

**OPERATION AND MAINTENANCE
MANUAL FOR A LIFEBOAT
WITH ENGINE
FREE FALL LIFEBOAT
(HDFN 25&35 T/F)**

Note

For operation and maintenance of the launching appliance the end user should be guided by the instructions provided by the manufacturers of these equipments in their respective manuals.

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OPERATION AND MAINTENANCE MANUAL FOR A LIFEBOAT SYSTEM

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APPENDIX A.

Marine diesel engine (type HB29D1, HB36D1)

1. General

The lifeboat is stored on the boat davit on after of the ship. In case of emergency, the crew can board the lifeboat and escaped with the lifeboat directly from its storage position.

The launching appliance consists of a boat davit (skid frame, jib frame), boat winch (reduction gear) and hydro unit (installed on steering gear room).

1.1 Technical specification

1.1.1 Lifeboat (HDFN35 T/F, HDFN25 T/F)

	HDFN35T	HDFN35F	HDFN25T	HDFN25F
Lightweight	4,814 kg	5,114 kg	4,585 kg	4,885 kg
Complement weight	2,887.5 kg (35P)		2,062.5 kg (25P)	
Fully Laden weight	7,701.5 kg	8,001.5 kg	6,647.5 kg	6,947.5 kg
MAX. Drop Height	25.7 M			
Dimensions	7.950x3.070x1.550 (m)			

1.1.2 Engine

Manufacture
Type
Towing Power

Hyundai lifeboats Co., Ltd.
HB29D1
320 kg

Fig. 1.1 Lifeboat davit arrangement

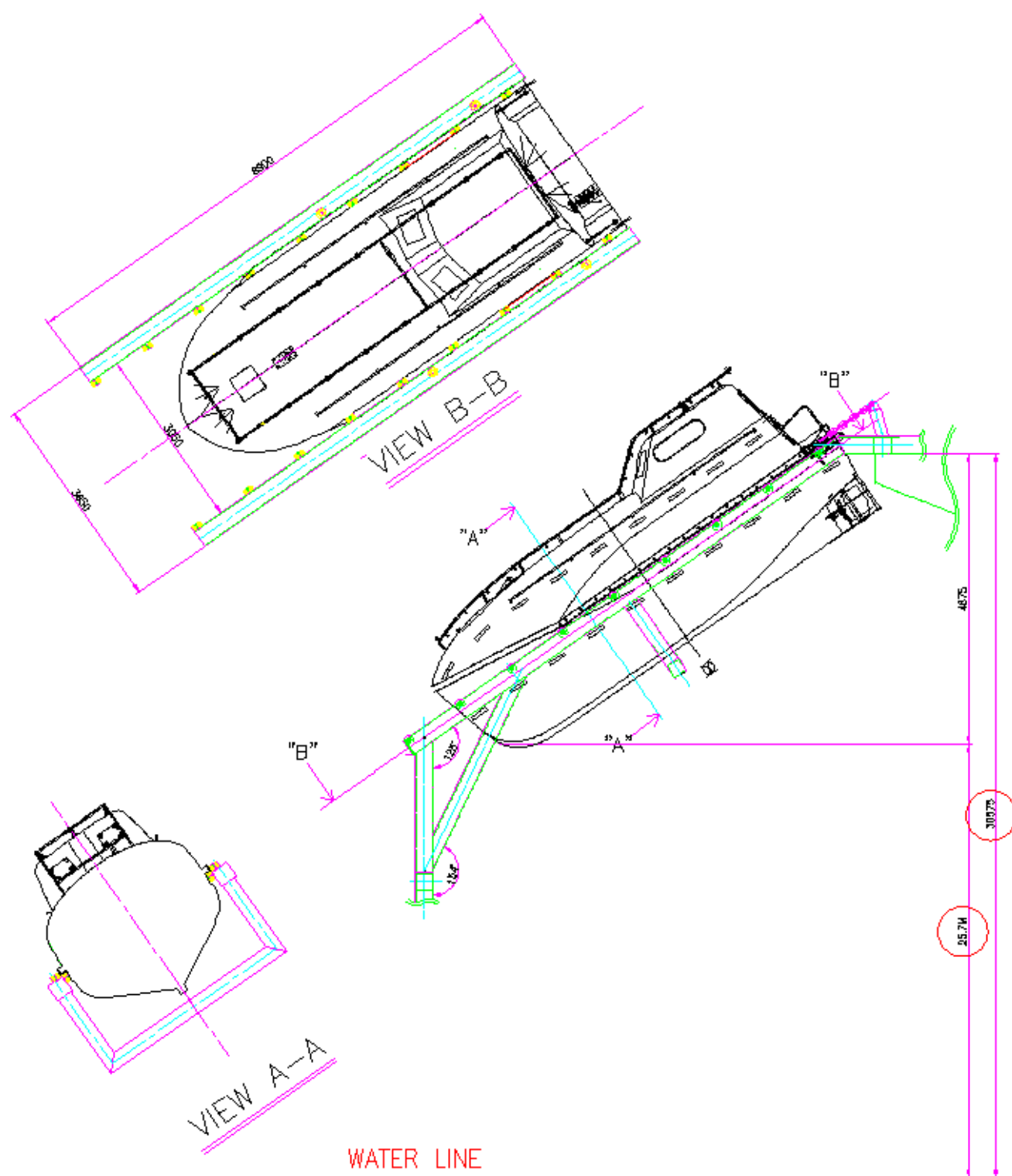


Fig. 1.2.1 Free Fall Lifeboat General Arrangement for NON-Tanker Type

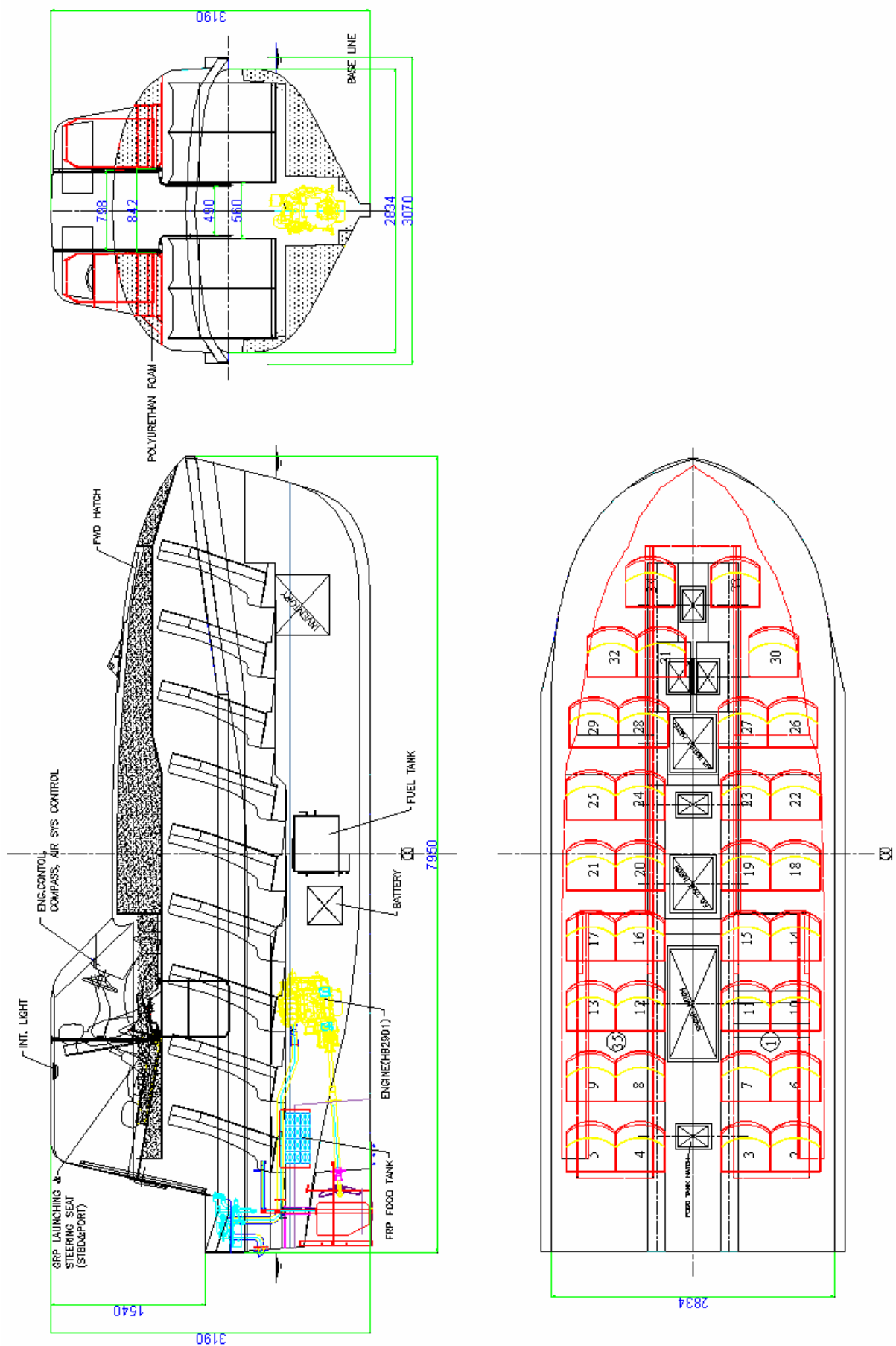
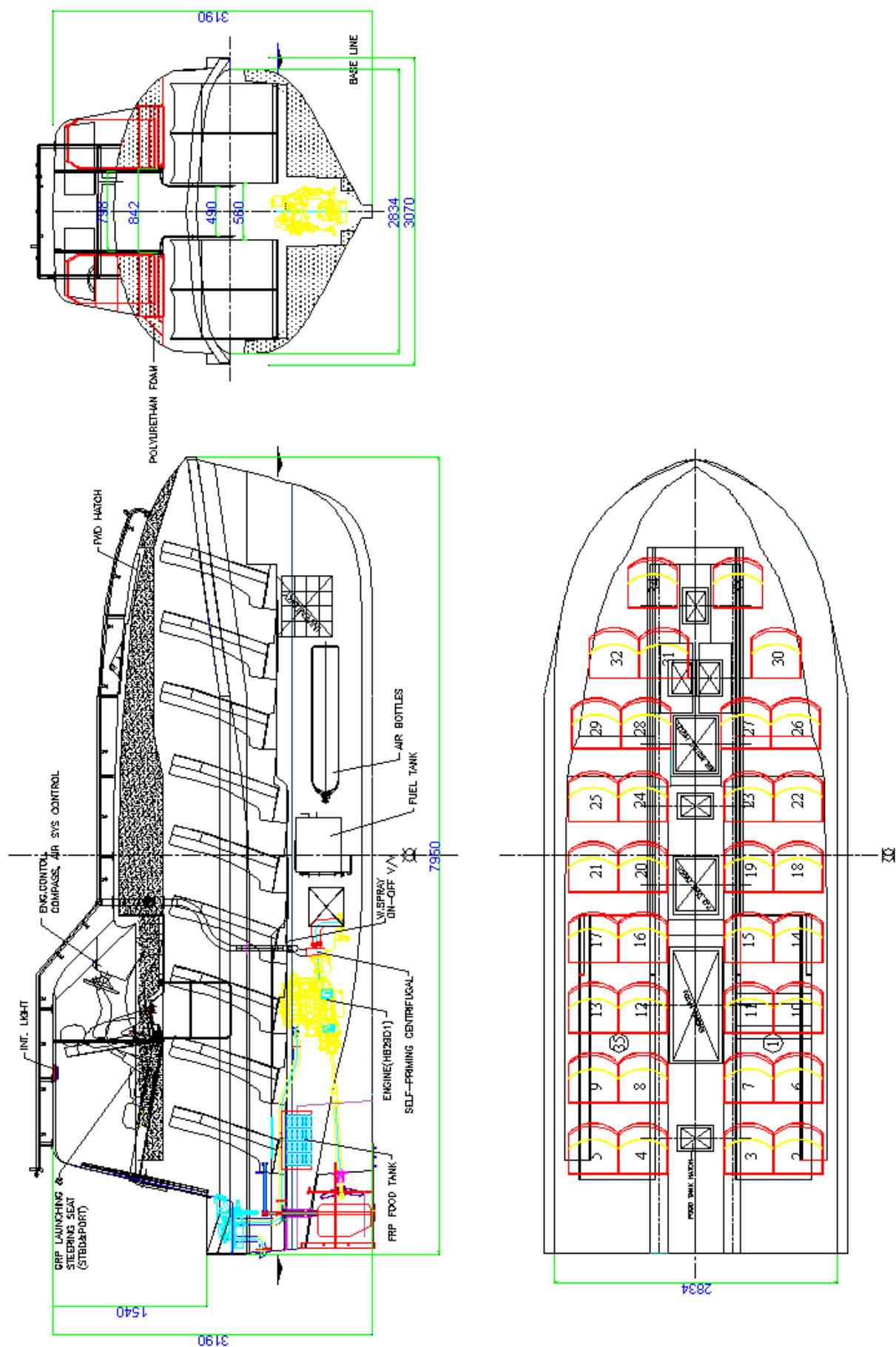


