FOREST MACHINE
(R320LC-9 FC)

This manual was produced by DAEMO Engineering and some revisions have been made in HYUNDAI CONSTRUCTION EQUIPMENT

Foreword

Forest equipment is an exclusive construction machine designed and manufactured to enable loading operations in forest areas where ordinary construction machines cannot be used. This equipment specialized in forest work is attached with a remodeled boom and wood grapple. Forest equipment of Daemo Engineering guarantees high work efficiency in combination with the wood grapple designed to exhibit outstanding forest performance.

The purpose of this User Manual is to provide detailed information to the users about management, operation and maintenance of forest equipment of Daemo Engineering.

To ensure safe use and maintenance of this equipment, please read and understand this User Manual before use.

Contact Daemo Engineering or Hyundai Construction Equipment if you have any questions about contents of this User Manual.

Contents

Ⅰ. Safety

***Dangerous operations presented below are prohibited for safe use of this equipment.**
***Dangerous operations can arouse serious damaging or failure of the equipment.**

1. Basic Precautions

Check and gain full knowledge of safety labels in this Manual and on the equipment. Forest equipment must be maintained in standard state at all times, and no alteration is allowed. If safety is not secured, operational performance and durability of the equipment will gradually decrease. Pay particular attention to safety over any other contents presented in this Manual.

Prohibition of remodeling
Remodeling the equipment without discussing with our company can cause serious safety risks, and the equipment owner is responsible. Please discuss with our company if you would like to remodel the equipment.

Safe clothing
Appropriate safety clothing such as helmet are required during work. Inappropriate attire and accessories can induce unintended operation of the lever or other operating units. If the operator loses focus, a serious accident can occur. To keep safety, prohibit the use of radio or headphone.

Caution for attachments
Make sure to contact our company before attaching special attachments to the equipment. Do not use attachments that have not been approved by our company. We are not held responsible for accidents and failures caused by the use of unapproved attachments.

Caution for handling oil
Oil is very dangerous because of flammability. Since there is a concern for ignition nearby firearms, be extremely careful when handling oil. Keep the equipment clean by removing foreign substance and grease. Do not pile up mops stained with oil as they can momentarily show spontaneous ignition.

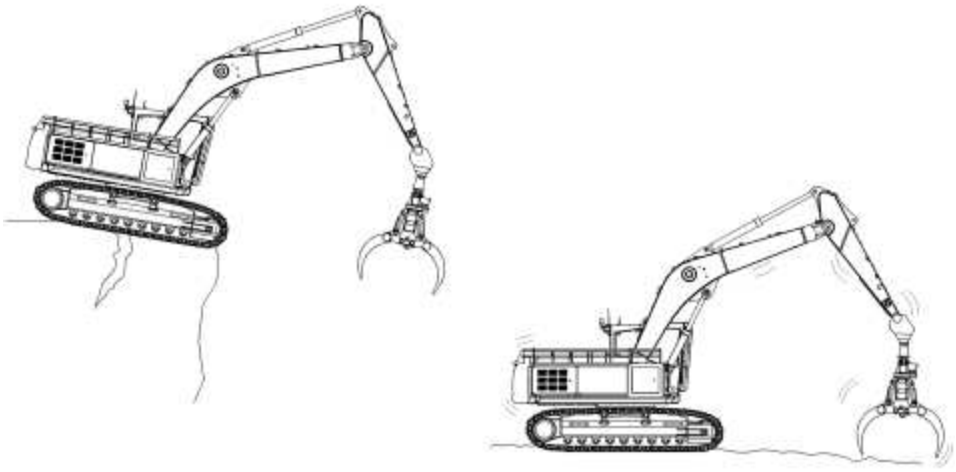
Prevention of burn
After stopping the equipment, conduct inspection and maintenance once temperature of the equipment is cooled down. Be careful about getting burned by hot oil. Gear oil, operating oil, high pressure hose and other pipe parts reach high temperature during operation.

Preparation of firefighting system
Be prepared for emergency injury or fire. Always keep first-aid kits and fire extinguisher ready. In particular, be aware of how to use the fire extinguisher. Keep a memo on emergency contact information such as phone numbers of hospitals, ambulances and fire stations.

Injury from attach and working devices
Be careful about rolling of hands, feet and body parts into operating parts such as between the equipment and working devices, working devices and cylinder, etc. Narrowing of distance by operation of operating devices can lead to serious human accidents.

Operation with window attached
During operation of the equipment, persons other than the operator must escape from the scope of scattered and fallen objects that can occur during work.

Securing workplace safety
Check risk factors in the workplace before work. Decide the safest work method after confirming the work environment.

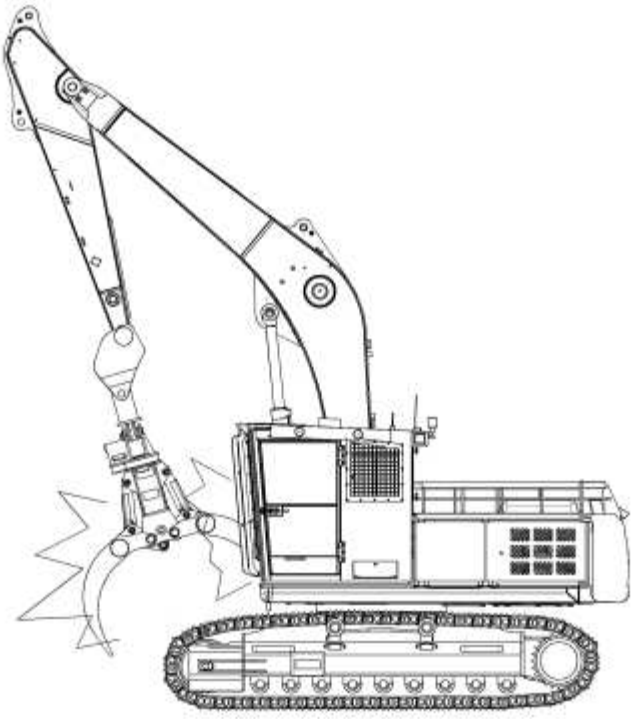


Communication
Inaccurate communication can cause accidents. When working in groups, make sure that workers understand hand signals of one another.

Fire prevention
Remove inflammable substances nearby the equipment. Inspect status of hydraulic pipes and leaking of operating oil, and perform maintenance and repair as necessary. Leakage of inflammable liquids such as fuel, lubricant and operating oil can cause fire. Inspect short circuit and damaging of electric wiring that cause spark, and keep connecting parts of power cables clean. Paint on the equipment surface must be removed before welding or heating. Do not apply forcible heat on the hydraulic device or pipes. Confirm location and method of using the fire extinguisher.

Prevention of collision of attachments
Check appropriate interval with the equipment in the case of a workplace with height limitation.

Caution for collision between attachments and operating room



Securing visibility
When working in a dark place, install additional working light as necessary.

Precaution for inspection and maintenance of hydraulic parts
Stop the equipment on a flat and solid ground surface. Put attachments down on the ground and stop the engine. Do not perform maintenance immediately after work. Wait until the entire equipment is completely cooled down. If the equipment is still hot and hydraulic parts have residual pressure, the user can be seriously injured by spurting of hot operating oil. Residual pressure inside the operating oil tank must be removed before performing maintenance on hydraulic parts. Operate the working lever in the operating room many times to remove pressure remaining in the hydraulic circuit. Keep body parts and face away from the workpiece when loosening plugs and screws on the hydraulic line.

Warning sign during inspection and maintenance
To prevent persons other than the maintenance worker from moving the equipment during inspection or maintenance, hang a warning sign for “Under maintenance” or “Inspection in process” in the operating room or on the work lever.

Use appropriate tools.

Stop the engine to conduct inspection or maintenance on the equipment.

Keep the equipment clean.
Water can cause malfunctioning of electric devices.

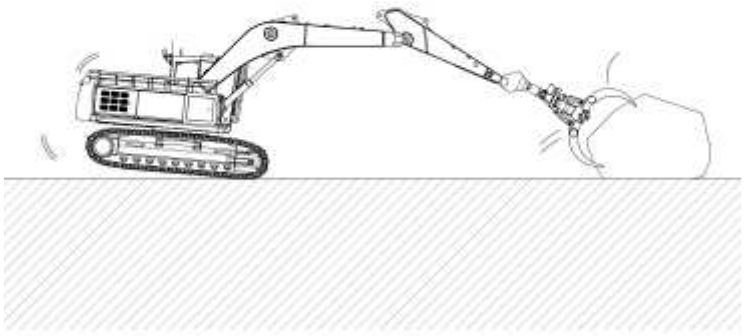
Do not touch moving parts of the equipment with hands.

Be careful about high pressure of operating oil in the hydraulic circuit.

