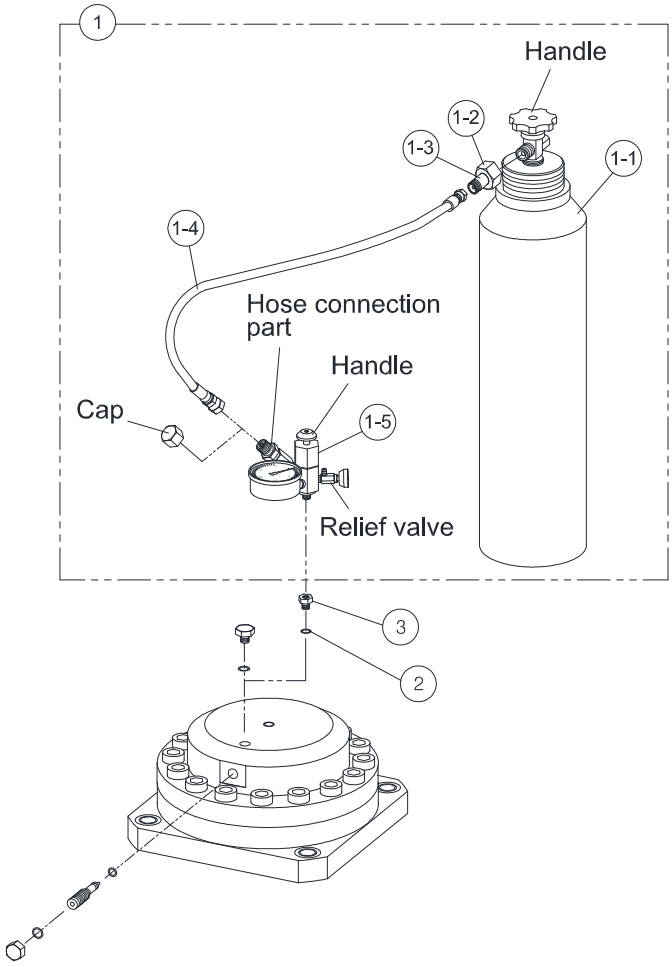
■ Accumulator(B) Sticker (C61211)
- appears on the accumulator body

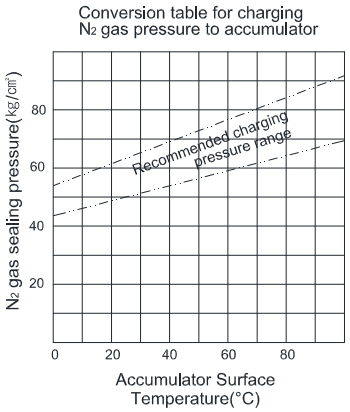


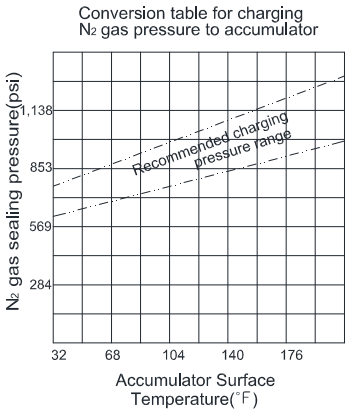
■ N_2 gas Charging Tools to Accumulator

ITEM	PART No.	Q'ty	Part Name
ASSY	C61205	1 SET	Accumulator Charging Set
1	C61204	1 SET	N_2 Gas Charging Set
1–1	2900003	1	N_2 Gas Cylinder
1–2	C91121	1	Bombe Adapter Nut
1–3	C91122	1	Bombe Adapter
1–4	2651001	1	Synflex Hose
1–5	C01244	1	B–3way Valve Assembly
2	2850014	1	O–Ring
3	U81414	1	Accumulator Charging Connector

[SQ60~181]