Fig. 1.2.2 Free Fall Lifeboat General Arrangement for Tanker Type



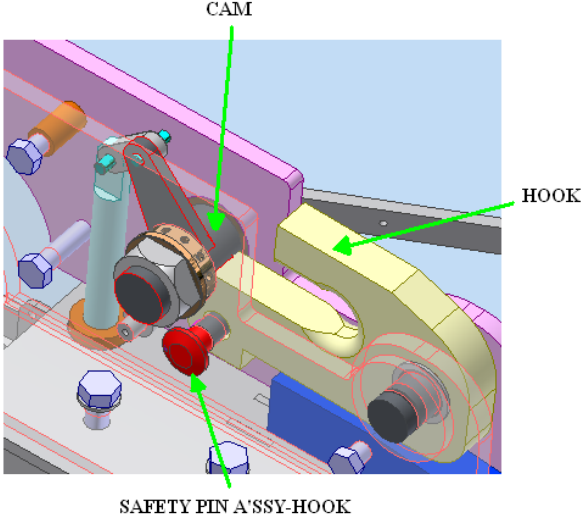
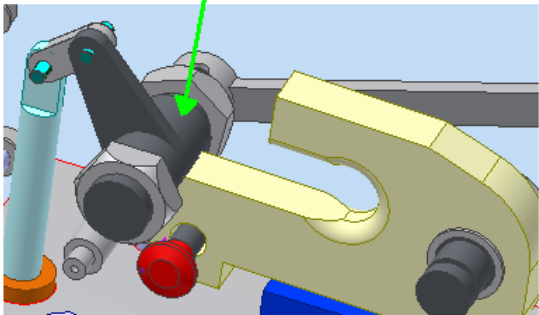
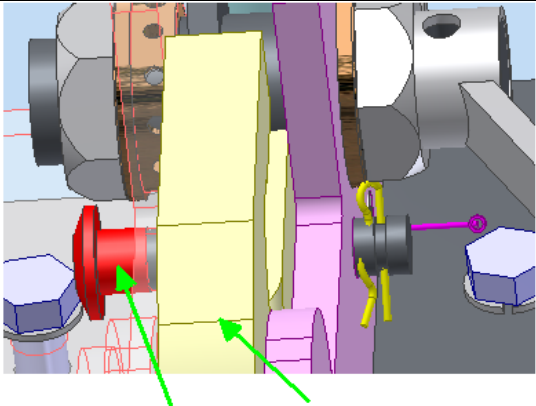
2. Method of checking proper closure of release hooks

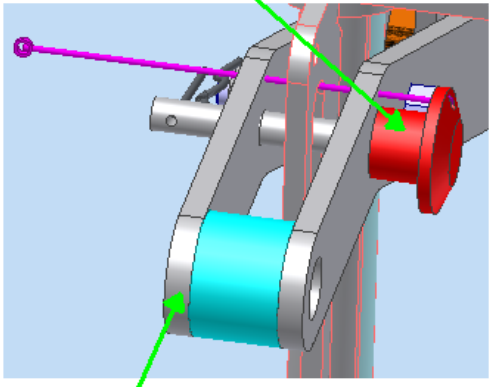
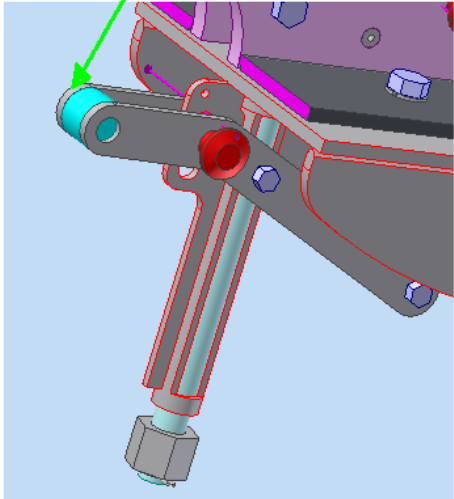
2.1. Safe use and operation of lifeboats during drills, inspection and maintenance is dependent on knowing that the release gear is properly reset.



Never enter lifeboat without ensuring complete closure of release hooks. Incomplete resetting of the release hooks can cause the lifeboat to drop resulting in death.

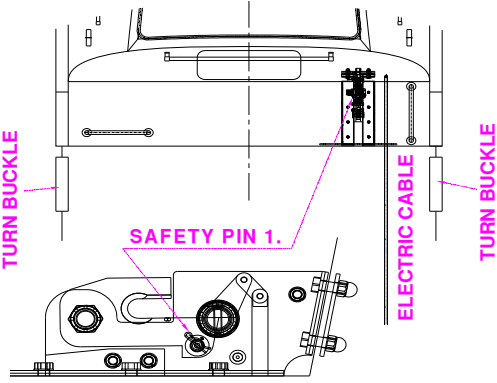
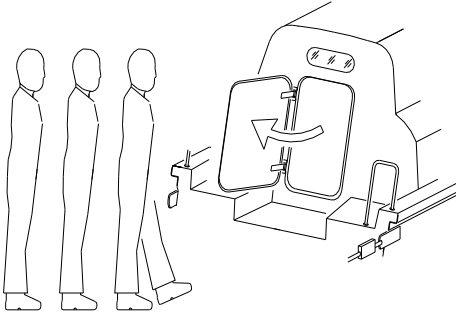
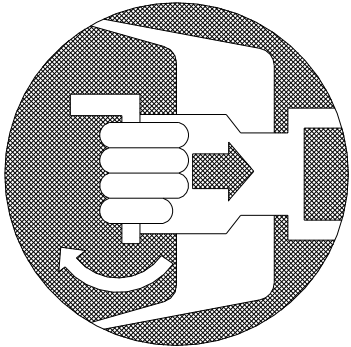
2.2 Ensuring release hook closure. The release hook needs to be checked firstly when passenger enters the lifeboat in case that it is supported by the fall and reset properly as follows:

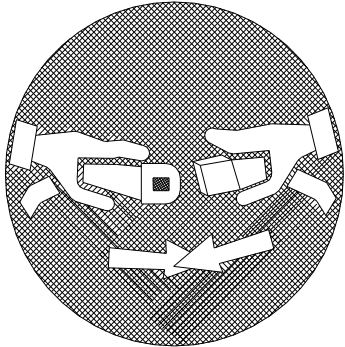
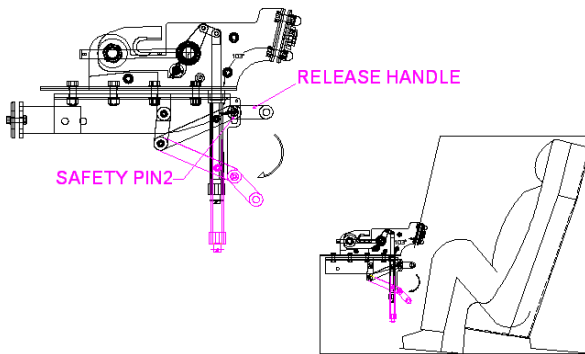
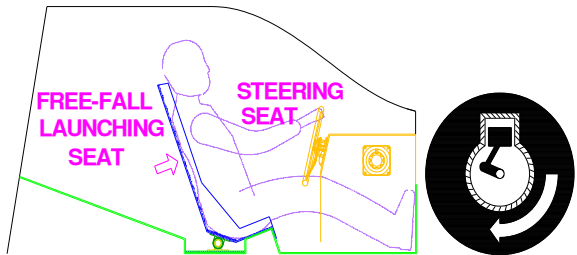
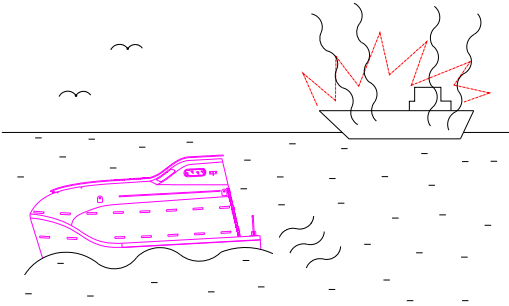
No.	Operation Guide	Schematic Diagram
1	Check that the hook is in the closed position. <Activity on the lifeboat>	 CAM HOOK SAFETY PIN A'SSY-HOOK
2	Check that the cam is in the closed position. <Activity on the lifeboat>	 CAM CLOSED POSITION
3	Check that the safety pin a'ssy-hook is inserted through the hook. <Activity on the lifeboat>	 SAFETY PIN HOOK

No.	Operation Guide	Schematic Diagram
4	Check that the safety pin a'ssy-handle is inserted in the connect-handle. <Activity on the ship>	SAFETY PIN A'SSY HANDLE  CONNECT-HANDLE
5	Check that connect-handle is in upper position. <Activity on the ship>	CONNECT-HANDLE (UPPER POSITION) 

3. Launching operation

3.1 Free fall launching operation

No.	Operation Guide	Schematic Diagram
1	Remove the safety pin1 and turn-buckles. <Activity on the ship> Note. Electric cable is disconnected automatically during free-fall launching	
2	Open the boarding hatch and embark. <Activity on the ship>	
3	Secure all hatches. <Activity in the lifeboat>	

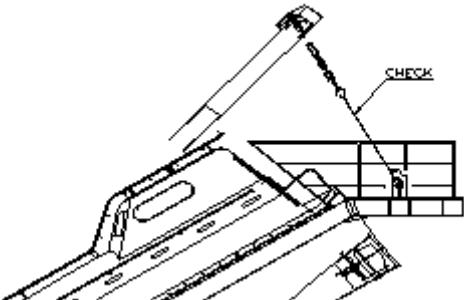
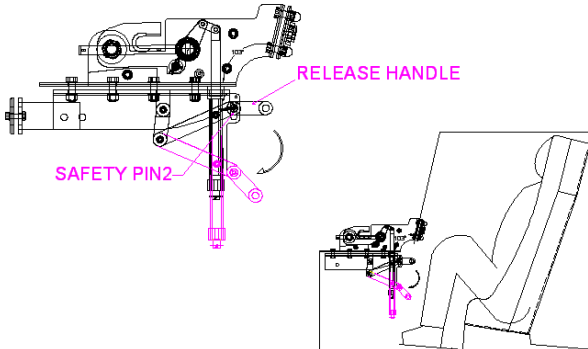
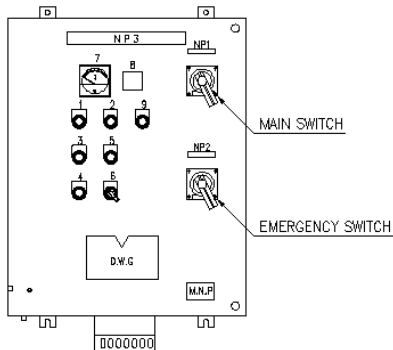
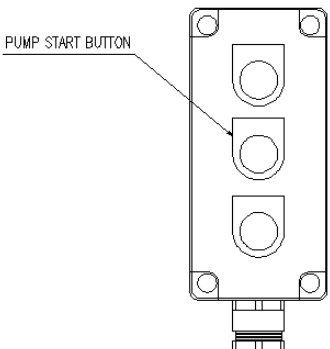
No.	Operation Guide	Schematic Diagram
4	Fasten the seat belts. <Activity in the lifeboat>	
5	Remove the safety pin 2 and operate (step on) the release handle for free-fall launching. <Activity on the lifeboat>	
6	After free-fall launching, helmsman move to steering seat and start engine. <Activity on the lifeboat>	
7	Run at full speed to escape from dangerous area quickly.	