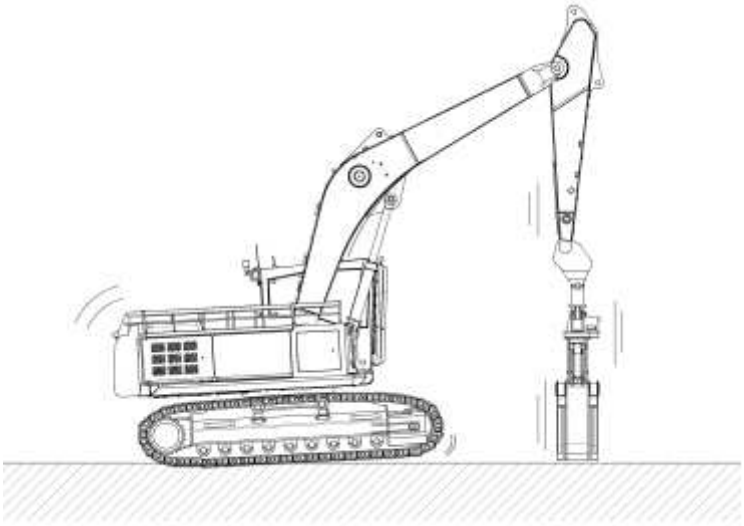
2. Dangerous Operations

The work methods introduced below are not permitted for the safe use of the equipment. Such operations can cause serious damaging and failure of your equipment.

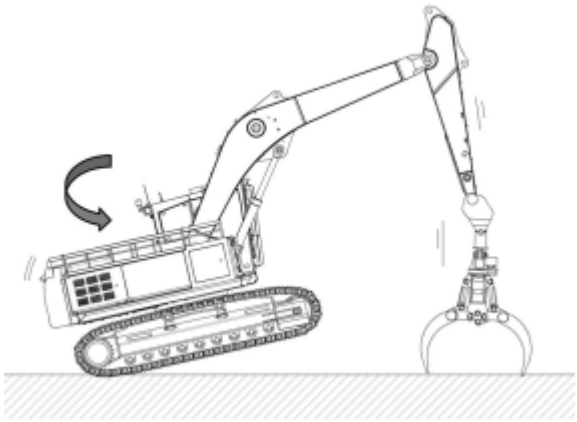
Do not work over the permitted scope of work.
Do not operate the equipment beyond its limit. Working beyond the limit can damage the equipment and result in danger.



Do not lift the equipment using the wood grapple.
Do not strike or press the ground with the boom cylinder or wood grapple.

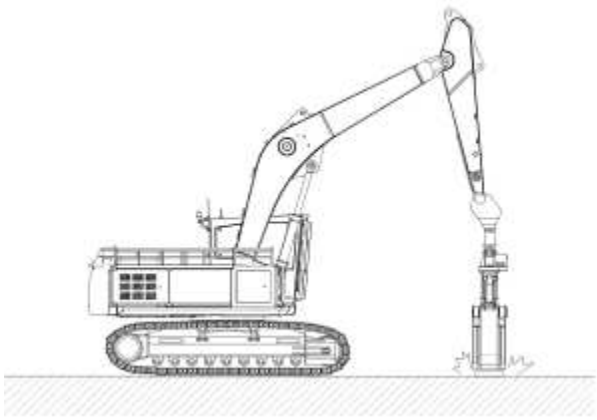


Do not rotate the body using the grapple.
Do not rotate the body using the boom cylinder or wood grapple.

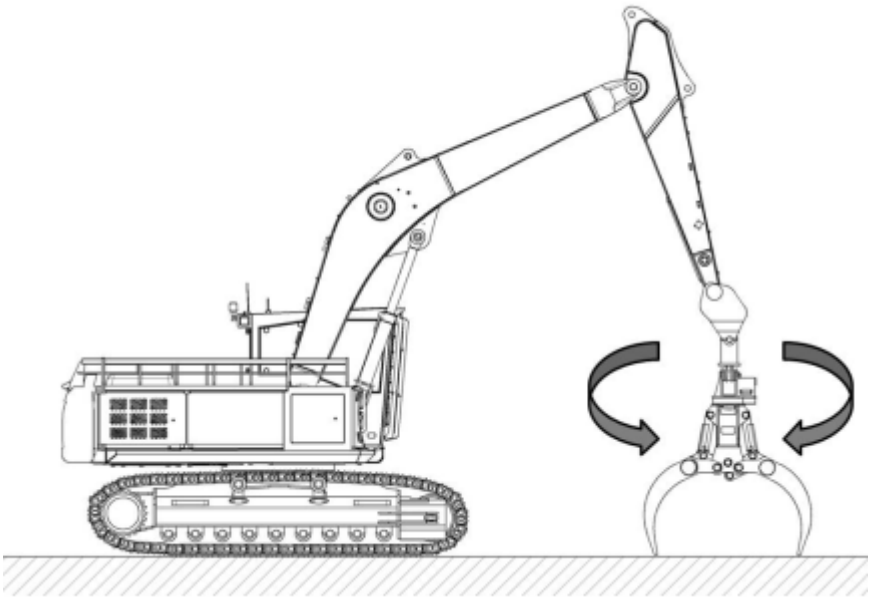


Do not move the grapple above people.
Do not move the wood grapple above people's head or truck operating room. Direct collision with the wood grapple or dropping of workpiece can lead to serious injury or damaging of truck.

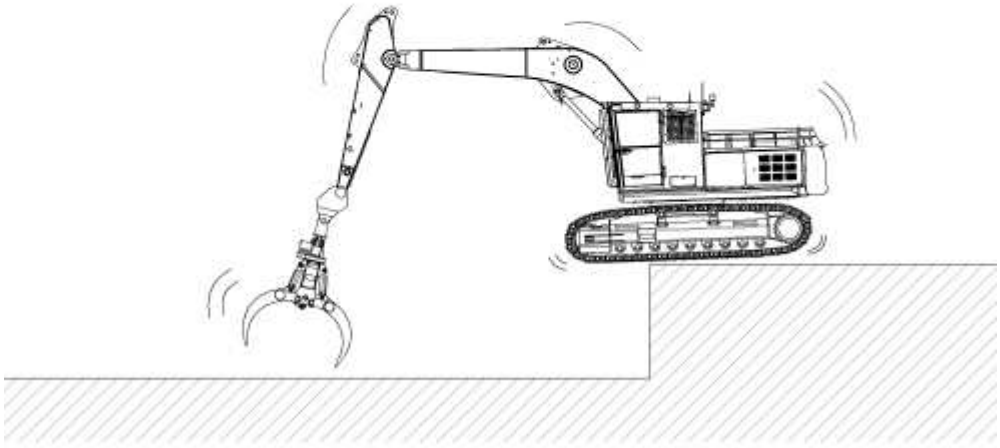
Do not perform hammering.
Do not use the grapple like a hammer or pile driver. Striking solid ground or flattening the workplace floor can seriously damage the wood grapple and boom.



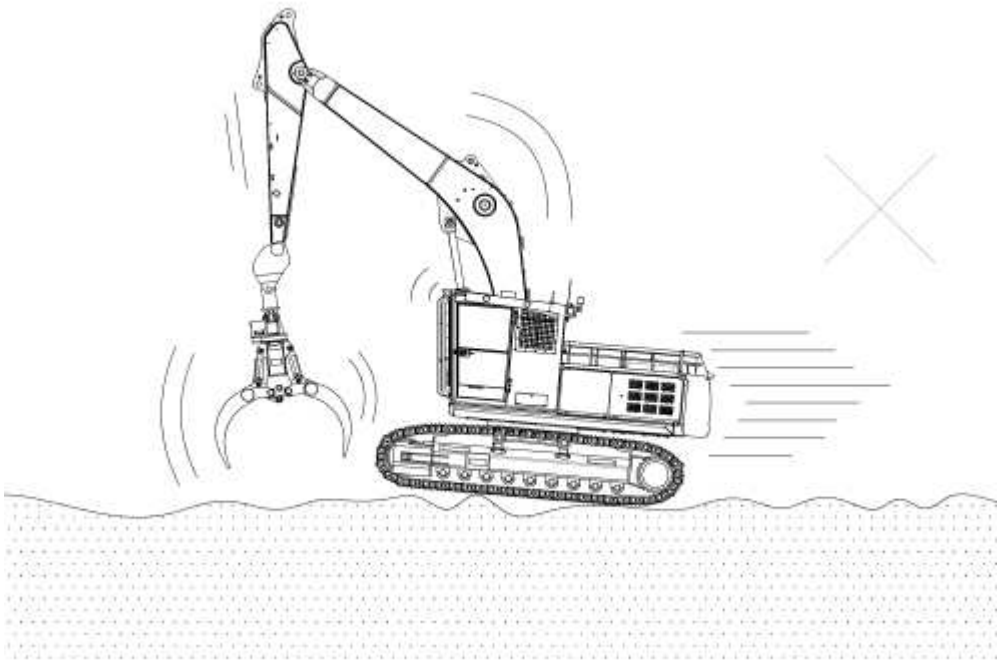
Do not rotate the wood grapple when it is touching the ground surface.
Doing so can seriously damage the wood grapple, arm and connector.



Do not operate hastily.
Hasty operation can cause overturn of the equipment. Be careful to maintain stability of the equipment.