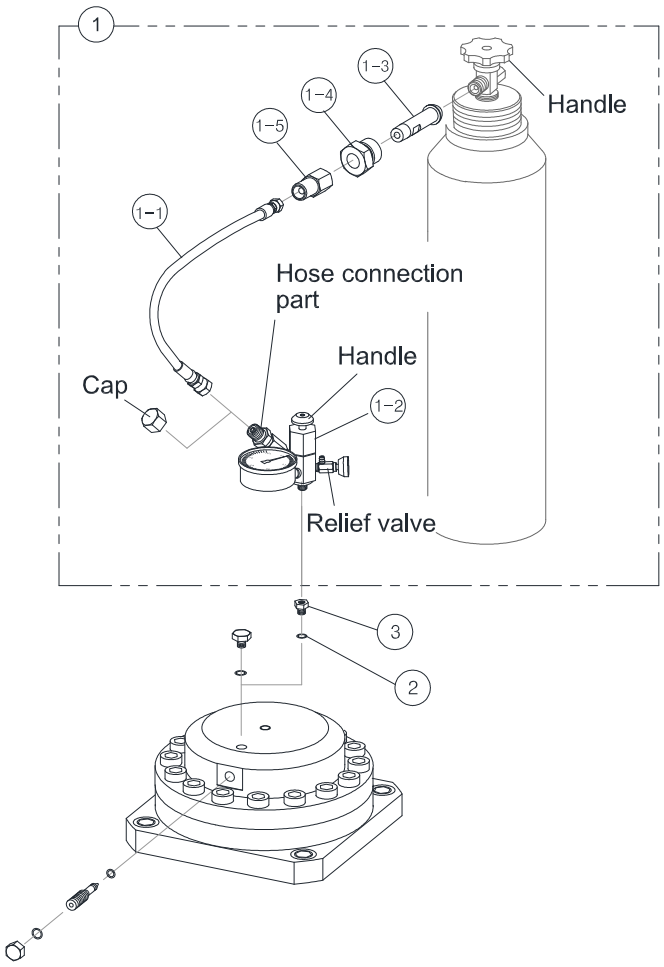


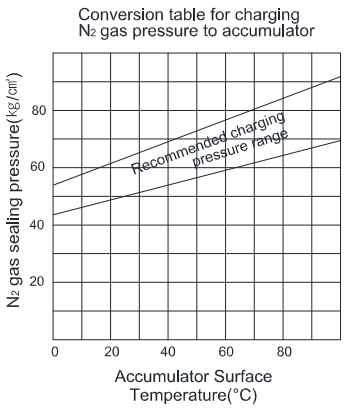


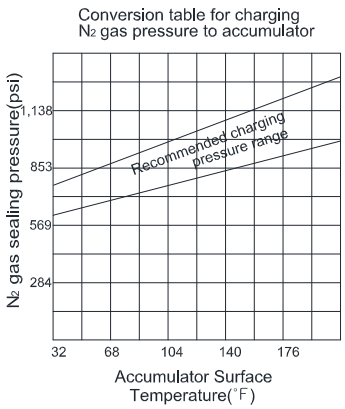
■ N_2 gas Charging Tools to Accumulator (Option - USA)

ITEM	PART No.	Q'ty	Part Name
ASSY	B0006879	1 SET	Accumulator Charging Set
1	B0006847	1 SET	N_2Gas Charging Set
1-1	2651001	1	Synflex Hose
1-2	C01244	1	B-3way Valve Assembly
1-3	B0006842	1	Bombe Adapter
1-4	B0006843	1	Bombe Adapter plug
1-5	B0006844	1	Bombe Adapter bushing
2	2850014	1	O-Ring
3	U81414	1	Accumulator Charging Connector

[SQ60~181]







10. Trouble Shooting

The trouble-shooting chart is prepared to help operators find out causes and remedies instantly when troubles occur. When a trouble is found, have a good grip of the problem and contact our service station.
When diagnosing faults in operation of the breaker, always check that hydraulic power source is supplying the correct hydraulic flow and pressure to the breaker as listed in the table.
Check the flow with the hydraulic oil temperature at least 176℉/80℃. An approved test procedure is available form Soosan.

TROUBLE	CAUSE	REMEDY
1. Breaker fails to hammer		
* Sufficient high pressure oil does not flow to breaker inlet.	* Defective hose or pipes · * Clogged or damaged piping	* Check, clean and repair piping or replace with new one.
* Sufficient high pressure oil flows to breaker inlet.	* Defective control valve and related parts * Insufficient hydraulic oil * Internal breaker defects	* Check and repair valve and its related parts or replace with new one. * Refill oil tank. * Consult with our service station.
2. Breaker hammers with hammering force reduced.		
* Sufficient high pressure oil does not flow to breaker inlet.	* Defective hose or pipes Clogged piping, Oil leakage * Defective control valve and related parts * Deformed pedal * Deformed control valve * Stuck control valve * Insufficient control valve stroke due to loose screws * Clogged filter in return line of base machine tank * Insufficient hydraulic oil * Contaminated or deteriorated hydraulic oil	* Check, clean and repair piping or replace with new one. * Check control valve and related parts or replace with new one. * Clean or replace. * Refill. * After flushing tank, change oil entirely.
* Sufficient high pressure oil flows to breaker inlet.	* Defective pump * Internal breaker defects * low N_2 –gas pressure of back head	* Ask service station for base machine service. * Consult with our service station. * Adjust the gas pressure referring to Chapter 10.
3. Hammering force weakens suddenly and high pressure hose vibrates excessively during operation.	* Defective Back Head Gas leakage	* Ask our service station for repair.
4. Excessive oil leakage from Front Head or Rod.	* Worn cylinder seals	* Ask our service station for repair.
5. Piston works but does not hammer.	* Stuck in rod	* Remove front parts and pull out rod. * Repair with a grindstone.