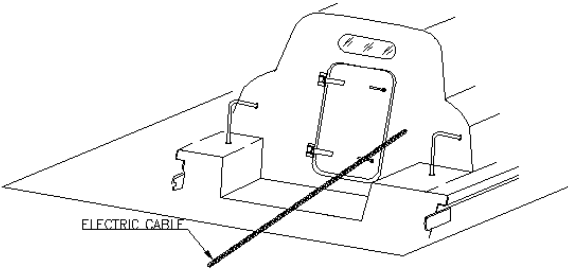
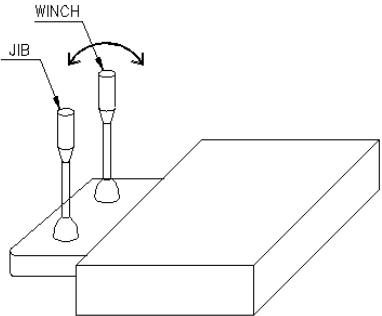
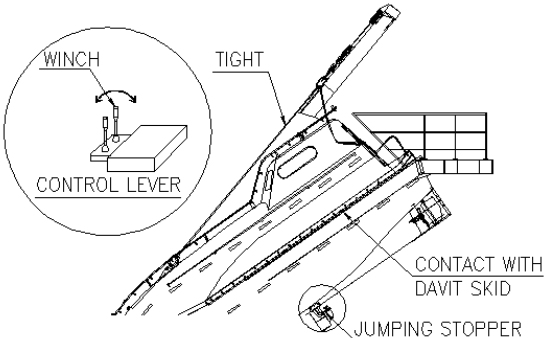
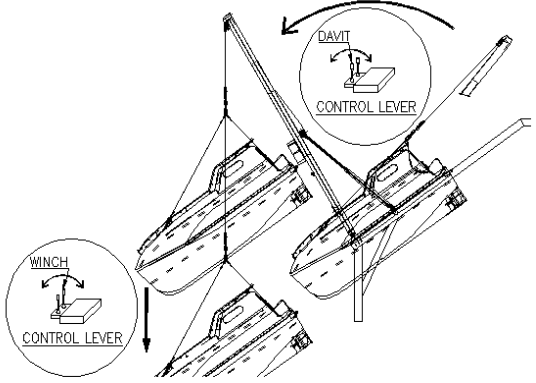
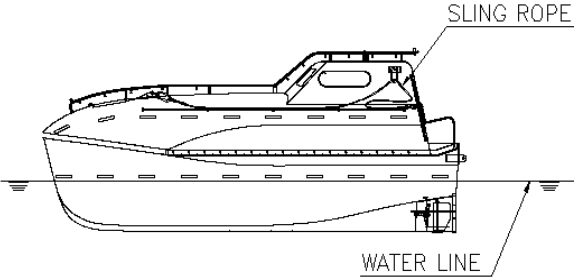


Caution

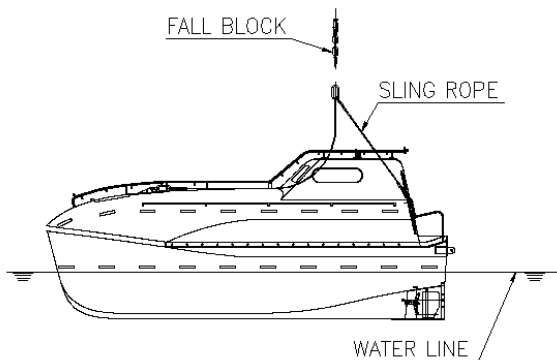
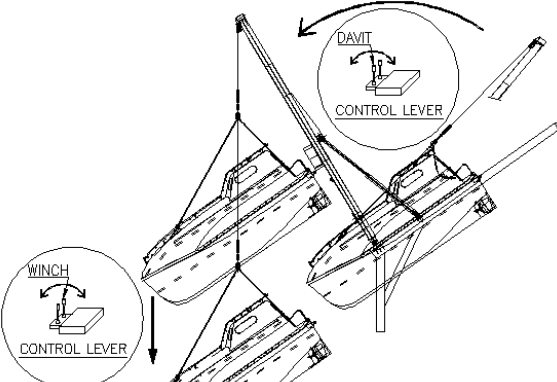
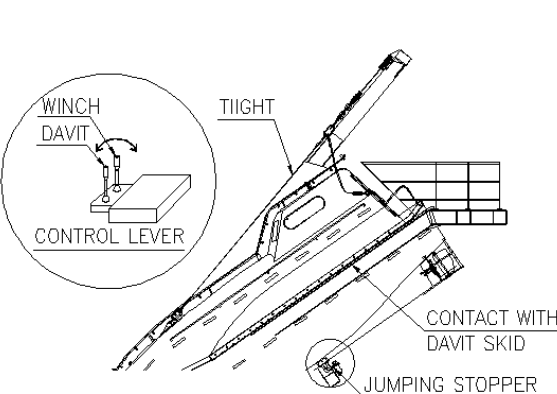
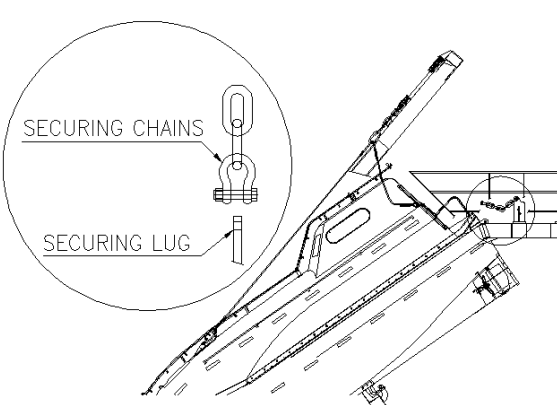
Remove all obstructions for launching and check again before free-fall launching.

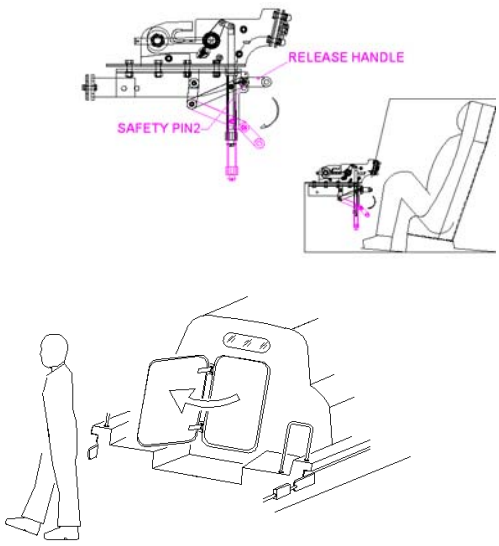
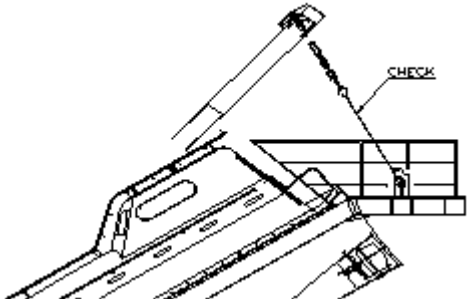
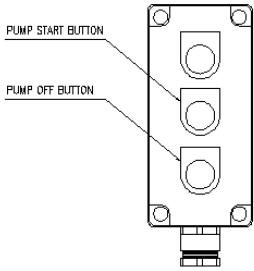
3.2 Launching by the davit

No.	Operation Guide	Schematic Diagram
1	The anchored rope & securing chains remove from upper deck. Please see if whether or not the sling rope connected. For jib launching, sling rope shall be securely connected to the boat.	
2	The master link connected to boat shall be taken out by boarding person inside the boat.	
3	please see if the starter get ready or not. If the power is " OFF ", please turn the power on.	
4	Located on the side of davit, RPB BOX shall be turned "on" for jib launching.	

5	The electric cable which has been connected to boat for recharging shall be disconnected by person who prepares freefall-launching.	 ELECTRIC CABLE
6	Roll down the winch using control lever. At that time, you can see the boat move along the ramp & get out of jumping stopper.	 WINCH JIB
7	After doing these process, you can see the boat moving like this, please be aware that jumping stopper is sensitive to the boat moving, so please move the boat slowly, the next following procedure is moving the jib using the control v/v.	 WINCH CONTROL LEVER TIGHT CONTACT WITH DAVIT SKID JUMPING STOPPER
8	Swing out the jib to the end into the sea. And then lower the boat into the water surface using control v/v.	 WINCH CONTROL LEVER DAVIT CONTROL LEVER
9	Remove the sling rope from the fall block, hereby , all the process was done for launching using jib.	 SLING ROPE WATER LINE

4. Recovery operation (Max 3 persons onboard)

No.	Operation Guide	Schematic Diagram
1	Please be ready to recover the boat, the boarding person in the boat , connect sling ropes to both sides of boat for fall recovery.	 FALL BLOCK SLING ROPE WATER LINE
2	You should connect sling ropes to floating block. Roll up the boat slowly in the condition of jib out position, then move the boat in the middle of ramp.	 DAVIT CONTROL LEVER WINCH CONTROL LEVER
3	Please see the boat move along with ramp paying attention to jumping stopper.	 WINCH DAVIT CONTROL LEVER TIGHT CONTACT WITH DAVIT SKID JUMPING STOPPER
4	You think that the boat gets settled on the ramp to some extent, master link shall be connect to the rear of the boat, and then please connect securing chain to securing lug.	 SECURING CHAINS SECURING LUG

5	The boarding person for boat recovery will do connect the safety pin inside the boat, and then get out of the boat.	
6	Lock the hatch securely. provided wire rope for floating block shall be connected to anchoring eye.	
7	Please turn the power off using R.P.B. herewith, that's the end of jib launching. With our product equipped, BON VOYAGE!	 REMOTE PUSH BUTTON

5. Release gear system

5.1 General

This section describes the details of the release gear system. Read this section carefully for safe operation. This release gear system consists of external hook and internal release handle near the after sheet.

5.2 Structure and part names

The structure and parts names of the external hook and internal release handle are shown in Figures

5.2.1 and 5.2.2.

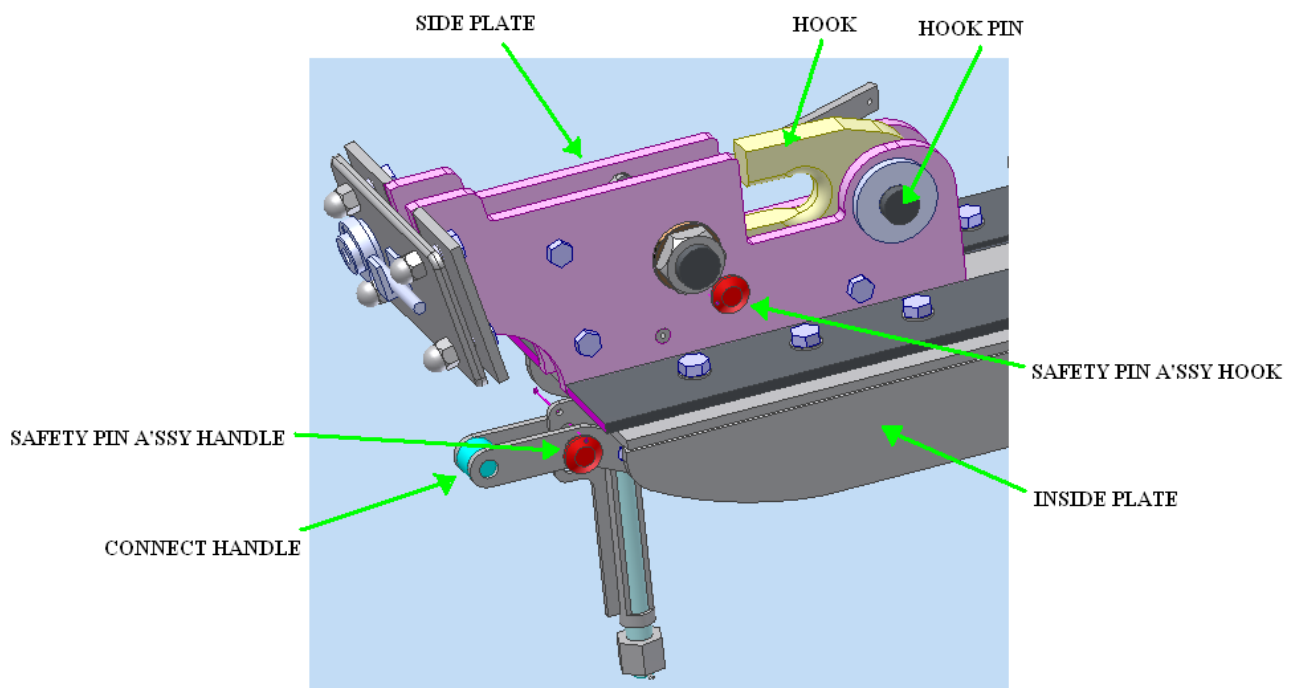


Fig. 5.2.1 Perspective of the hook and release handle

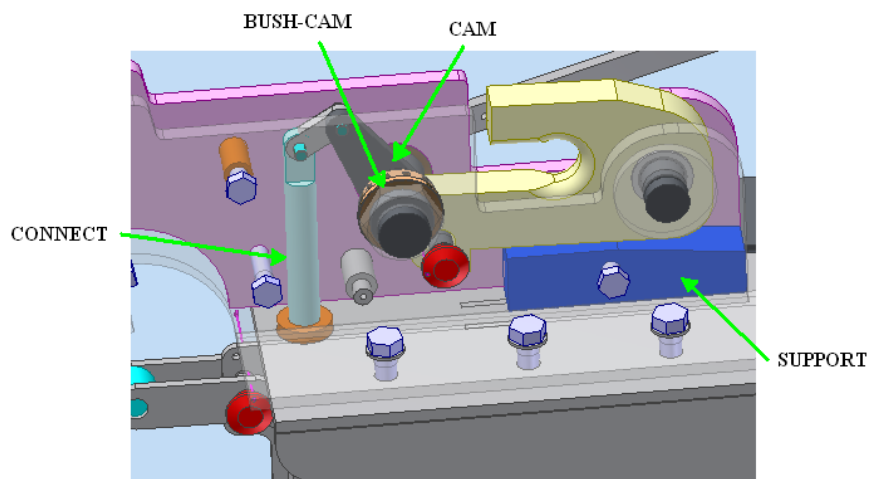


Fig. 5.2.2 Internal of the hook and release handle

5.3 Releasing

Firstly, pull out the snap-pin (item 41), safety-pin (item 11), snap-pin (item 42) and safety-pin (item 20) in the order named. (see figure 5.3.1) and then push the handle (item 19) down by using hands or feet.