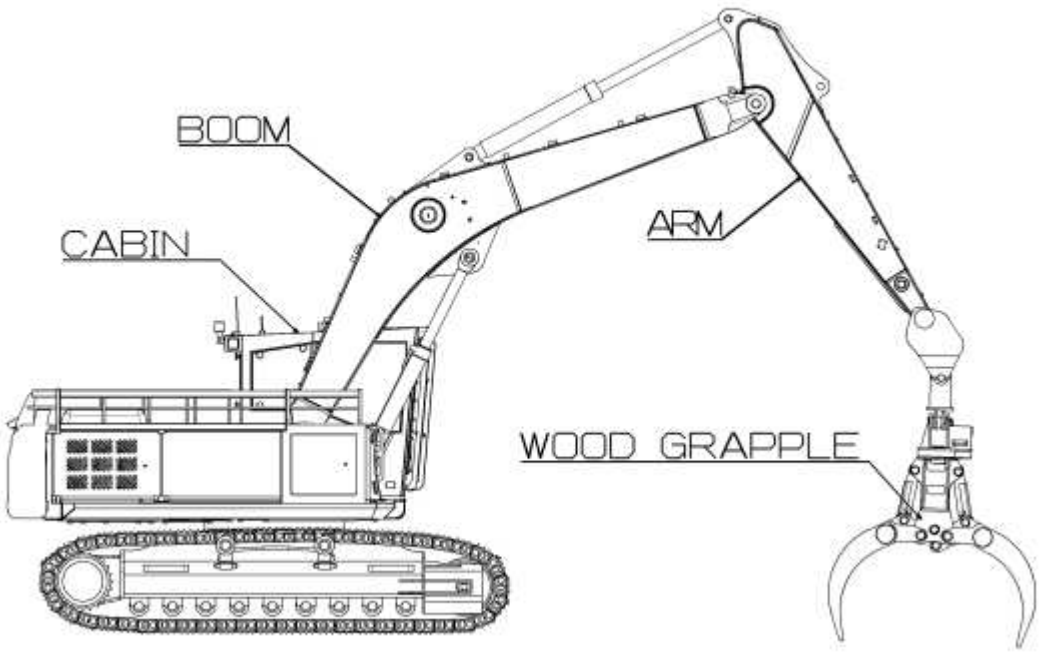
Do not drive at high speed on a rough flatland with uneven floor.
If the floor is rough, frozen or uneven, drive as slow as possible. Driving at high speed can weigh excessive impact on the body and wood grapple.



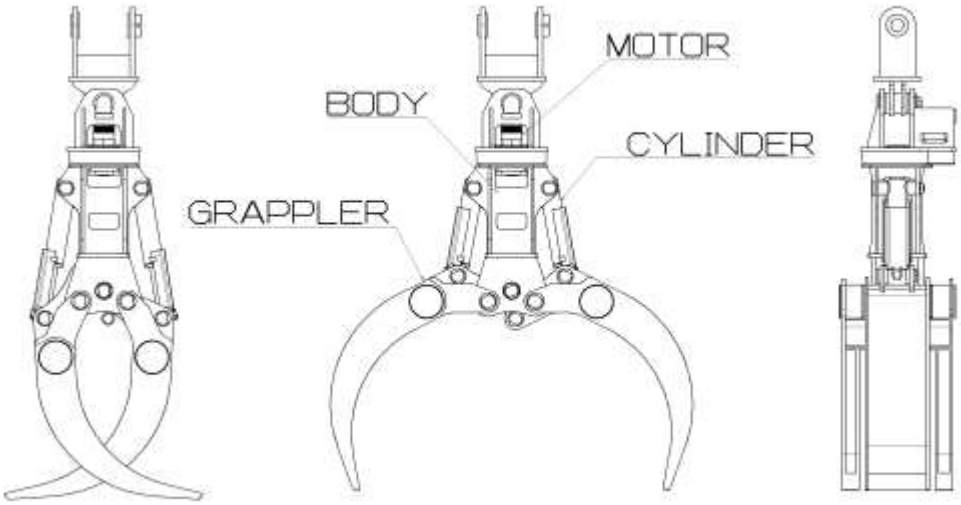
Ⅱ. Specifications

1. Name of Each Part

-Forest Equipment (R320LC-9 FC)

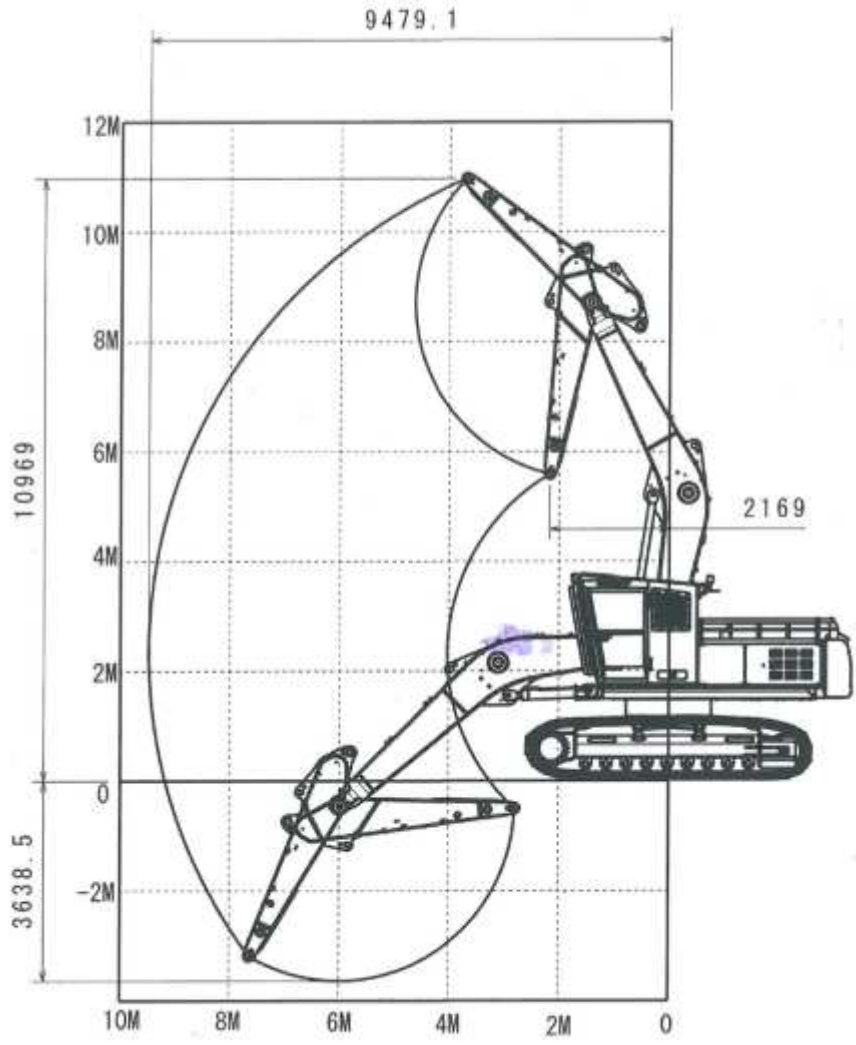


- Wood Grapple

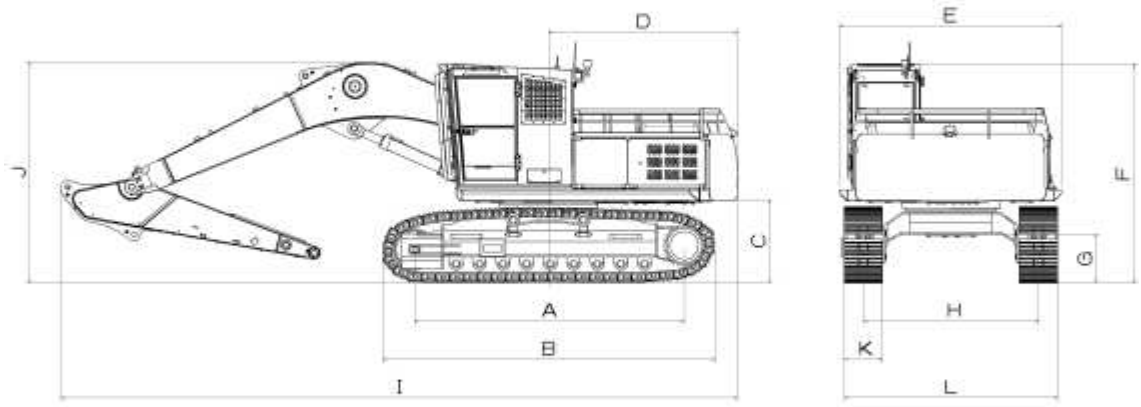


2. Forest Equipment

- Work Scope Diagram (Standard Boom_R320LC-9 FC)



- Transport Specifications (R320LC-9 FC)