※ Ask base machine service station to repair defective base machine.

11. Hydraulic Oil and Grease.

Selection of hydraulic oil determines the efficiency of the hydraulic breaker performance.
Please consult with our service station under following conditions.

(1) When used in special regions where climate is severe (extremely cold or hot weather)
(2) When recommended brands of hydraulic oil are not available
(3) When hydraulic oil supplied for the base machine differ from the recommended one.

■ Hydraulic Oil and Grease
Recommended for Hydraulic Grab by Soosan

LUBE & SPEC / Manufacturer	HYDRAULIC OIL			GREASE (MOS2)
	SUMMER	WINTER	ALL SEASON	
	ISO VG 46	ISO VG 32	ISO VG 46	NLGI No2
MOBIL	MOBIL DTE 25	MOBIL DTE 24	MOBIL DTE 15M	MOBIL GREASE SPECIAL
	MOBIL SHC 525 *			MOBILITH SHC 220 *
	MOBIL EAL SYNDRAULIC 46 **			
LG-CALTEX	RANDOHD 46	RANDO HD 32	NEW RANDO HD CZ	MOLYTEX EP2
BP	ENERGOL HP46	ENERGOL HP32	ENERGOL HP46	–
SHELL	TELLUS 46	TELLUS 32	TELLUS T 46	RETINAX HDX-2

★: Synthetic Lubricant
★★: Environmentally Friendly Synthetic Lubricant

■ Oil Contamination
Contaminated oil results in malfunctions of the breaker as well as the base machine and causes damage to parts. Pay special attention to oil contamination.
Contaminated oil should be changed without delay. When changing oil, thoroughly wash oil tank, cylinder and pipes. Cleaning or replacing oil filter also requires check for oil contamination.
※ Replacement of filter : after first 50 hours and every 100 hours thereafter
※ Replacement of hydraulic oil : every 500 hours

⚠ WARNING

Hydraulic oil Temperature and viscosity
Do operate the hydraulic breaker at oil temperatures from 20℃/68℉ to 80℃/176℉.
Operation at higher temperatures can damage the internal components of the breaker and carrier there will result in reduced breaker performance.

■ Criterion of Oil Contamination and Malfunction

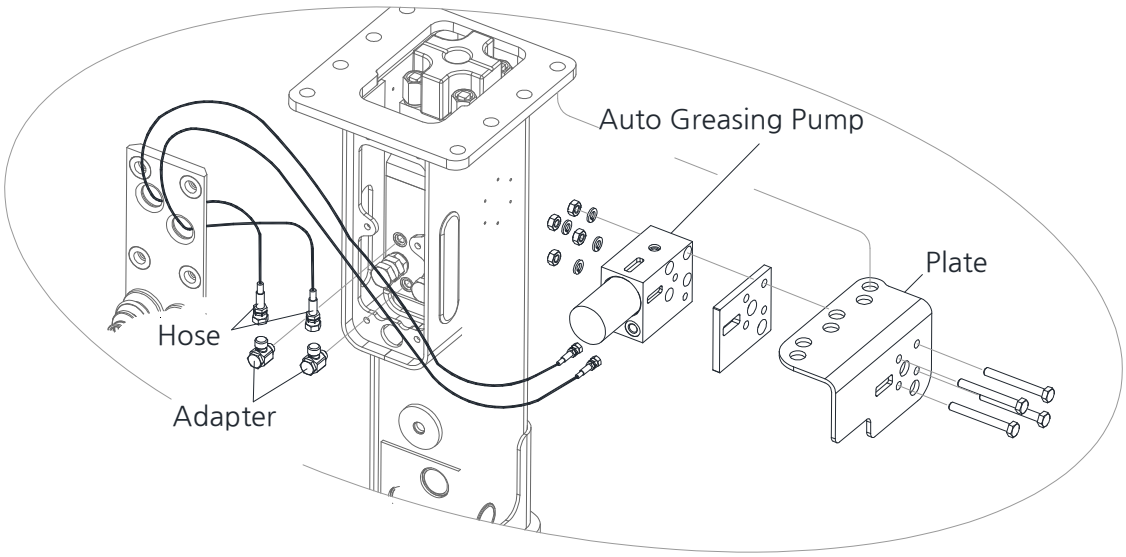
(General Analysis)