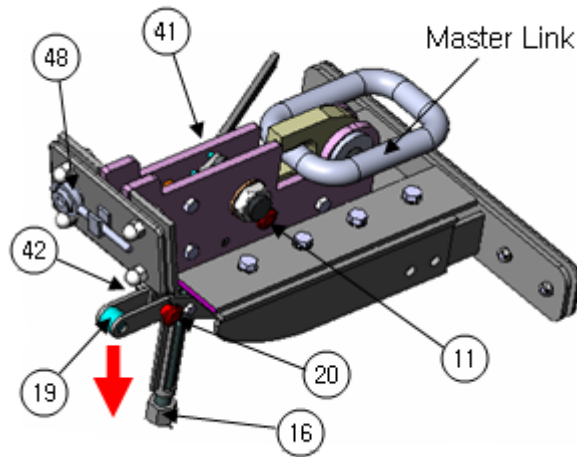


Fig. 5.3.1 Release principle of the hook unit

When the connect handle near after bench is pushed down, the cam is turned by the connect and the hook is then made free. Finally the hook is turned and released. (see figure 5.3.2)

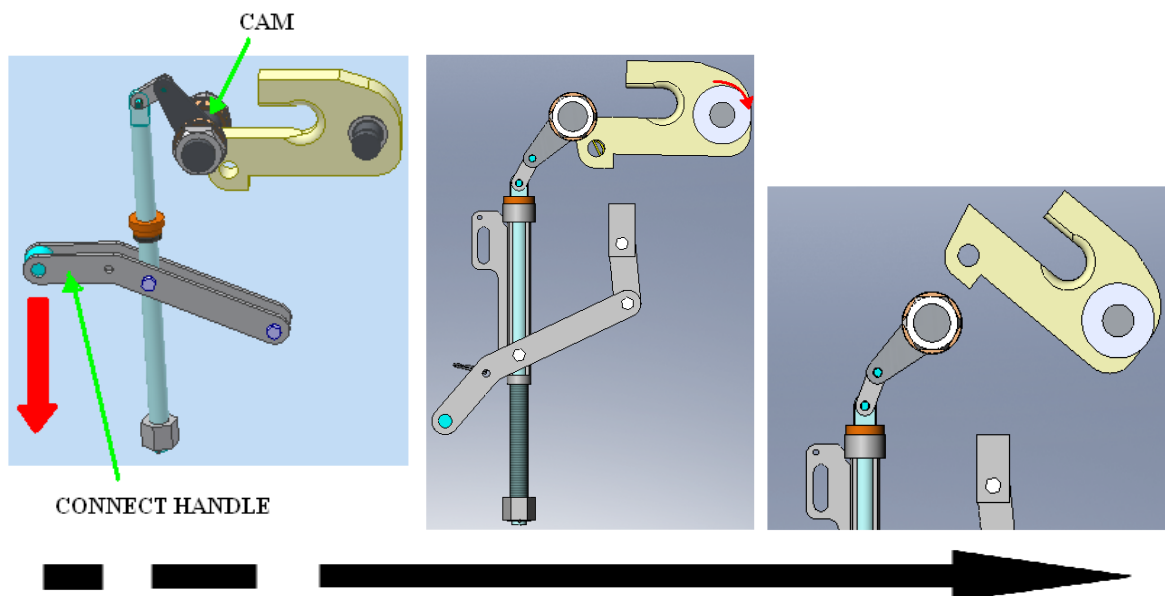


Fig. 5.3.2 Release principle of the hook unit

5.4 Resetting

After the resetting of hook, the posture of hook is returned at the close position. And insert safety pin a'ssy hook and snap-pin on the ship. (see figure 5.4.1)

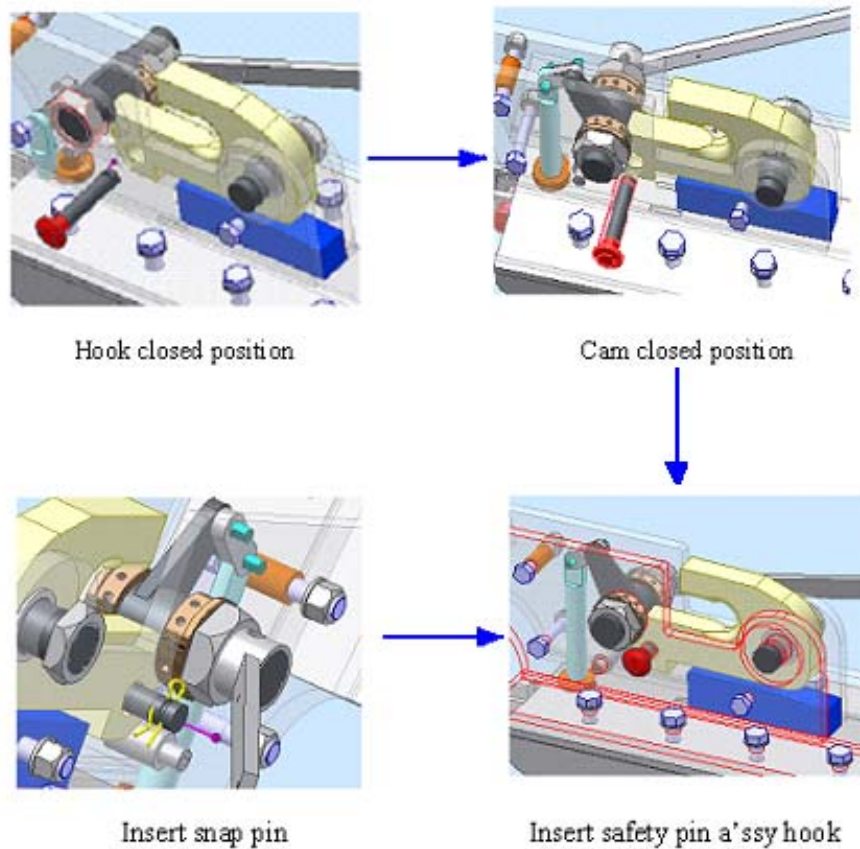


Fig. 5.4.1 Reset principle of the hook unit on the ship

And board in the lifeboat, Raise the connect handle and insert safety pin a'ssy cam and snap-pin in the lifeboat. (see figure 5.4.2)

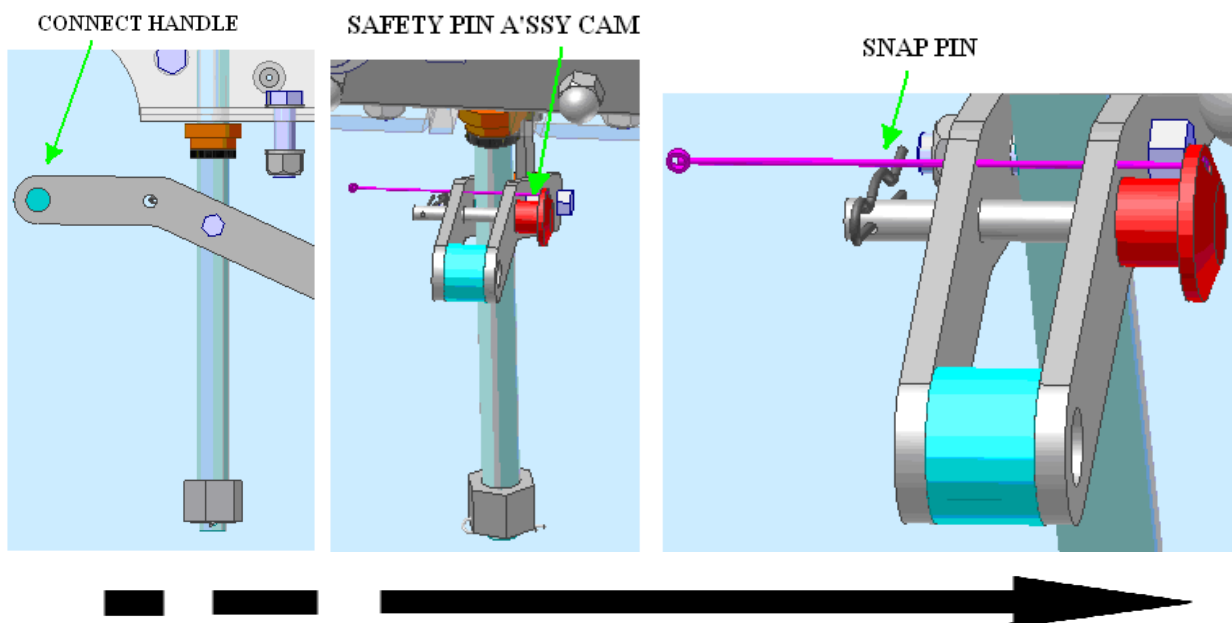


Fig. 5.4.2 Reset principle of the hook unit in the lifeboat

5.5 Emergency release and recovery

5.5.1 Emergency release

In case of the emergency situation, turn the emergency nut (item 16) counterclockwise by using the hexagon ratchet (item 48) after pull out the snap-pin (item 41), safety-pin (item 11), snap-pin (item 42) and safety-pin (item 20) in the order named as above. (See figure 5.4.1)

5.5.2 Recovery

Pull the master link in the hook (item 4) and then, raise the handle (item 19) after inserting the safety-pin (item 11) and snap-pin (item 41) in sequence. (See figure 5.4.1)
Finally, insert the safety-pin (item 20) and the snap-pin (item 42). (See figure 5.5.1)

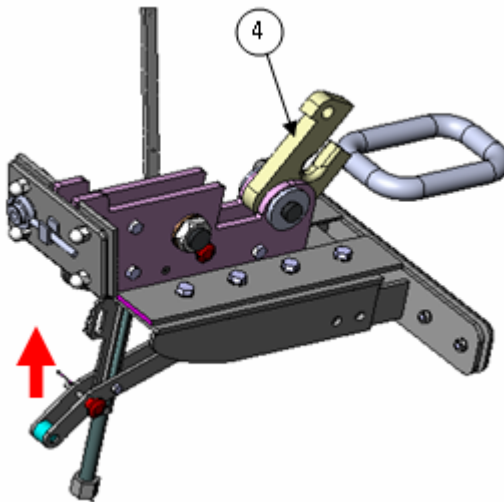


Fig. 5.5.1 Recovery principle of the hook unit in the lifeboat

6. Inspection and maintenance

6.1 General precautions

SOLAS regulation III/20 requires that all life-saving appliances shall be in working order and ready for immediate use before the ship leaves port and at all times during the voyage. Lifeboats, launching appliances and release gear are required by SOLAS regulation III/20 to be inspected weekly and monthly according to the instructions for on-board maintenance complying with the requirements of SOLAS regulation III/36. Also, MSC.1/Circ.1206 describes more detailed procedures for periodic servicing and maintenance of lifeboats, launching appliances and release gear.

This manual includes the weekly, monthly and annual inspection and maintenance, which are conducted on board under the direct supervision of a senior ship's officer.

Note: All users are requested to include a clear statement in their manual that any inspection, servicing and repairs should be completed in accordance with the system for inspection and servicing developed by Hyundai lifeboats Co., Ltd.

Personnel undertaking inspections, maintenance and adjustment of lifeboats, launching appliances and associated equipment are to be fully trained and familiar with these duties.

6.2 Inspection and maintenance of lifeboat and release gear system

6.2.1 Inspection and maintenance plan

Lifeboats should be inspected and maintained weekly, monthly and annually in accordance with the following tables. The tables list items to be checked, the method of inspection, the procedures to be followed, and the frequency at which the items are to be attended to.

Table 6.2.1.1 covers the basic lifeboat .

Table 6.2.1.2 covers the lifeboat engine.

Table 6.2.1.3 covers the electric parts.

Table 6.2.1.4 covers the lifeboat equipment.

Table 6.2.1.1 - Inspection procedure and maintenance plan for boat

Items		Method	Inspection procedure	Maintenance Plan		
				W	M	Y
Outside hull		Visual	Inspect for deformation or other defects. Inspect for peeling or any damage of retro-reflective material.		X	X
Outside canopy		Visual	Inspect for deformation or other defects.	X	X	X
Buoyant lifeline		Visual	Inspect for any damage.		X	X
Inside boat	GRP	Visual	Inspect for deformation or other defects.	X	X	X
	Wood	Visual	Inspect for crack or rot.	X	X	X
	Metal	Visual	Inspect for corrosion.	X	X	X
Drain valve		Visual	Inspect for any damage.	X	X	X
Release device		Visual	Check resetting condition. Remove any dirt on moving parts.	X	X	X
Painter release device		Visual	Check resetting condition. Remove any dirt on moving parts.	X	X	X
All hatches		Visual Operation	Inspect for easy operation and good condition of gasket.		X	X
Window		Visual	Inspect for any crack on glass. Clean both sides of glass.		X	X
Steering gear		Visual	Inspect for any damage of rudder, tiller and emergency tiller.	X	X	X
		Operation	Inspect for good operation of main steering and connecting emergency tiller.	X	X	X
Stern tube		Visual	Inspect gasket and check for leakage of seawater.	*2	*2	*2
Propeller and guard		Visual	Inspect for any damage.	X	X	X
Breather valve		Operation	Inspect operation of valve.		X	X
Water spray system (only tank- er version)	Clutch V-belt	Visual	Inspect for proper tension of V-belt. Inspect for any damage of belt.		X	X
		Operation	Inspect for proper operation.		X	X
	Spray pipe	Visual	Inspect for corrosion or any damage.	X	X	X
	Spray nozzle	Visual	Remove any deposit.	X	X	X

Items		Method	Inspection procedure	Maintenance Plan		
				W	M	Y
Air support system (only tank-er version)	High pressure pipe	Visual	Inspect for any damage.		X	X
	Regulator	Visual	Inspect for any damage.		X	X
	Air cylinder	Visual	Inspect for corrosion or any damage.		X	X

Note: 2 When waterborne.