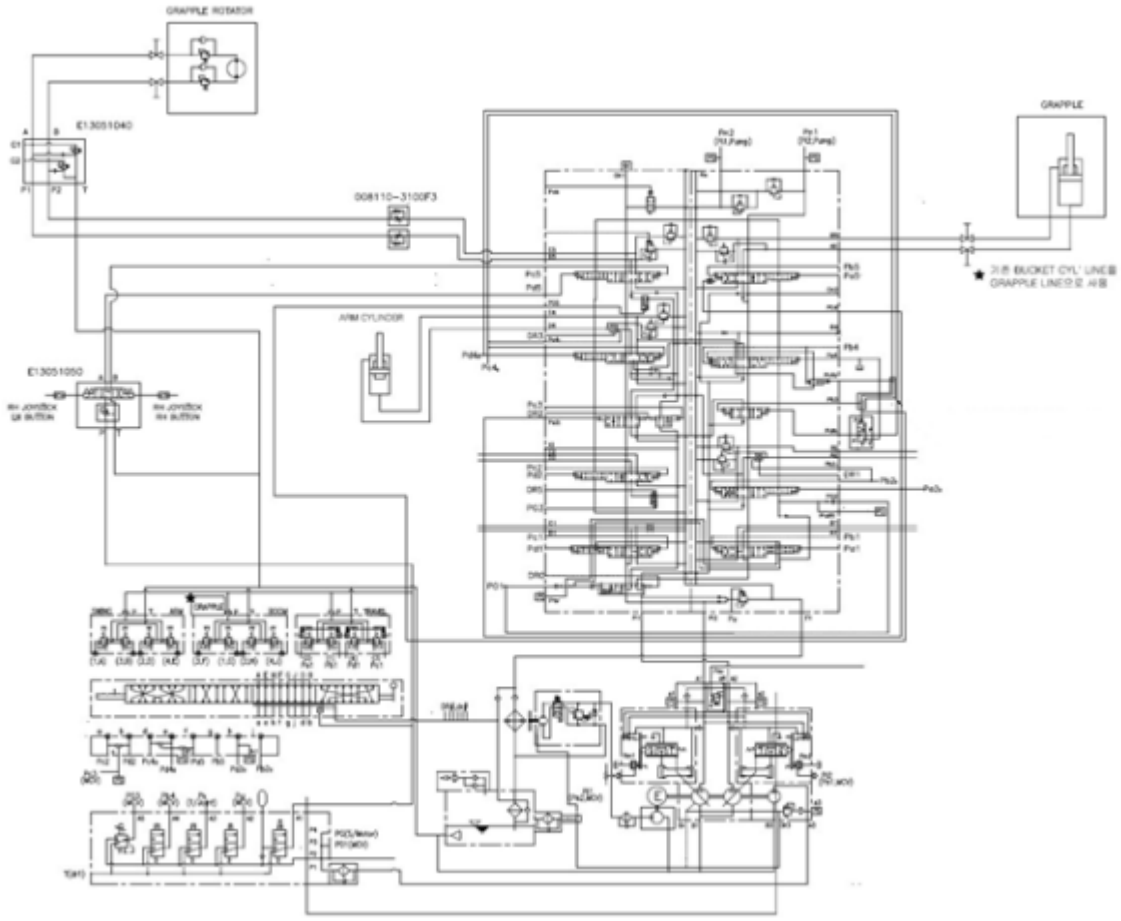
Item		Specification	Unit
Tumbler distance	**A**	**4,030**	mm
Track length	**B**	**4,940**	
Counterweight clearance	**C**	**1,500**	
Turning radius	**D**	**3,330**	
Top width	**E**	**3,490**	
Driving height	**F**	**3,800**	
Minimum ground clearance	**G**	**765**	
Track center distance	**H**	**2,870**	
Overall length	**I**	**10,995**	
Overall height	**J**	**3,490**	
Shoe width	**K**	**600**	
Overall width	**L**	**3,470**	

3. Wood Grapple

MODEL / CATEGORY			DMWP300
Operating weight		kg	1,400
		lb	3,086
Capacity		m^3	0.9
Maximum widened width		mm	1,924
		inch	75.7
Overall length		mm	2,989
		inch	117.7
Maximum grabbing force		ton	3.5
Operating pressure		kg/cm^2	260
		psi	3,698
Applied excavator		ton	25~32
Hydraulic rotation	Setting pressure	Kg/cm^2	100
		psi	1,422
	Operating flow	LPM	60
		GPM	15.9
	Rotation speed	PRM	30

4. Hydraulic Circuit Diagram

-Hydraulic Circuit Diagram



Ⅲ. Installation

1. Preparations Before Work

1) Inspect the amount of hydraulic oil.
If insufficient, fill the oil tank with enough hydraulic oil.

2) Check that the stop valve is opened.

3) Operate after checking that all bolts and nuts are tightened properly.
If bolts or nuts are loosened, serious issues such as leaking of oil, falling of bolts and damaging of screw threads can occur.

4) Surely push grease into the pin and bush before use.

5) Operate the product smoothly, always check for abnormalities, and pay attention to leaking of oil.

2. Installation of Wood Grapple

1) Put rectangular lumber on a flat ground surface and place the product on top.

2) Close the stop valve of the excavator and adjust setting pressure of the cylinder line and motor line. (Refer to setting pressure of the product.)
When adjusting setting pressure, consult with A/S personnel or employee of our company for advisory.

3) After aligning the hole on the excavator arm with the hole on the attachment bracket, insert two bracket pins and tighten the stop ring, bolts and nuts.
When attaching, use hand signals to make sure that the product bush is properly aligned with the hole on the excavator arm.

4) Open the union cap of the stop valve and connect the product hose.
Since oil residues can flow out of the pipe, prepare an empty box to receive flowing oil.

5) Open the stop valve and warm up sufficiently before operating the product.

6) In the case of the motor, adjust flow of the motor for adequate rotation.
(13~15 RPM. Refer to setting pressure of the motor.)

7) When using a quick coupler, attach the product according to the method of use provided by the quick coupler manufacturer.

8) For detachment, detach the product in the reverse order of attachment.

Setting Pressure

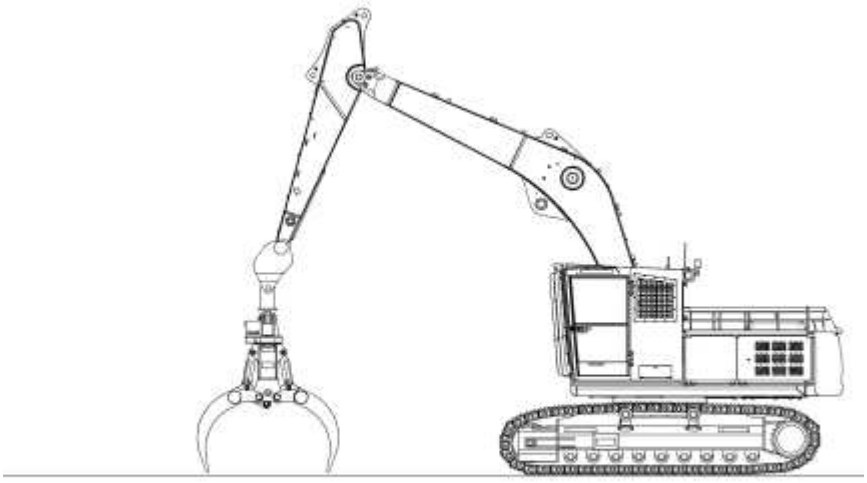
Part	Operating Pressure (Kg/cm²)
Hydraulic cylinder	**260**
Hydraulic motor	**100**

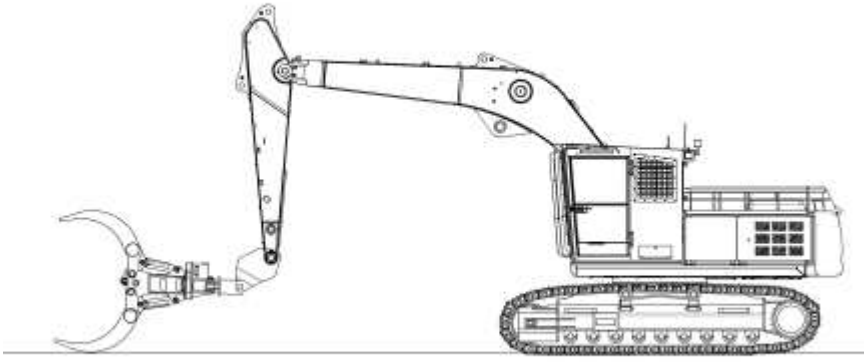
3. Attachment and Detachment

1) Remove the bucket pin from the excavator and replace the bucket by a Daemo product.

2) Clean the inner surface of the bracket using a cloth, and pull the bracket close to the excavator to insert the excavator arm into the bracket.

3) Carefully clean dust on the pin and bush. Insert the bucket pin and align with an appropriate safety device before fixing in place.





Ⅳ. Operation

1. Operating Precautions

Before starting work

- Pay attention in a workplace where there is a concern for falling objects.
- Check proper operation of the equipment.
- Check leaking of operating oil, cooling water and engine oil.
- Check that the warning sign is hung on the dashboard in the operating room.
- To prevent injury, close the screen of the operating room cap or fragment protection device. Workpiece can fly into the operating room during operation.
- Operate on the operator's seat. Do not operate until the equipment and accessories are placed in the proper position.
- Do not operate in poor conditions such as medication and drinking.