Analysis Item	Criterion	Causes and Effects when exceed the criterion
Adhesiveness	Within±10% (40℃ cst)	Adhesiveness rarely decreases because of hydraulic oil. Entry of different kind of oil may reduce the adhesiveness which contributes to rising oil temperature , wear and scratch of bearing and gear and malfunction of hydraulic oil.
Oxidizing Level	Less than 0.3 (mg KOH/g)	Use of lubricating oil in a long period or in a high temperature (above 60℃) will oxidize it. Oxidizing level rises as oxidization proceeds. Sludge will be produced during the process and it leads to malfunction, corrosion and ageing.
Moisture	Less than 0.1 (%)	Moisture causes rust, wear and scratch. Moisture of 0.3% goes considerably rusty and moisture of 0.5% occurs the damage of machine.

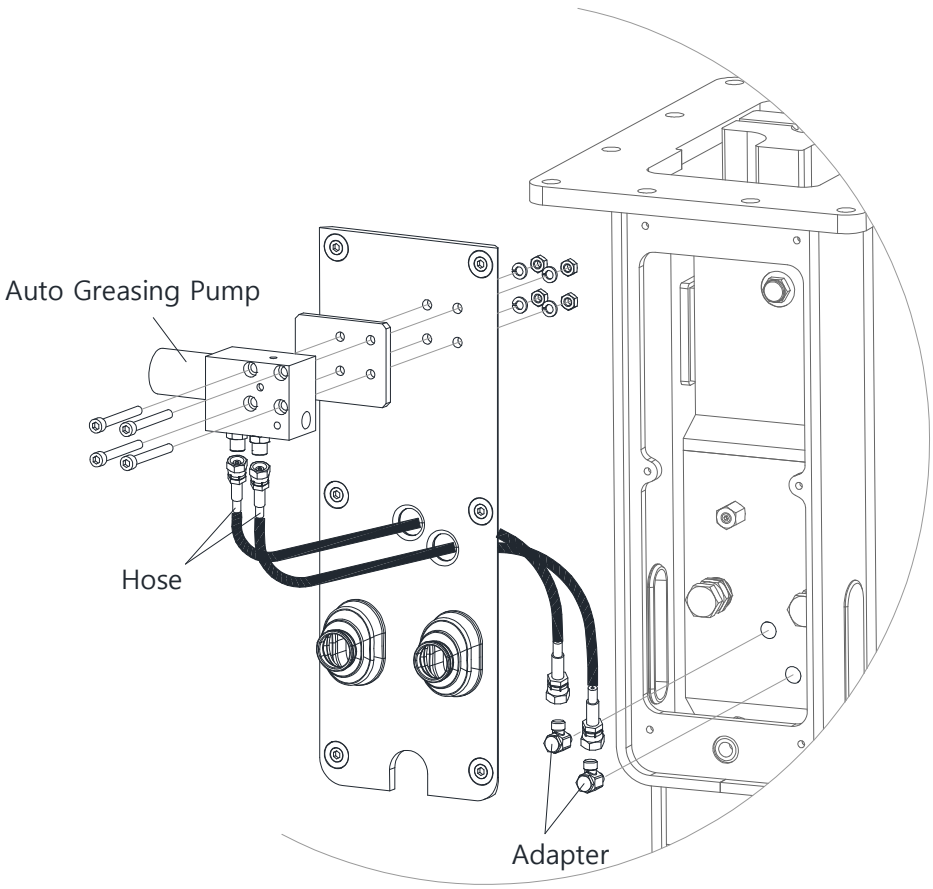
■ Criterion of Oil Malfunction by Hydraulic Oil Color
(Simple discrimination by ASTM color)
Hydraulic oil turns black as the breaker fails to display best performance. The old oil is assumed to be contaminated when there is a visual difference between the old new oil color and functions begin to deteriorate when hydraulic oil turns darker than the new oil color (ASTM number) by more than two.