* W: Weekly, M: Monthly, Y: Annual

Table 6.2.1.2 - Inspection procedure and maintenance plan for engine

Items		Method	Inspection procedure	Maintenance Plan		
				W	M	Y
Engine	Visual		Check in good condition.		X	X
	Operation		Start and operate the engine. Check operation of throttle. Check operation of clutch.	X	X	X
Lubricating oil	Visual		Check an amount of oil.		X	X
	Visual		Check viscosity of oil with finger and ensure it's not dirty.		X	X
Fuel oil tank	Visual		Check securing condition of the tank (corrosion or leakage and connecting parts). Check an amount of fuel oil.		X	X
Fuel oil pipe	Visual		Check any leakage on connecting parts.		X	X
Water cooler	Visual		Check an amount of fresh water.		X	X
Cooling water pipe	Visual		Check any leakage on pipe.		X	X
Starter switch	Operation		Check operating properly.	X	X	X
Glow lamp	Operation		Check light on when pre-heating.	X	X	X
Oil pressure warning lamp, Charge lamp	Operation		Check proper light on or light off condition.	X	X	X

* W: Weekly, M: Monthly, Y: Annual

Table 6.2.1.3 - Inspection procedure and maintenance plan for electric parts

Items	Method	Inspection procedure	Maintenance Plan		
			W	M	Y
Battery	Visual	Check lead wire.	X	X	X
	Measure	Measure voltage of battery. When voltage is low, charge battery.		X	X
Inside lamp	Operation	Check light on.	X	X	X
Canopy lamp	Operation	Check light on.	X	X	X
Search light	Operation	Check light on.	X	X	X
Electric wiring	Visual	Check any defects on wiring.	X	X	X

* **W**: Weekly, **M**: Monthly, **Y**: Annual

Table 6.2.1.4 - Inspection procedure and maintenance plan for lifeboat equipment

Check for condition, quantity and expiry date where applicable

No .	Items	Maintenance plan		
		W	M	Y
1	Thole pins or crutches		X	X
2	Boat hooks		X	X
3	Buoyant bailer		X	X
4	Bucket		X	X
5	Survival manual		X	X
6	Compass		X	X
7	Sea-anchor		X	X
8	Painters		X	X
9	Hatchets		X	X
10	Watertight receptacle and fresh water		X	X
11	Dipper with lanyard		X	X
12	Graduated drinking vessel		X	X
13	Food ration in watertight container		X	X
14	Rocket parachute flare		X	X
15	Hand flare		X	X
16	Buoyant smoke signal		X	X
17	Waterproof electric torch		X	X
18	One daylight signalling mirror		X	X
19	One copy of life-saving signals		X	X
20	One whistle		X	X
21	A first-aid kit		X	X
22	Anti-seasickness medicine		X	X
23	One seasickness bag for each person		X	X
24	A jack knife		X	X
25	Three tin openers		X	X

No.	Items	Maintenance plan		
		W	M	Y
26	Two buoyant rescue quoits		X	X
27	A manual pump	X	X	X
28	One set of fishing tackle		X	X
29	Portable fire-extinguishing equipment		X	X
30	A radar reflector		X	X
31	Thermal protective aids		X	X
32	Compartments for storage		X	X
33	Seat belts		X	X
34	Instructions of immediate action	X	X	X
35	Water resistant instructions	X	X	X

* **W**: Weekly, **M**: Monthly, **Y**: Annual

6.2.2 On board maintenance procedures

6.2.2.1 General

As a result of inspection, any defective parts should be repaired in accordance with following procedures. Any shortage of quantity should be supplemented to the correct number. Defective parts other than the following should be recorded along with their details and ordered for maintenance and repair by the manufacturers.

6.2.2.2 Boat

6.2.2.2.1 Rust on metal parts

Give anti-rusting treatment according to degree of damage, or replace if significantly wasted.

6.2.2.2.2 Damage of fabric

Repair fabric products by same material according to degree of damage.

6.2.2.2.3 Gasket

Repair with adhesive sealant according to degree of damage.

6.2.2.2.4 Drain valve

Remove any dirt and check correct operation.

6.2.2.2.5 Water spray system

Remove any deposit from spray nozzles. Tighten up pipe connecting parts when any leakage was noted. Adjust to proper tension on V-belt.

6.2.2.3 Engine

6.2.2.3.1 Oil coating and filling

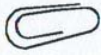
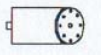
When any rust exists, remove rust and coat with machine oil. Rotating parts should be filled with lubricating oil.

6.2.2.3.2 Operating test

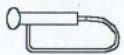
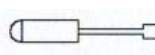
An operational test of the engine should be carried out on board the ship and in the afloat condition after launching at an appropriate opportunity to check the running condition. After the operational test, ensure that the valves for the cooling water line are opened and flushed with fresh water and drained completely.

6.2.2.3.3 Spare parts and tool list

Spare Parts List

No.	Part Name	Sketch	Description	Part No.	Weight (Kg)	Working	Spare
1	Belt		Fitted in front of Engine Flywheel.	E5800-72531	0.09	1	1
2	Filter - fuel		for Engine	31973-44001	0.40	1	1
2	Filter - oil		for Engine	E6201-32443	0.32	1	1
4	Relay - glow		Boat inside	C5510-43101/2	0.12	1	1

Tool List

No.	Part Name	Sketch	Description	Weight(Kg)	Q'ty/Boat
1	Hand pump for Lube oil Draining		500mm/ Flex. Tube	0.34	1
2	Adjustable Spanner		8"x200mm	0.14	1
3	polygrip Toge		150mm	0.32	1
4	Open Spanner		N/V 8/10	0.01	1
5	Open Spanner		N/V 12/14	0.04	1
6	Screw Driver		Maker Standard	0.03	1
7	Gear oil gauge		Fitted on transmis- sion.	0.01	1
Total :				1.86	

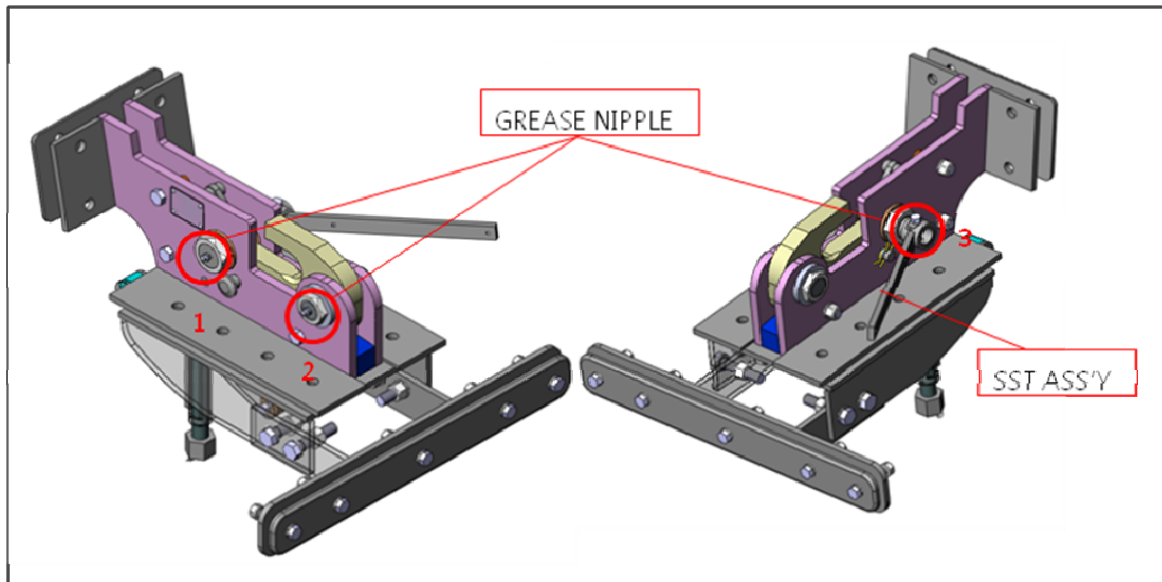
*** Tools are depended on Engine maker standard at Boat's delivery.**

6.2.2.4 Electric parts

6.2.2.4.1 Battery

Fill up battery with electrolyte if level is below the designated position. Tighten up electric terminal if it is loose.

6.2.2.5 Release gear



Procedure of apply grease

- Check the amount of grease on the grease nipple
 - Apply grease if necessary. Remove any excess grease.
 - Remove SST ass'y when check and apply grease on the No. 3 grease nipple.
- ※ NOTE : A good quality marine grease should be used

6.3 Inspection and maintenance of launching appliances (davits and winches)

6.3.1 Inspection and maintenance plan

Launching appliances should be inspected and maintained weekly and monthly in accordance with

the following tables. The tables list the items to be checked, the method of inspection, the procedure to

be followed, and the frequency at which the items are to be attended to.

Table 6.3.1.1 covers the davit.

Table 6.3.1.2 covers the winch.

Table 6.3.1.3 covers the electric parts.

Table 6.3.1.1 - Inspection procedure and maintenance plan for davit

Items	Method	Inspection procedure	Maintenance plan	
			Weekly	Monthly
Frame	Visual	Check corrosion, deformation and depression.	X	X
Davit arms	Visual	Check corrosion, deformation and depression.	X	X
	Operation	Moving out from stowed position.	X	
	Operation	Turning out from stowed position.		X
Sheave, suspension block	Visual	Check wear and corrosion.		X
	Operation	Check moving condition.	X	X
	Lubricate	Lubricate/grease.		X
Hinge pin, sheave pin	Lubricate	Lubricate/grease.		X
Davit arm stopper and trigger hook	Visual	Check wear and corrosion.	X	X
	Operation	Check moving condition.	X	X
	Lubricate	Lubricate/grease.		X
Boat fall, Turn buckle	Visual	Check wear, breakage of wire and corrosion.		X
	Lubricate	Lubricate/grease.		X
	Turn ends	Turn ends of boat fall (2.5 years).		
	Replacing	Replacing boat fall (5 years).		
Lashing Guide	Visual	Check wear, corrosion and looseness.	X	X
Deck operation device	Operation	Check moving condition.		X
	Lubricate	Lubricate/grease.		X

Table 6.3.1.2 - Inspection procedure and maintenance plan for winch

Items	Method	Inspection procedure	Maintenance plan	
			Weekly	Monthly
Gear box, gear, bearing, oil seal	Visual	Check level and deterioration of lubricating oil.		X
	Operation	Check unusual noise.		X
Brake system, Centrifugal brake	Visual	Check corrosion or any defects.	X	X
Wire end cotter	Visual	Check looseness.		X
Brake lever	Visual	Check corrosion or any defects.	X	X
	Operation	Check operating condition.	X	X
Speed change lever	Lubricate	Lubricate/grease.	X	X

Table 6.3.1.3 - Inspection procedure and maintenance plan for electric parts

Items	Method	Inspection procedure	Maintenance plan	
			Weekly	Monthly
Electric motor	Visual	Check wiring.	X	X
	Operation	Check normal operation.		X
Limit switch	Visual	Check wiring.	X	X
	Operation	Check normal operation.		X
	Lubricate	Lubricate/grease.		X
Push-button switch box and cable	Visual	Check wiring and other defects.	X	X
	Operation	Check normal operation.		X
Start panel	Visual	Check wiring and other defects.	X	X
	Operation	Check normal operation.		X

6.3.2 On-board maintenance procedure

6.3.2.1 General

As a result of inspection, any defective parts should be repaired in accordance with following procedures. Any shortage of quantity should be supplemented to correct number. Defective parts other than the followings should be recorded along with their details and ordered for maintenance and repair by the manufacturers.

6.3.2.2 Wire rope

6.3.2.2.1 Wire ropes should be changed in the following cases: **6.3.2.2.2** Check fixing condition of wire ropes.

- .1 Break of elemental wire was observed;
- .2 7% reduction of nominal diameter was observed;
- .3 Kink or looseness of ply was observed; or
- .4 Erosion / corrosion was observed.

6.3.2.2.3 Change the boat falls within an appropriate period.

6.3.2.2.4 Adjust the length of boat falls as necessary so that the clearances between the davit arm and davit arm stopper at fore and aft are almost the same.

6.3.2.2.5 Ensure that material and diameter of suspension links are as specified by the release gear manufacturer.

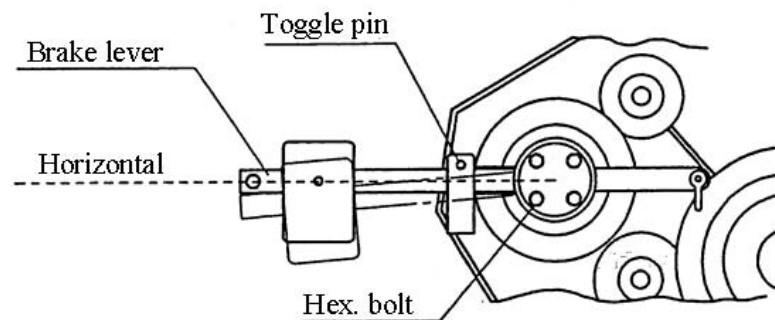
6.3.2.3 Boat winch

6.3.2.3.1 Prior to commencement of the maintenance work for the winch, the boat should be secured to prevent movement.

6.3.2.3.2 Oil should be checked and changed if discoloured. In case that oil level is low, oil should be added until its surface comes to the designated level in the oil gauge.