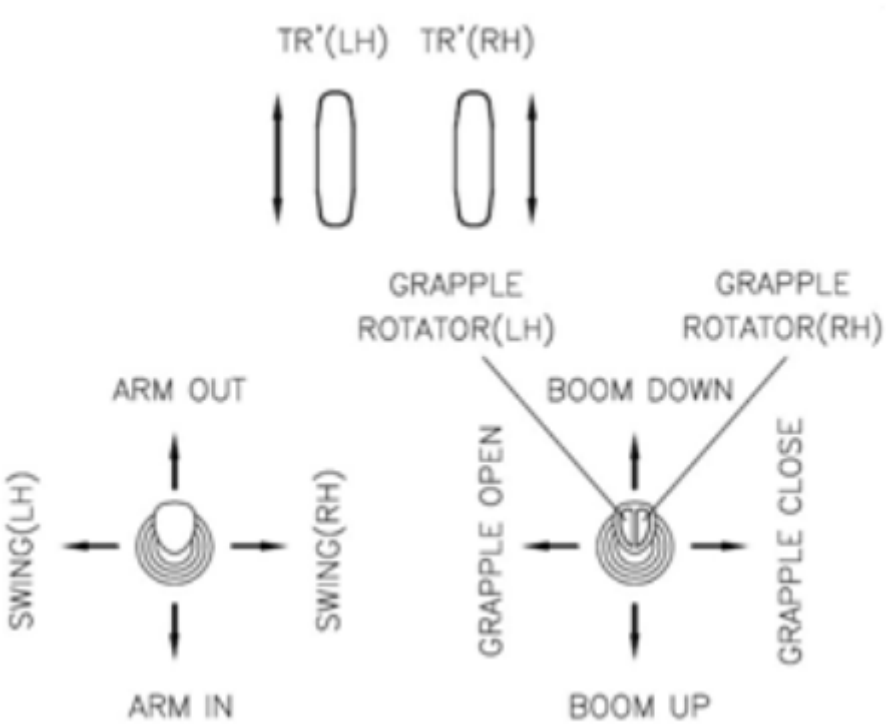
During work

- Remove any obstacles within the work scope.
- Do not perform dangerous operations presented in this Manual.
- Contact our company (Daemo Engineering) for remodeling of the equipment.

After work

- During maintenance and repair, guarantee stable working conditions and equipment.
- Inspect leaking of operating oil, cooling water and engine oil, as well as loosening of the hydraulic hose, bolts and nuts.
- Check the oil level of the operating oil tank.
- Clean the equipment and important parts.

2. Operation of Lever and Pedal



Ⅴ. Inspection and Maintenance

1. General

Inspection and maintenance help fully exhibit functions of the equipment and extend service life of the equipment.

Pay particular attention to the following while operating the equipment.
- Are operating devices and meters functioning properly?
- Are there abnormalities in appearance, strange noise and heating?
- Are there loosened bolts and nuts?
- Have structures and parts been damaged, worn or disassembled?
- Is each part operating smoothly?

If an abnormality is discovered during operation or inspection, identify the cause and perform maintenance immediately. If the cause is unclear or there is a problem in the hydraulic unit, contact our company (Daemo Engineering).

2. Inspection Method

- Be especially careful about safety.
- Devise appropriate inspection and maintenance plans considering the conditions and environment of use for effective inspection and maintenance.
- Only use parts approved by our company.
- Do not allow water and moisture to infiltrate into electric parts.

Caution:

Malfunctioning of electric parts is related to safety.
Never disassemble electronic parts.
Remodeling and alteration of the equipment is strictly prohibited.

3. Preparations Before Maintenance

Before starting maintenance work described in this Manual, stop the equipment as below for maintenance unless described otherwise.
- Place the equipment on a safe and flat place.
- Attach a “Do not start” tag to the work lever.
- Wear appropriate protective clothing when working on a dangerous task.
  Wear safety helmet, safety shoes, protective glasses, tight work trousers, ear protection, industrial gloves and breathing mask.

4. Periodic Inspection of Important Parts

Periodic inspection must be conducted to secure safety during work and operation.

Inspection Points
1. Injection of grease into each part
2. Deformation, damaging and abnormal noise of each part
3. Loosening, loss and falling of bolts, nuts and stoppers
4. Abrasion and damaging of pin, bush and pad
5. Operating status and oil leakage of hydraulic valve
6. Oil leakage of hydraulic cylinder and deformation and damaging of rod
7. Deformation of wood grapple structure
8. Abrasion and damaging of grappler of wood grapple

5. Types and Causes of Ordinary Troubles

Failure Type	Cause of Failure
Poor hydraulic performance	Temperature of operating oil fails to reach normal level.
	RPM of the engine is too low.
	Flow of operating oil is low.
	There is an obstacle on the hydraulic line.
	The cooling system, pump control system or pilot line is damaged.
	Oil is leaking internally (control block, valve, power unit, etc.).
	The hydraulic hose is entangled or twisted.
	The spool of the control valve is not opened maximally.
	The relief valve is damaged or cannot be adjusted.
	Internal oil leak occurs due to aging of the cylinder.
	The hydraulic pump is damaged.
Poor equipment power	The cylinder rod is bent.
	The piston is jammed.
	The cylinder tube has partially increased inner diameter or flaw.
	Air exists in the hydraulic line.
	Temperature of operating oil is too low.
	The valve spool is jammed or the spring is broken.
	The pump or engine control system is damaged.
	The power control valve is damaged.
	Engine oil is insufficient or improper lubricant is used.
Generation of abnormal noise	The bearing is damaged.
	The gear tooth of the turning reducer is worn and broken.
	The gear tooth of the driving reducer is worn and broken.

6. Wood Grapple Inspection and Maintenance Points

Body
Inspect damaging of the body at every 120 hours.

Hydraulic cylinder
Inspect oil leakage or damaging of the cylinder at every 20 hours.

Pipes
Hydraulic pipes are necessary. If there is a hydraulic double-acting pipe in the excavator, some pipes can be used as is.
(Piping and hydraulic circuit can differ according to the excavator model.)
After work is done, inspect oil leakage, piping and damaging of connections at every 120 hours.

Arm and wood grapple
Check abrasion, deformation or cracking of the arm and wood grapple at every 120 hours.

Pin and bush
Check abrasion of the pin and bush at every 120 hours.

Various caps, bolts and nuts
Inspect loosening of each cap, bolt and nut and tighten any loose parts at every 120 hours.

Rotation
Inspect loosening of rotating parts at every 120 hours and tighten any loose parts.
Inspect oil leakage or damaging of hydraulic parts.

Replacement of internal house
Close the rotary arm and remove the hose from the adaptor above the rotating joint.
Attach the hose in the reverse order.

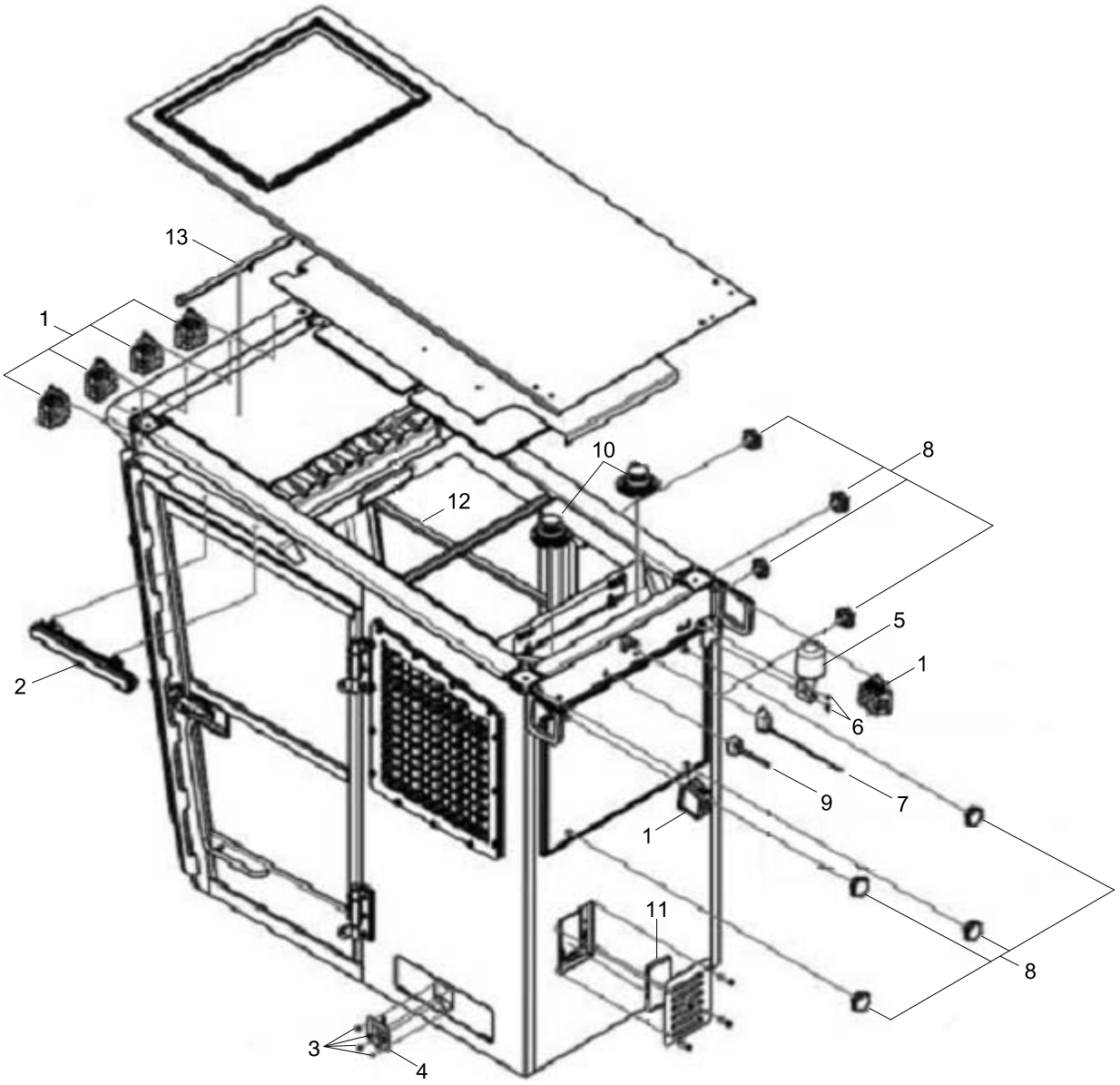
External hose and rotating hose
Grab the rotating part with a spanner and turn the hose metal so that the hose does not fall out. Remove the rotating joint. Attach in the reverse order.