12. Auto Lubrication (Option)

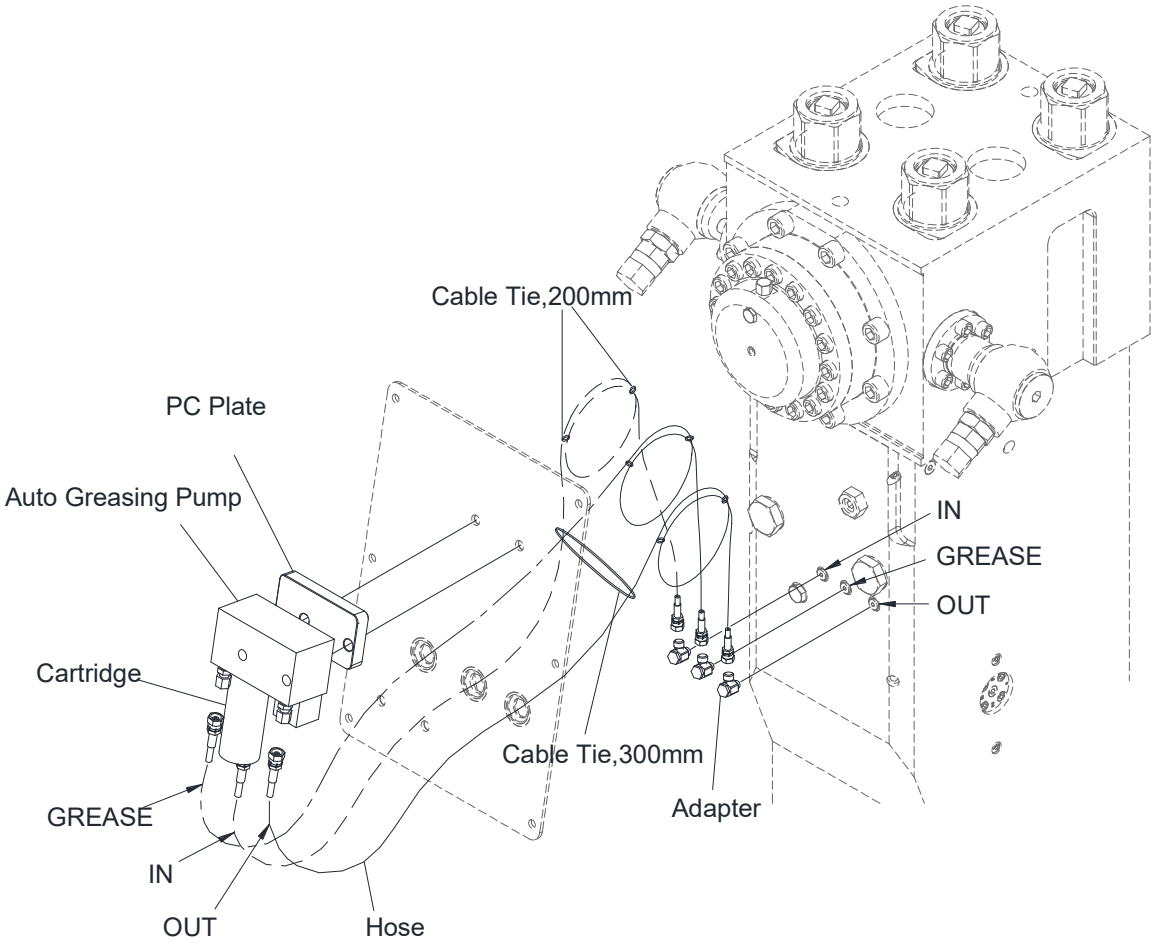
■ SQ10 ~ SQ43



■ SQ45 ~ SQ50



■ SQ60 ~ SQ180


Cable Tie,200mm
PC Plate
Auto Greasing Pump
IN
GREASE
OUT
Cartridge
Cable Tie,300mm
Adapter
GREASE
IN
OUT
Hose

MAINTENANCE FOLLOW-UP

In order to follow the maintenance of a hydraulic breaker, a maintenance card presented below can be used

SOOSAN HEAVY INDUSTRIES

HYDRAULIC BREAKER SERVICE CARD NO._____

Equipment S/No._____

Model type S/No._____

SERVICE IMFORMATION

Purpose of the service		Serviceman	
Service Date		Engine working hours	

Replaced parts			Part inspection				
Qty	Description	Part No.	Description	S/No.	Repaired	Replaced	OK
			Cylinder		☐	☐	☐
			Motor		☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐
					☐	☐	☐

Percussion mechanism tested ☐

Rotation mechanism tested ☐

Remarks