6.3.2.3.3 Surfaces of each gear inside the gear box should be checked. In case that a defect is found on a surface of gear, the gear box should be replaced or repaired.

6.3.2.3.4 In case that the angle of brake lever has dropped due to abrasion of the brake lining, the angle of the brake lever should be adjusted by loosening the bolts, adjusting the angle and tightening the bolts again.



6.3.2.4 Greasing

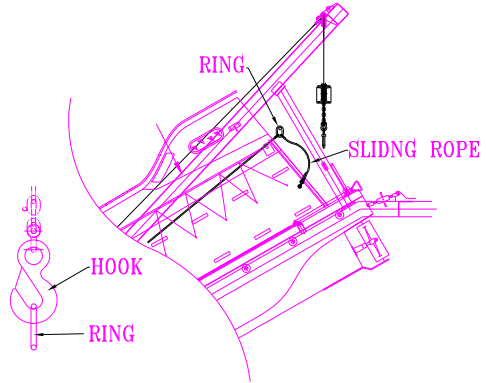
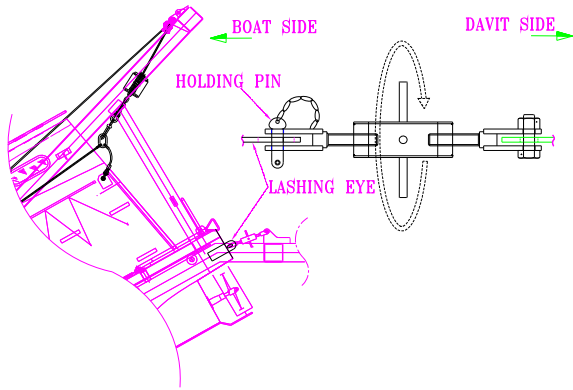
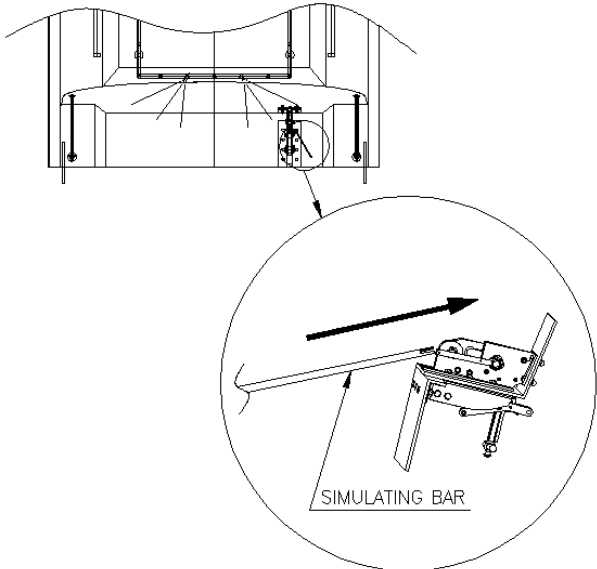
6.3.2.4.1 Lubrication is essential for the function of the davit and winch and regular checking is necessary. Greasing also should be regularly conducted. For appropriate greasing, the detailed structure of the davit and winch and the functions of their parts should be understood.

6.3.2.4.2 All grease nipples of the davit should be greased at least once a month.

6.3.2.4.3 Gear oil inside the boat winch should regularly be checked regarding amount, change of colour and mixture of moisture.

6.3.2.4.4 Wire rope oil/grease should be regularly checked to prevent loss of oil/grease. Wire rope should be oiled or greased every two months in general.

7. Simulation launching system

No.	Operation Guide	Schematic Diagram
1	Disconnect the davit hook from suspension eye and connect it to the ring for the sliding rope. Note. Weight load should not act on the sliding rope.(only for safety) <Activity on the ship>	
2	Unravel the turn buckle until the holding pin comes loose for weight load not to act on it. (Now, weight load acts on the boathook ring only.) .	
3	Check the simulation launching system by operating the sst ass'y after removing the safety pin 1 & 2 . <Activity on the ship> Note. If launching system is working correctly, the boat will show free fall status (short distance). Weight load will act on the turn buckle again.	

APPENDIX A

MARINE DIESEL ENGINE

(TYPE HB29D1, HB36D1)

MARINE DIESEL ENGINE
(HB29D1, HB36D1)

OWNER`S MANUAL

HLB CO., LTD
(DWG NO. E0901-00002)
UPDATE : 2 January, 2013

INDEX

1. General arrangement plan --- 2 page
2. Operation the engine --- 5 page
3. Maintenace --- 10 page
4. Technical data --- 27 page
5. Engine part list--- 31 page
6. Transmission manual --- 61 page

1. GENERAL ARRANGEMENT PLAN

1) NAMES OF PARTS

(1) Intake manifold

(2) Speed control lever

(3) Engine stop lever

(4) Fuel injection pump

(5) Fuel feed pump

(6) Water pump

(7) Oil filter

(8) Exhaust manifold

(9) Alternator

(10) Starter motor

(11) Oil level dipstick

(12) Oil pressure switch

(13) Oil pan

(14) Marine gear

(15) Breed screw

(16) Coupling flange

(17) Engine mounting bracket

(18) Control lever – marine gear

(19) Marine gear control cable bracket

(20) Coolant outlet plug

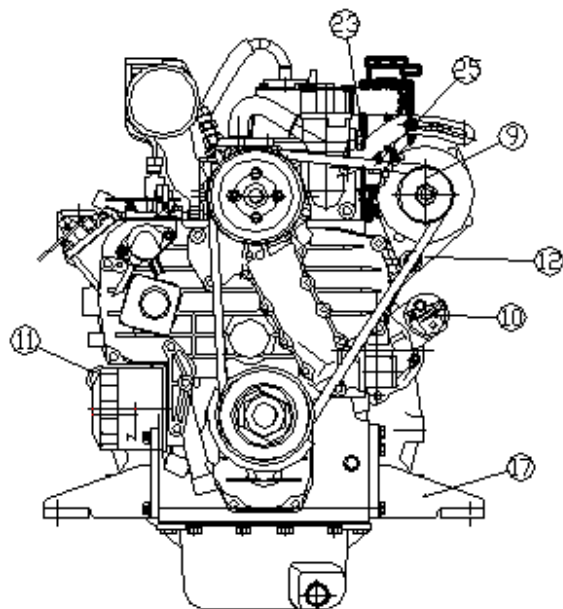
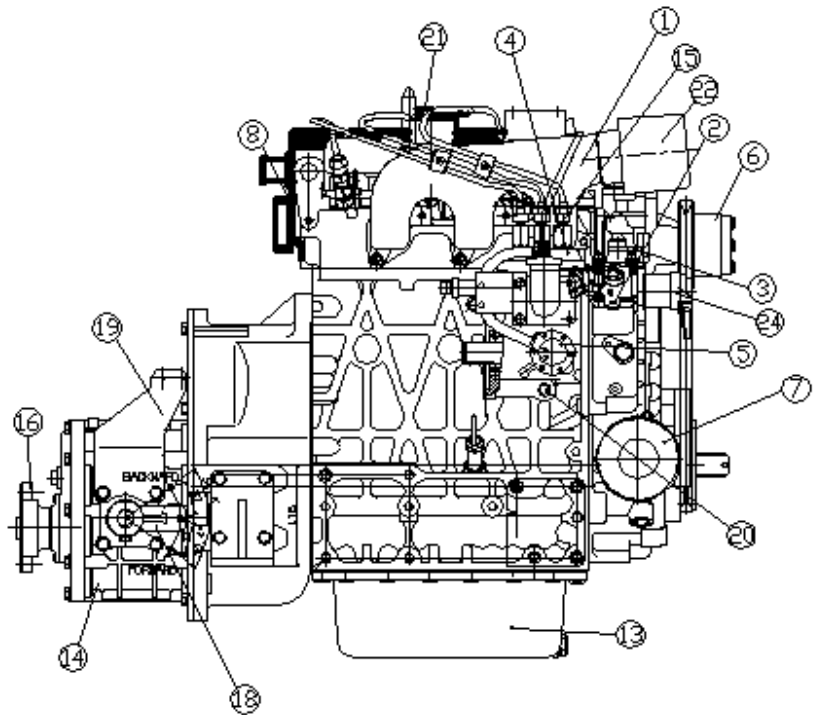
(21) Coolant tank cap

(22) Air cleaner

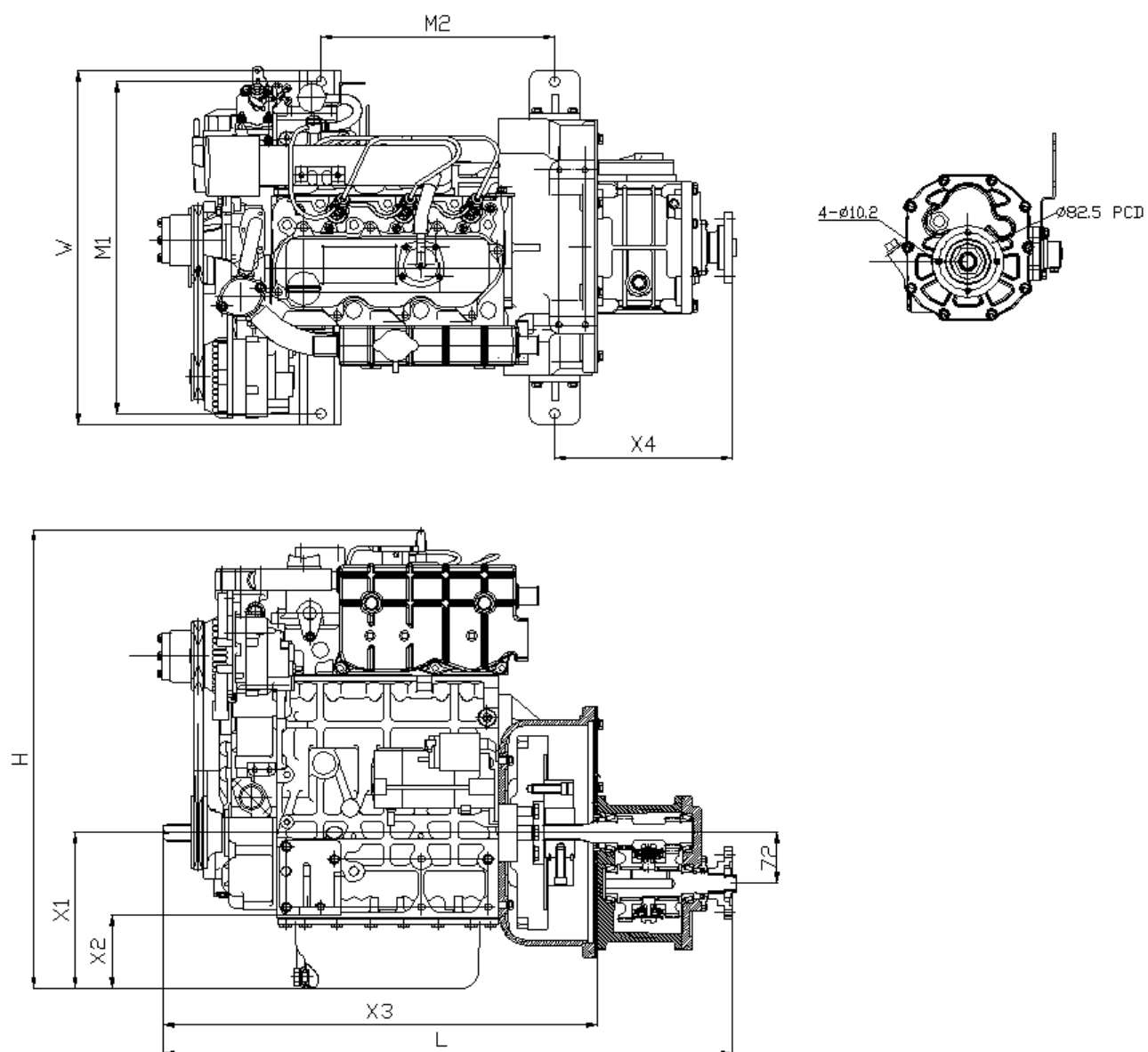
(23) Coolant water temperature switch

(24) Stop solenoid valve

(25) Belt



2) DIMENSIONS



2) DIMENSIONS

ENGINE TYPE	HB29D1, HB36D1
MARINE GEAR TYPE	HBG200
L (mm)	819
W (mm)	500
H (mm)	650
X1 (mm)	220
X2 (mm)	104
X3 (mm)	615
X4 (mm)	251.3
M1 (mm)	470
M2 (mm)	331.9

2. OPERATING THE ENGINE

Operating manual

This Owner's Manual is intended to help you get the maximum return on your investment and to ensure your safety.