CONTENTS

G. Structure System

H. Attachment System

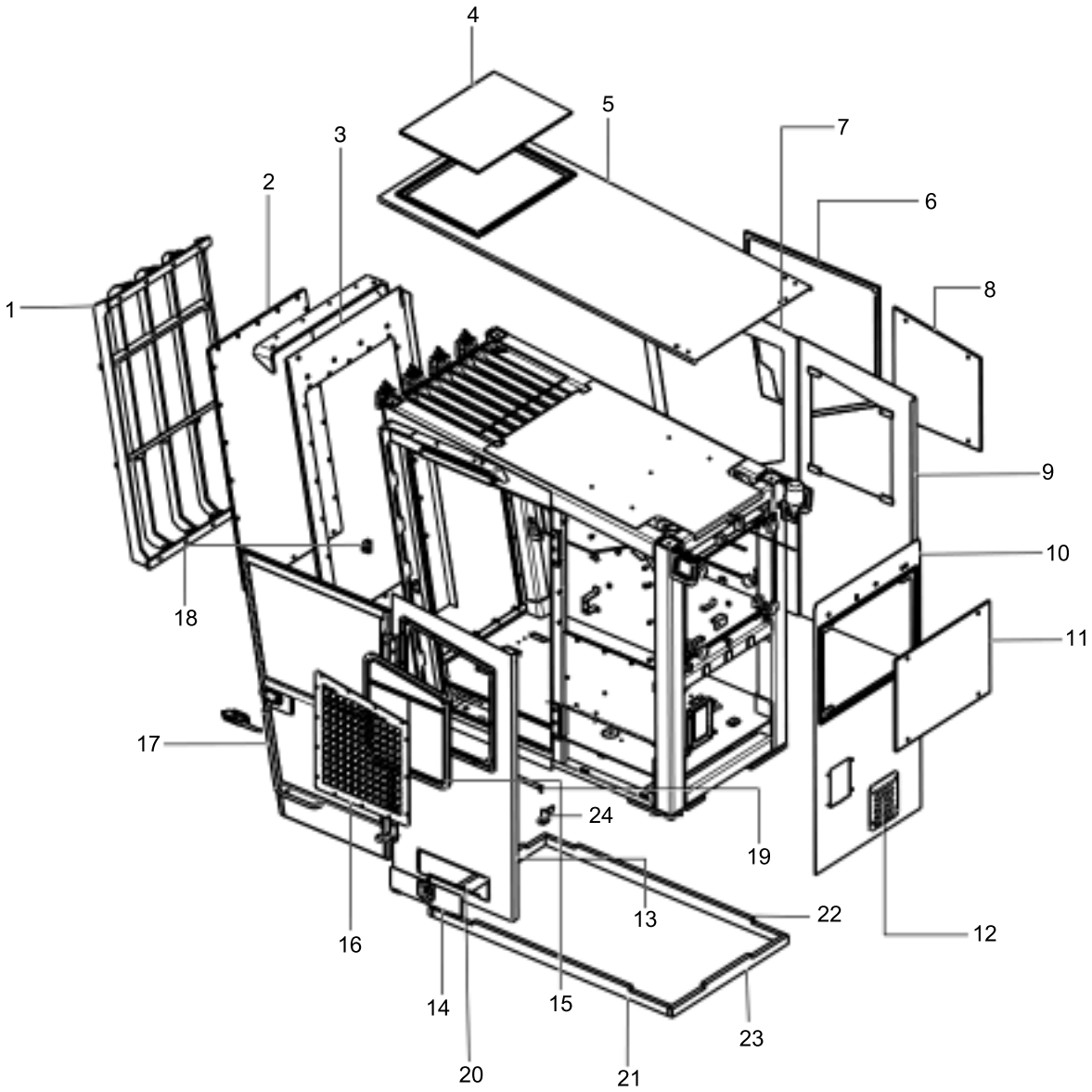
CABIN PART 1



CABIN PART 1

ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	XKBN-05656	LAMP ASSY-WORK	6			
2	XKBN-05690	LAMP ASSY-WORK	1			
3	XKBN-05700	SCREW	4			
4	XKBN-05698	LATCH-SIDE COVER	1			
5	21Q4-30381	LAMP ASSY-BEACON	1			
6	XKBN-05701	BOLT	2			
7	21Q8-32211	ANTENNA ASSY	1			
8	XKBN-05699	KNOB	16			
9	21M9-42500	ANTENNA-FM/AM	1			
10	21Q6-21110	SPEAKER ASSY	2			
11	11Q6-90510	FILTER-AIRCON	1			
12	XKBN-05691	LAMP-ROOM	1			
13	XKBN-05695	SUNVISOR	1			