We recommend that you thoroughly read and understand this Owner's Manual before handling, storing, installing, operating or servicing the engine. Should your engine require parts or service, please contact **HLB CO., LTD.**

We will need the following information in order to assist you.

1. Engine make, model number and serial number.
2. Names and code numbers of parts to be ordered.
3. Make and model number of the machine in which engine is installed.

Preparation before first start

1. Check that oil level is between the marks on the dipstick, placed at the side of the engine.
2. Check the lubricating oil of reverse and reduction gear
3. We always recommend checking of oil level before start.
4. Fill the fuel tank. **Use only diesel fuel.**

After the engine has been taken into use

Always check the engine and make sure it is ready for safe operation before installing the engine, be sure that the equipment is on firm, level Ground. Do not run the engine on gradients. Never use starting fluid or gasoline in the air intake. Engine damage will result and an explosion may occur.

Before start

1. The oil level of the engine should be checked every 14 days or every 25 hours of running. It is not necessary to refill oil if the level is between the two marks on the dipstick.
2. The oil level of the reduction gear should be checked every 14 days or every 25 hours of running.
3. Check the quantity of fuel in the tank.

STARTING ENGINE (TURN KEY TYPE)

Electric start with remote control and instrument panel

1. Set the No.1 battery switch to the "ON" position.
2. Put the marine gear into "neutral position" by means of gear separation button.
3. Set the fuel cock to the "ON" or "OPEN" position.
4. The engine stop lever must be in the "START" position.
5. Turn the starter switch to the "ON" position.
6. Verify that the oil pressure and charge lights are on.
7. In cold weather (for cold engine starts), turn the starter switch counterclockwise to the "PREHEAT" position for 8 to 10 seconds. (Do not operate glow plugs continuously for more than 180 seconds).

Preheating time	Glow temperature	Current
8 second	900°C(1652°F)	14A(for each plug)

8. Turn the key to the "START" position to engage the starter motor. Release the key immediately as the engine starts.
9. Verify that the oil pressure and charge lights are now off. If either light is on, stop the engine immediately and check the following.
 - A. Correct oil level.
 - B. Verify that the engine contains clean oil of the proper viscosity.
 - C. Check for faulty wiring.
 - D. Verify that the battery is charged sufficiently.
10. Run at a moderate speed until the engine reaches a normal operating temperature before doing work.



Note

Do not turn the starter switch to "START" while the engine is running.

If the engine does not start in 10 seconds, wait 30 seconds and repeat the Starting sequence.

Never run the starter motor continuously for more than 20 seconds.

Always warm up the engine before working. Using a cold engine will shorten its life.

When the temperature would fall down below -15°C(5°F), you have to separate the battery from the engine and keep it in indoor. Use the battery next engine starting.

STARTING ENGINE (BUTTON TYPE-SMART KEY)

1. Put the marine gear into "neutral position" by means of gear separation button.
2. Press 1 time the "START" button on engine operation panel
(Automatically all lamps are light on for 1 second)
3. Automatically fuel solenoid valve is operated and operate pre-heating system for 9 seconds and then starter motor rotate the engine. (Do not operate glow plugs continuously for more than 180 seconds and the starter should not work for more than 20 seconds continuously.)
4. Automatically operate the after-heating system for 8 seconds to reduce exhaust gas.
5. Run at a idle speed until the engine reaches a normal operating temperature before doing work



- If you do not want to engine pre-heating, push the start button three times continuously within 1 second and then engine will be starting without pre-heating.
- Verify that the oil lamp, water lamp and charge lamp lights are off after run the engine. If either light is on, stop the engine immediately.
- To secure long life and maximum power it is recommended to run the engine for the first 25 hours at not more than 80% of the maximum output.
- Do not run the engine over idle speed (about 1000 rpm) and 5 minutes without supplying it with cooling water or seawater. Either the engine seawater pump will be damaged or the engine will be damaged from overheating. Before starting the engine, be sure to supply seawater or cooling water with provided auxiliary device to the seawater pump.

ALARM SYSTEM

INSTRUMENT PANEL	ALARM POINT
GLOW LAMP	GLOW SWITCH ON
OIL LAMP	BELOW 0.5 kg/cm ²
CHARGE LAMP	ALTERNATOR CONDITION CHECK
WATER LAMP	ABOVE 110°C



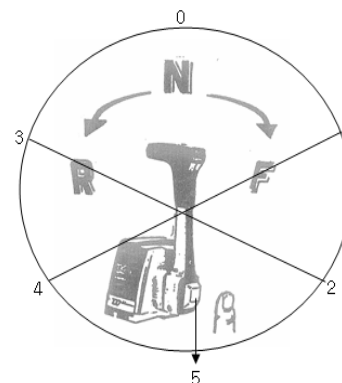
Automatically engine stop when the oil lamp or water lamp light is on.

MANEUVERING

TYPE (A)

- With the control lever in neutral position the engine is idling, and the marine gear is in neutral. When the lever is moved forward in range 1, the marine gear is engaged to "Ahead" first by means of working clutch-forward, and then in range 2 the engine R.P.M is increased.

When the lever is moved from the neutral position to range 3, the marine Gear is engaged to "Astern" first by means of working clutch-backward, And then in range 4 the engine R.P.M is increased.



TYPE (A)



DO NOT STOP CONTROL LEVER IN CLUTCH RANGE(0~1 or 0~3)

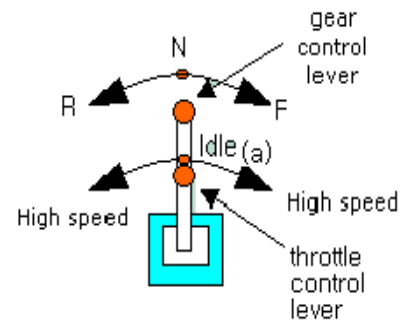
- Only engage "Ahead" or "Astern" when the engine is idling.
- To accelerate engine without engaging gear operate gear release button 5 and move control handle in either direction.

TYPE (B)

1. At first, put the throttle control lever into the idle position(a).

The marine gear engaged to "Ahead" or "Astern" when the gear control lever is put into the "Ahead" or "Astern" position.

When the throttle control lever is moved in direction of "Ahead" or "Astern" the engine R.P.M is increased.



TYPE (B)

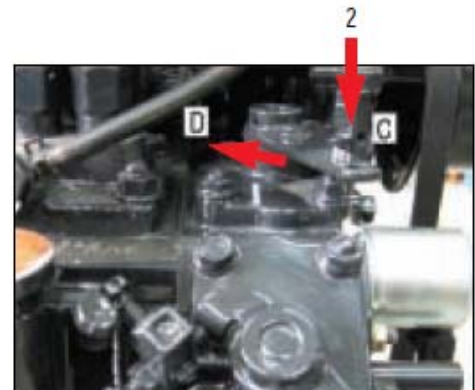


DO NOT STOP GEAR CONTROL LEVER IN CLUTCH RANGE(N~F or N~R)

2. When the throttle lever is idle position(a), only the gear control lever is engaged "Ahead" or "Astern"
3. Put the gear control lever into "Ahead" or "Astern" as soon as possible.

STOPPING THE ENGINE

1. Move the engine control lever into the neutral position.
2. Turn the starter switch to "OFF" and remove the key.
3. Turn the all of battery switch to "OFF"



If engine do not be stopped in spite of doing the preceding 1~3, move the engine stop lever (2) to the "STOP" position(D).

3. MAINTENANCE

BLEEDING THE FUEL SYSTEM

Bleeding air from the fuel system may be required.

1. After the fuel filter has been removed or any fuel lines have been disconnected.
2. If the fuel tank has been allowed to run dry.
3. After long-term storage.

Bleed air from the fuel system. Check for leaks.

1. Loosen an air plug.
2. Check fuel leakage of air plug.
3. Operate manual pump up and down. Bleed air from the fuel system.
4. Start the engine after screw air plug.



Replacing the fuel filter periodically will significantly reduce injection pump and fuel injector wear.

ENGINE OIL & OIL FILTER



Stop the engine when you change engine oil, fuel oil cartridge or check engine oil level.

Checking and adding engine oil

1. Always check oil level before starting.
2. Wait at least 5 minutes after shutdown to get an accurate oil level reading.
3. Wipe the dipstick clean, insert it all the way in and remove to get the correct oil level reading.
4. If the oil level is below the lower mark on the dipstick, add oil through the fill port on top of the engine.

5. For the best results, it is recommended that the oil level be kept at the upper mark.
6. Use SAE 15W-40 oil or equivalent.
7. Always drain the oil completely when changing. Never mix different oils or engine damage may result.

Changing engine oil

1. Change the oil after the first 50 hours of operation.
2. Remove the hose plug from the flywheel cover using oil drain pump and allow all of the oil to drain. Draining the oil will be easier when the engine is slightly warm.
3. Reinstall the plug and fill with the correct amount of oil. Ensure that the oil level on the dipstick is at the upper mark.
4. Change the oil after every 150 hours of operation thereafter.



Replacing the oil filter

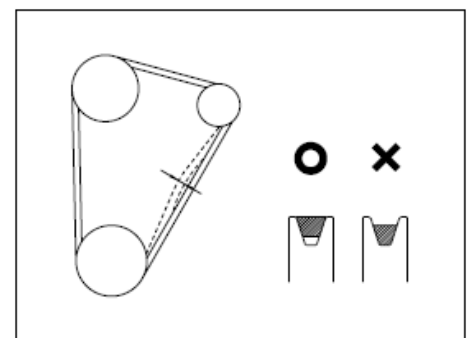
1. Replace oil filter with at least every 2 times oil change.
2. Remove the filter using a filter wrench.
3. Apply a thin layer of clean oil to the gasket on the new filter.
4. Screw the new filter on. Hand tighten only.
5. Ensuring that oil level is correct and run the engine.
6. Check for leaks. Recheck that the filter is hand-tight.
7. Clean up and properly dispose of any spilled oil. Wipe any spilled oil from the engine.



FAN BELT

MEASUREMENT AND ADJUSTMENT

Measure the deflection by depressing the center of the belt between the fan drive pulley and the alternator pulley at 98N (10kgf, 22lbs) of force. If the deflection is out of the specified value, loosen the bolts and nuts and adjust the location of the alternator. If the belt is damaged or worn, replace the belt.



Fan belt deflection : 7~9mm



Low belt tension can result in engine overheating and insufficient battery charging. A belt that is too tight may cause bearing failures and belt life may be shortened.

BELT TENSION ADJUSTMENT

1. Loosen both bolts that attach the alternator.
2. Move the alternator to adjust belt tension.
3. Retighten the bolts after adjustment.

COOLING SYSTEM.

Cooling water pump : impeller type.

Cooling water : fresh water

Cooling system capacity (with keel cooler)

HB29D1 ----- 5.5 ℓ

HB36D1 ----- 5.5 ℓ

TEMP. COOLING WATER----- 75~100°C

An anti-freeze concentration of 40% should be used as an all year round coolant. This concentration will give low temperature protection down to -25°C.

In addition to, a 40% concentration will protect the cooling system from corrosion.



Note

- The coolant mixture should not exceed 50% anti-freeze by volume.

Anti-freeze Vol%	Freezing point (°C)
40	-24
50	-37

- This data is the industry standard for a typical ethylene glycol based antifreeze.



Note

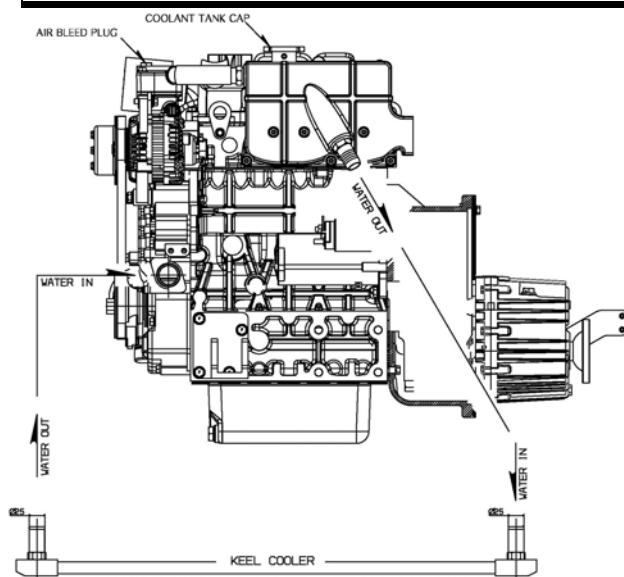
- Do not use dirty water or seawater for coolant.

- Check pressure cap condition tighten securely after service.

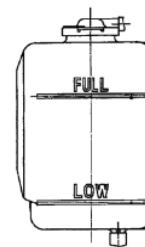
- When coolant is added, start the engine and check again before it gets hot. It may require additional coolant.

- To avoid injury, always stop the engine and allow it to cool before changing the coolant or performing any other cooling system service.

- Do not remove the pressure cap while the engine is hot. Escaping steam or coolant will cause serious injury to you or any bystanders.



Coolant reserve tank



The coolant level should be between "FULL" and "LOW".