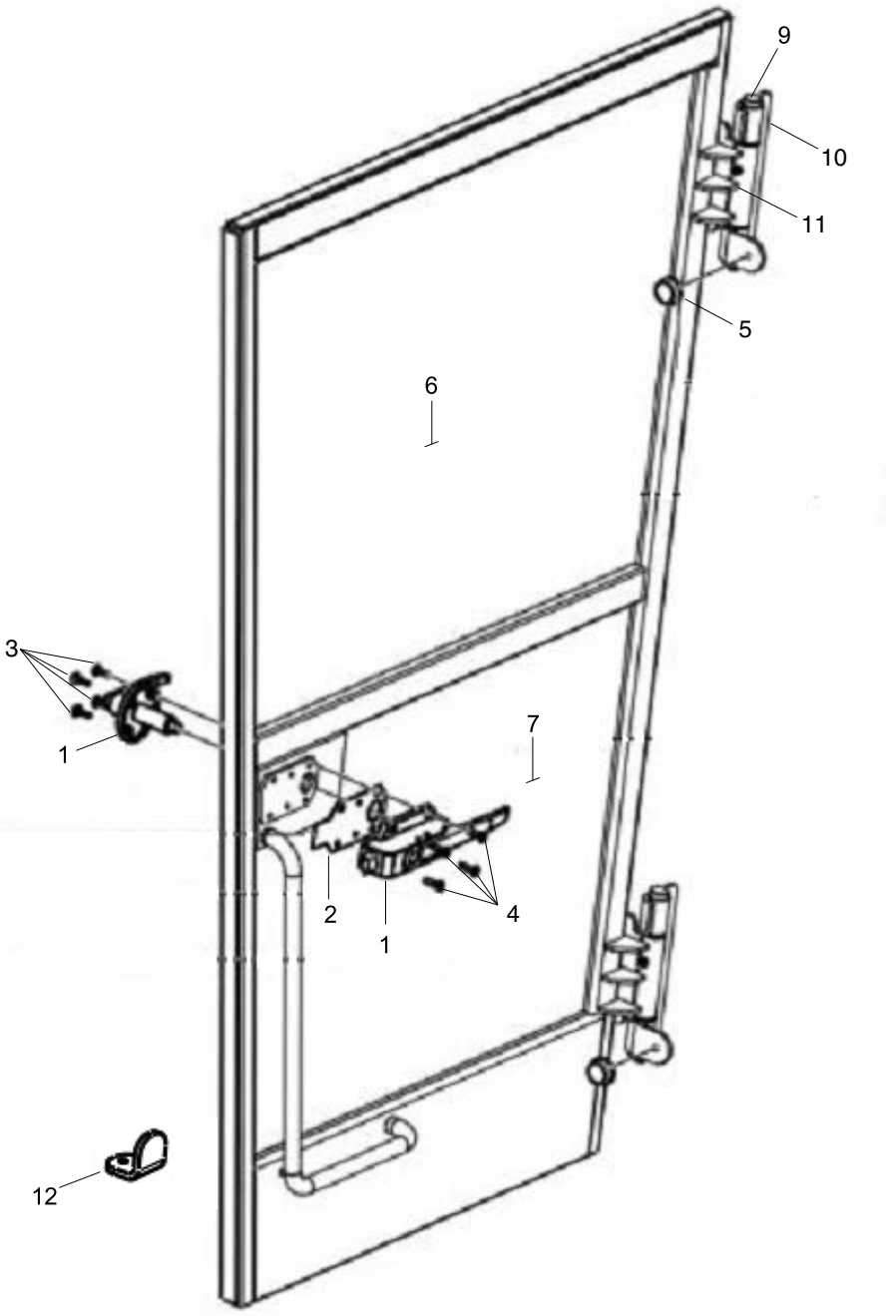
CABIN PART 2



CABIN PART 2

ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	XKBN-05702	GUARD-FRONT	1			
2	XKBN-05703	GLASS-FRONT	1			
3	XKBN-05704	PANEL ASSY-FRONT	1			
4	XKBN-05705	GLASS-ROOF	1			
5	XKBN-05706	PANEL ASSY-ROOF	1			
6	XKBN-05707	GLASS-RH FR	1			
7	XKBN-05708	PANEL ASSY-RH FR	1			
8	XKBN-05709	GLASS-RH RR	1			
9	XKBN-05710	PANEL ASSY-RH RR	1			
10	XKBN-05711	PANEL ASSY-REAR	1			
11	XKBN-05712	GLASS-REAR	1			
12	XKBN-05713	COVER-REAR FILTER	1			
13	XKBN-05714	PANEL ASSY-LH RR	1			
14	XKBN-05715	COVER-LH RR	1			
15	XKBN-05716	SASH ASSY	1			
16	XKBN-05717	COVER-LH RR	1			
17	XKBN-05718	DOOR-LH	1			
18	XKBN-05689	HANDLE ASSY	1			
19	XKBN-05800	GASSPRING-DOOR	1			
20	XKBN-05801	FORM-CENTER FR	1			
21	XKBN-05802	FORM-SIDE LH	1			
22	XKBN-05803	FORM-SIDE RH	1			
23	XKBN-05804	FORM-CENTER RR	1			
24	XKBN-05807	PLATE-DAMPER	1			

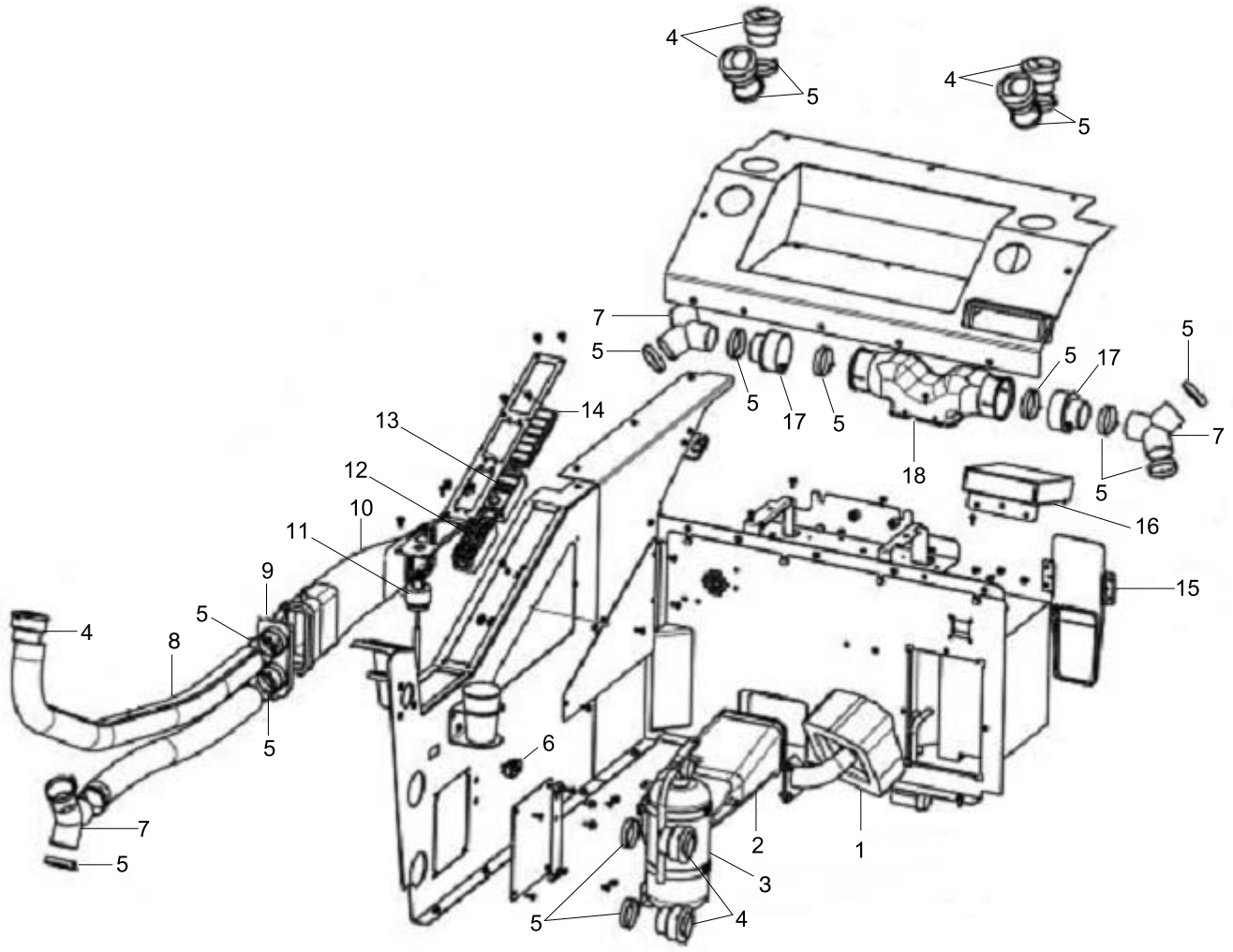
DOOR PART



DOOR PART

ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	XKBN-05689	HANDLE ASSY	1			
2	XKBN-05696	PLATE	1			
3	XKBN-05719	BOLT	4			
4	XKBN-05720	SCREW-SOCKET	4			
5	XKBN-05721	STOPPER-RUBBER	2			
6	XKBN-05722	GLASS-DOOR UP	1			
7	XKBN-05723	GLASS-DOOR LOW	1			
9	XKBN-05798	PIN-HINGE	2			
10	XKBN-05799	HINGE-DOOR LH	2			
11	XKBN-05805	PLATE-DOOR HINGE LH	2			
12	XKBN-05806	PLATE-GAS SPRING	1			

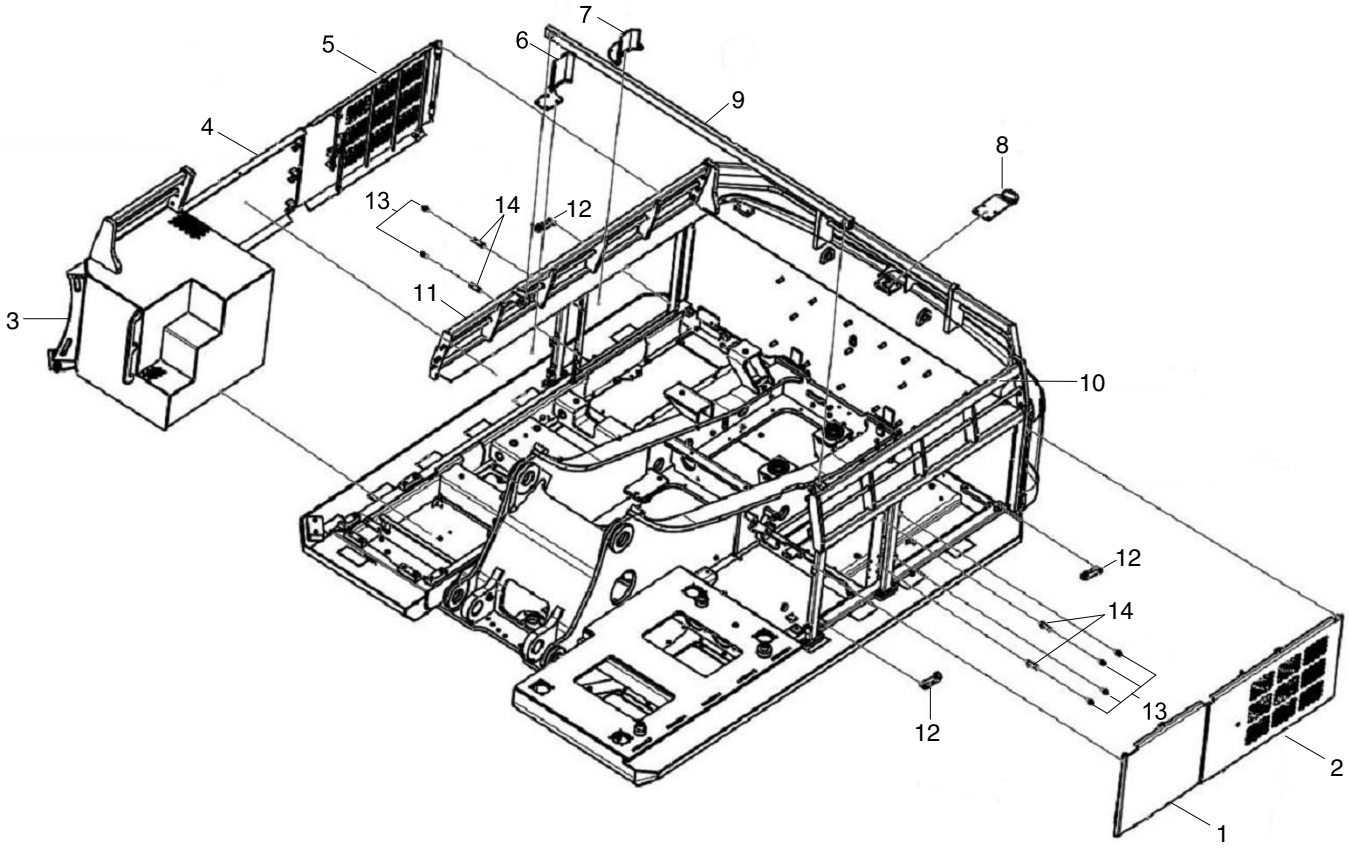
CABIN INTERIOR PART



CABIN INTERIOR PART

ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	21Q6-33400	CLUSTER ASSY	1			
2	71Q6-22590	DUCT	1			
3	XKBN-05697	EXTINGUISHER-FIRE	1			
4	XKBN-05688	NOZZLE	7			
5	XKBN-05724	CLAMP-STEEL BAND	20			
6	21K8-00760	METER ASSY-HOUR	1			
7	XKBN-05692	CONNECTOR-Y	3			
8	XKBN-05725	HOSE-DUCT	1			
9	XKBN-05693	JOINT-DUCT RH	1			
10	71Q6-22301	DUCT-DEFROSTER	1			
11	21Q4-00071	KEY ASSY-START	1			
12	21Q6-30601	SWITCH ASSY-MEMBRANE	1			
13	21Q6-30801	CONTROLLER-REMOTE	1			
14	21Q4-22141	SWITCH-BEACON	1			
15	71Q6-22431	DUCT-INLET	1			
16	21K8-52100	PLAYER ASSY-RADIO&USB	1			
17	XKBN-05694	JOINT-DUCT RR	2			
18	71Q6-22280	VENT-DUCT	1			

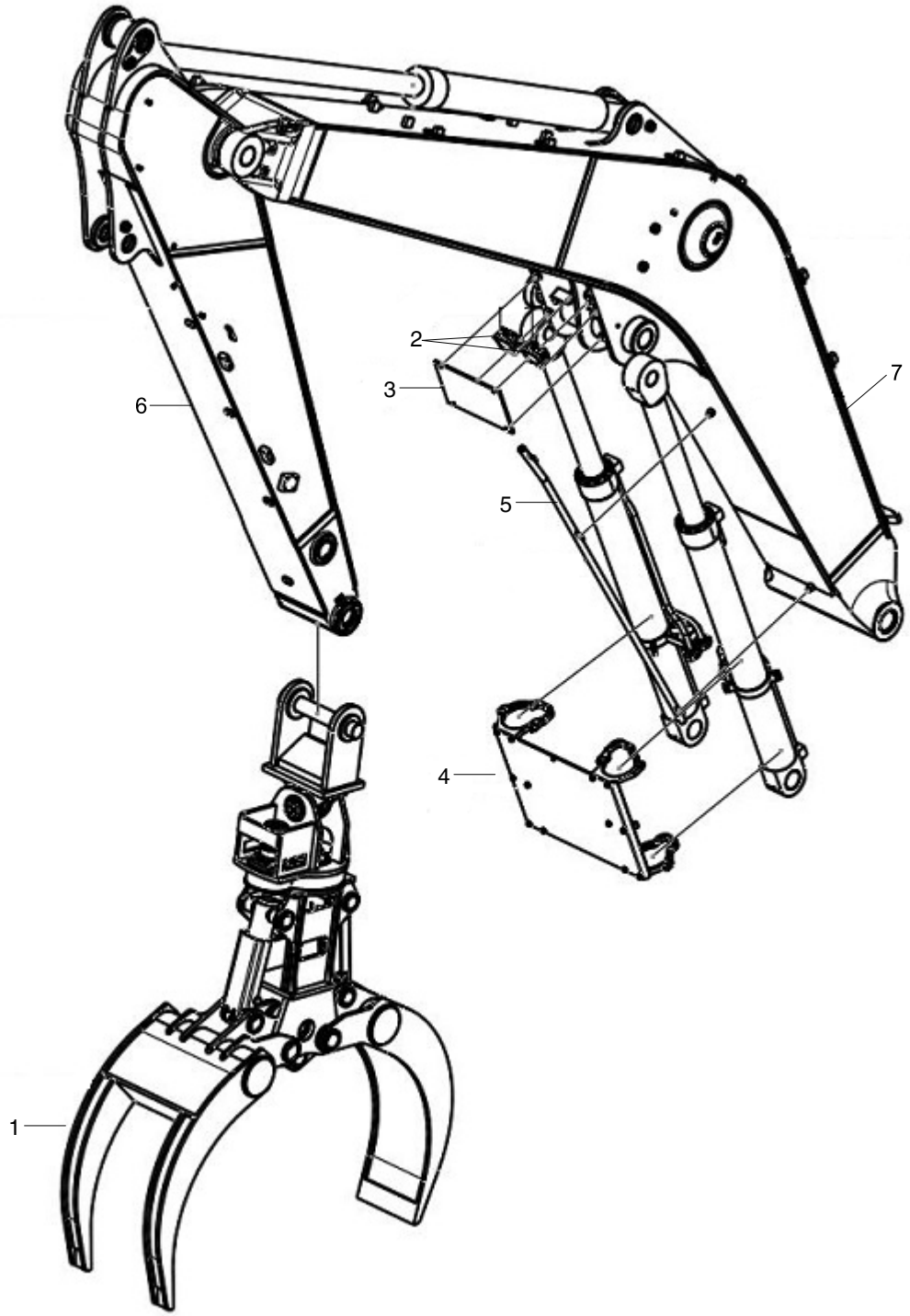
COVER PART



COVER PART

ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	XKBN-05662	COVER ASSY-LH FR	1			
2	XKBN-05682	COVER ASSY-LH RR	1			
3	XKBN-05666	BOX ASSY-TOOL	1			
4	XKBN-05664	COVER ASSY-RH FR	1			
5	XKBN-05683	COVER ASSY-RH RR	1			
6	XKBN-05657	CAP-FUEL TANK	1			
7	XKBN-05658	CAP-OIL TANK	1			
8	21Q6-60103	CAMERA KIT-A/VIEW RR	1			
9	XKBN-05661	SUPPORT-CROSS	1			
10	XKBN-05680	SUPPORT ASSY-LH	1			
11	XKBN-05681	SUPPORT ASSY-RH	1			
12	71Q6-52180	STAY ASSY-LH	3			
13	71Q6-53951	STOPPER-B	6			
14	XKBN-05667	BAR-STOPPER	4			

FRONT PART



ITEM	PART NO	DESCRIPTION	QTY	SERIAL NO	ITC	REMARK
1	XKBN-05687	GRAPPLE-WOOD	1			
2	XKBN-05656	LAMP ASSY-WORK	2			
3	XKBN-05684	COVER-WORK LAMP	1			
4	XKBN-05686	STOPPER ASSY-BOOM CYL	1			
5	XKBN-05685	PIPE-HARNESS GUIDE	1			
6	61K9-20100	ARM ASSY-3.2M	1			
7	61Q9-10100	BOOM ASSY-6.45M	1			

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PART NO	PAGE	ITEM	PART NO	PAGE	ITEM	PART NO	PAGE	ITEM
11Q6-90510	G010b	11	XKBN-05689	G010d	1			
21K8-00760	G010h	6	XKBN-05690	G010b	2			
21K8-52100	G010h	16	XKBN-05691	G010b	12			
21M9-42500	G010b	9	XKBN-05692	G010h	7			
21Q4-00071	G010h	11	XKBN-05693	G010h	9			
21Q4-22141	G010h	14	XKBN-05694	G010h	17			
21Q4-30381	G010b	5	XKBN-05695	G010b	13			
21Q6-21110	G010b	10	XKBN-05696	G010d	2			
21Q6-30601	G010h	12	XKBN-05697	G010h	3			
21Q6-30801	G010h	13	XKBN-05698	G010b	4			
21Q6-33400	G010h	1	XKBN-05699	G010b	8			
21Q6-60103	G050	8	XKBN-05700	G010b	3			
21Q8-32211	G010b	7	XKBN-05701	G010b	6			
61K9-20100	H010	6	XKBN-05702	G010c	1			
61Q9-10100	H010	7	XKBN-05703	G010c	2			
71Q6-22280	G010h	18	XKBN-05704	G010c	3			
71Q6-22301	G010h	10	XKBN-05705	G010c	4			
71Q6-22431	G010h	15	XKBN-05706	G010c	5			
71Q6-22590	G010h	2	XKBN-05707	G010c	6			
71Q6-52180	G050	12	XKBN-05708	G010c	7			
71Q6-53951	G050	13	XKBN-05709	G010c	8			
XKBN-05656	G010b	1	XKBN-05710	G010c	9			
XKBN-05656	H010	2	XKBN-05711	G010c	10			
XKBN-05657	G050	6	XKBN-05712	G010c	11			
XKBN-05658	G050	7	XKBN-05713	G010c	12			
XKBN-05661	G050	9	XKBN-05714	G010c	13			
XKBN-05662	G050	1	XKBN-05715	G010c	14			
XKBN-05664	G050	4	XKBN-05716	G010c	15			
XKBN-05666	G050	3	XKBN-05717	G010c	16			
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XKBN-05682	G050	2	XKBN-05721	G010d	5			
XKBN-05683	G050	5	XKBN-05722	G010d	6			
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