ELECTRIC SYSTEM

ELECTRIC SYSTEM

The engine is equipped with a 12 volt electrical system consisting of a starter motor and an alternator, the max charging current of which is 50 Amp.

BATTERY

The level of the electrolyte in the battery should be checked every 14 days or every 25 operating hours.

The battery must never be isolated from the alternator, when the engine is running.

LONG-TERM STORAGE (BATTERY)

1. Before long-term engine storage remove the battery. fully charge the battery, store the battery in a dry, dark place.

Do not store on the ground or a concrete surface.

2. Batteries will discharge even when not in use.

During long periods of inactivity, recharge regularly to maintain readiness and battery life.

WARNING!

It is not allowed to connect additional equipment to the wiring system of the engine.

Possible additional equipment has to be connected directly to the terminals of the battery.

COLD START

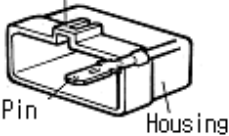
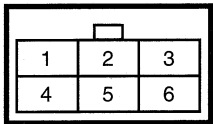
If you want to cold start the lifeboat engine at minus 30°C, please check the list as below.

CONTENT	SPECIFICATION
Model	HB29D1 or HB36D1
Fuel type	Diesel 50% + Kerosene 50%
Battery capacity	80 AH
Heater-cooling water	230W-AC42V
Lubrication oil	SAE 5W-30
Cable-battery	50 mm ²
Antifreezing solution ratio	Antifreezing solution 50% and Water 50%

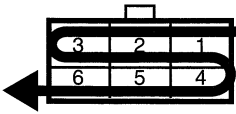
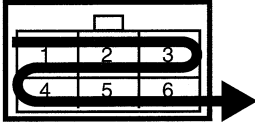
CONNECTOR CONFIGURATION.

Connector View and Numbering Order

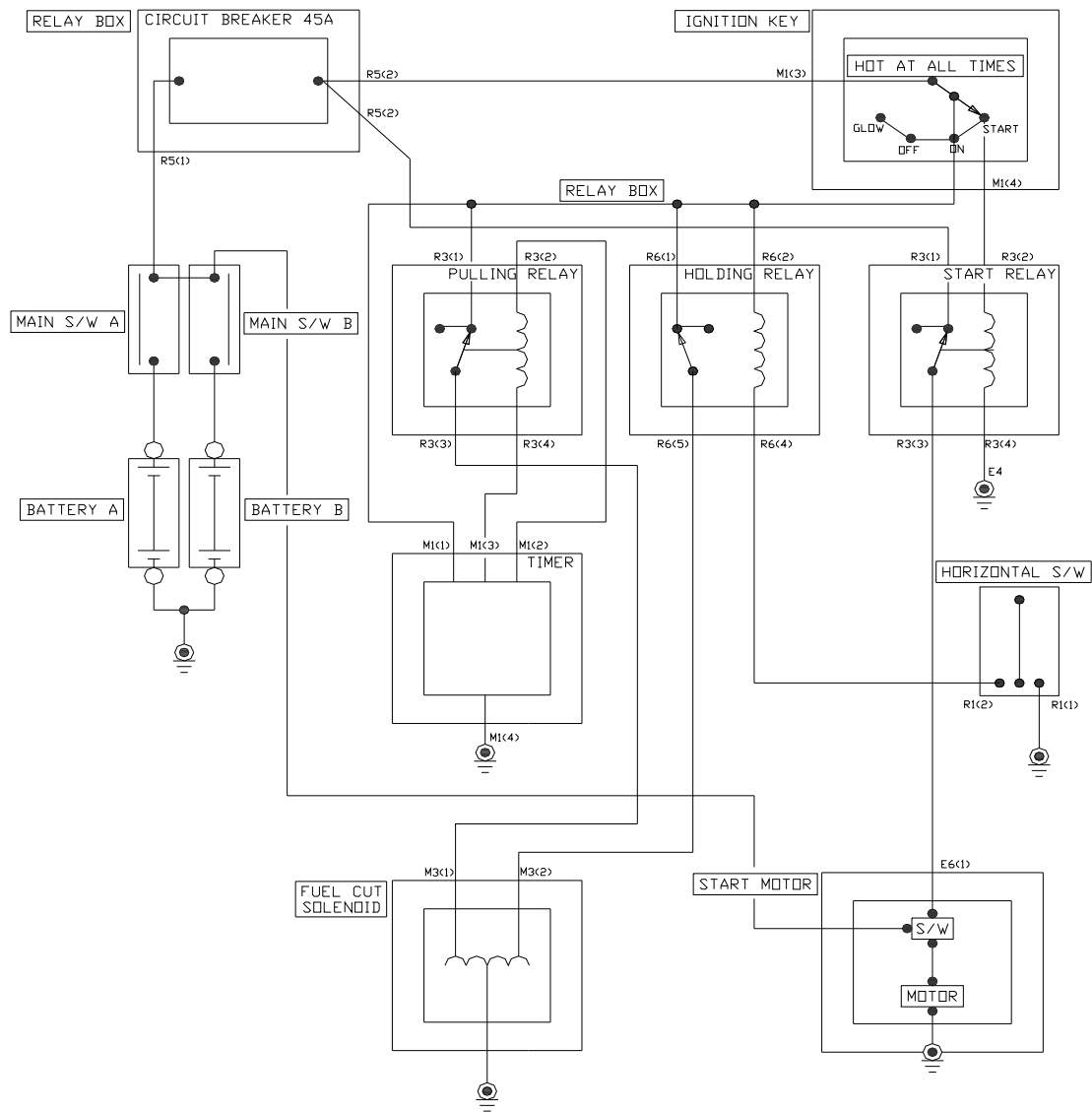
Connector view

Actual Illustration	Illustration in the Shop Manual	Remarks
Male Locking Point  Pin Housing	Male 	It is not the shape of the connector housing, but the connector pin that distinguishes between male and female connector. For individual detailed numbering refer to the Connector Configuration.

Numbering Order

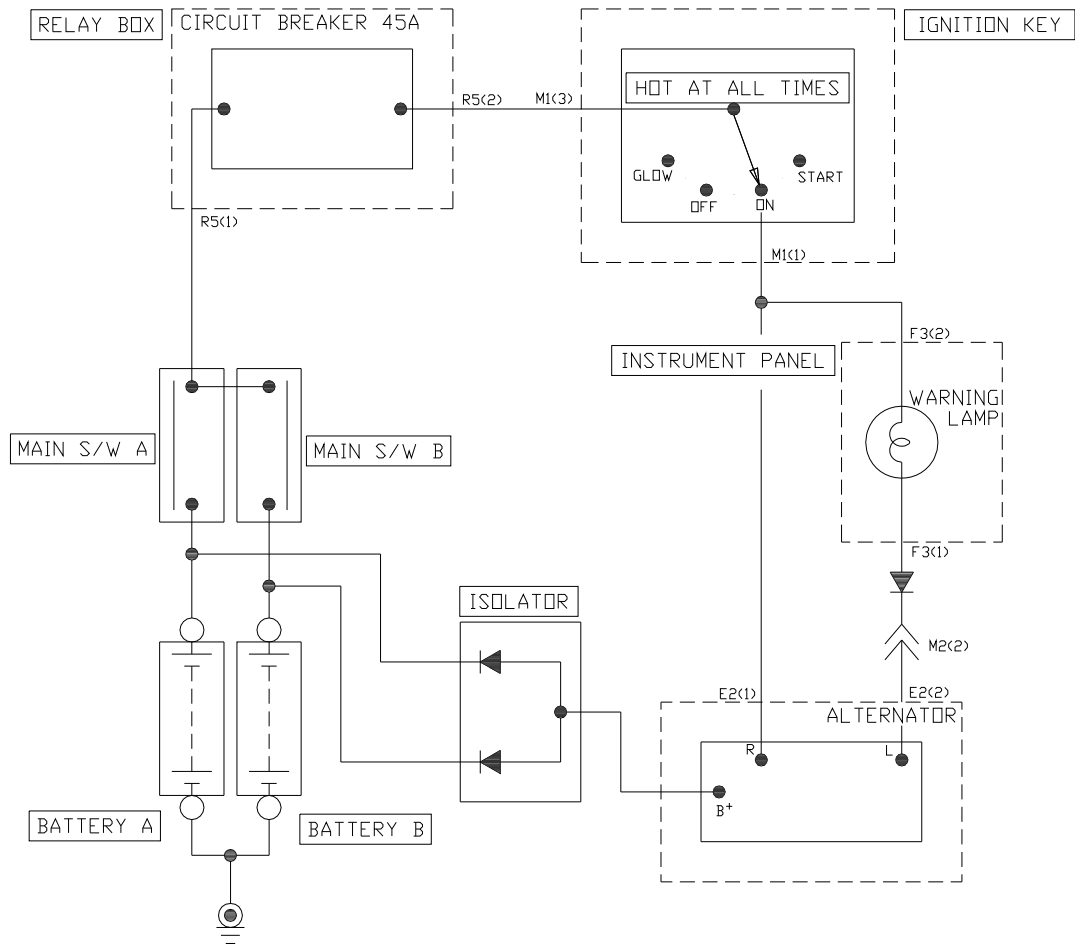
Female Connector	Male Connector	Remarks
		Female Connector's pins are numbering in order from upper right to lower left. Male Connector's pins are numbered in order from upper left to lower right.

STARTING SYSTEM (TURN KEY TYPE)



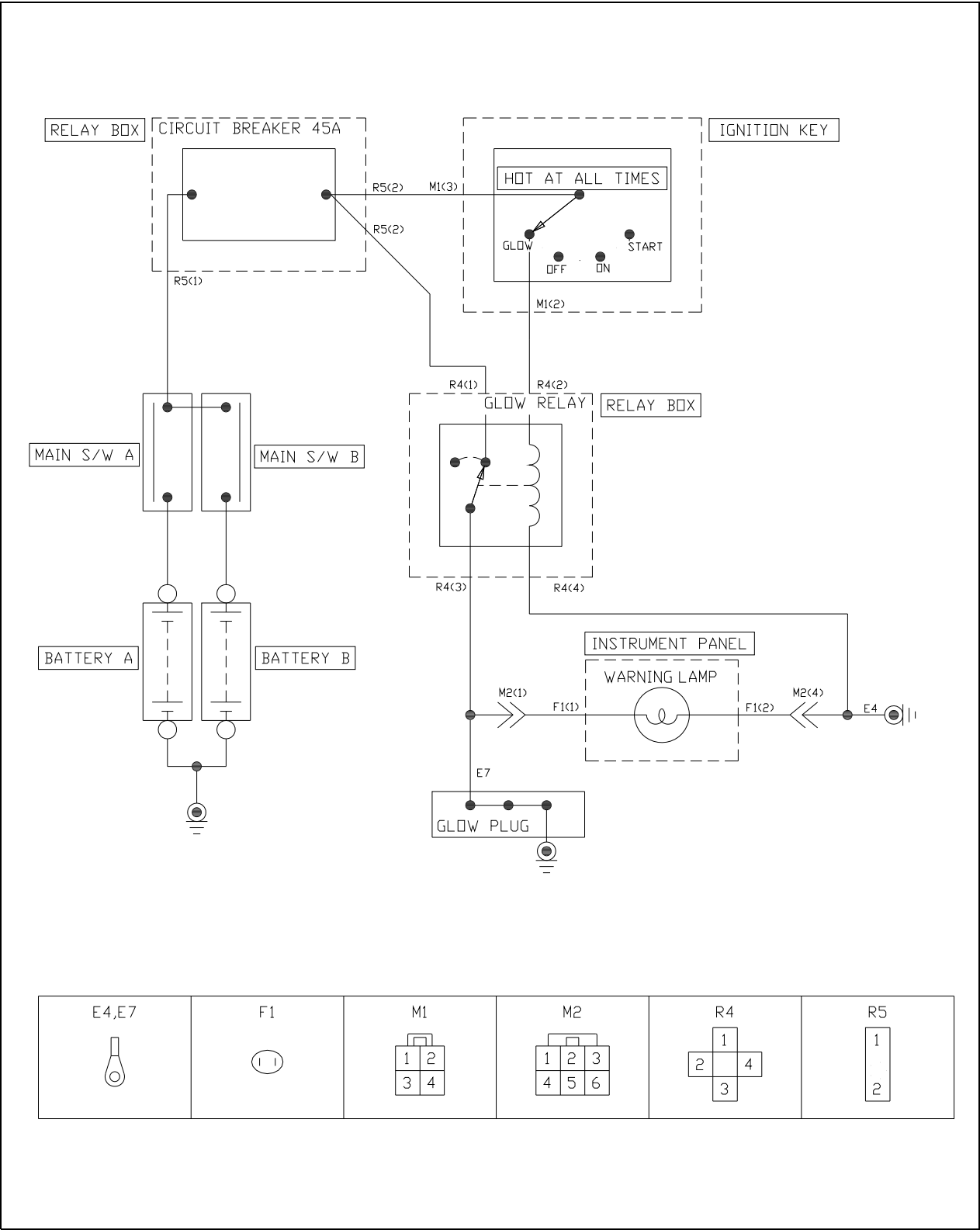
E4	E6	M1,R3	R5	R6	R4	M3

ALTERNATOR SYSTEM (TURN KEY TYPE)

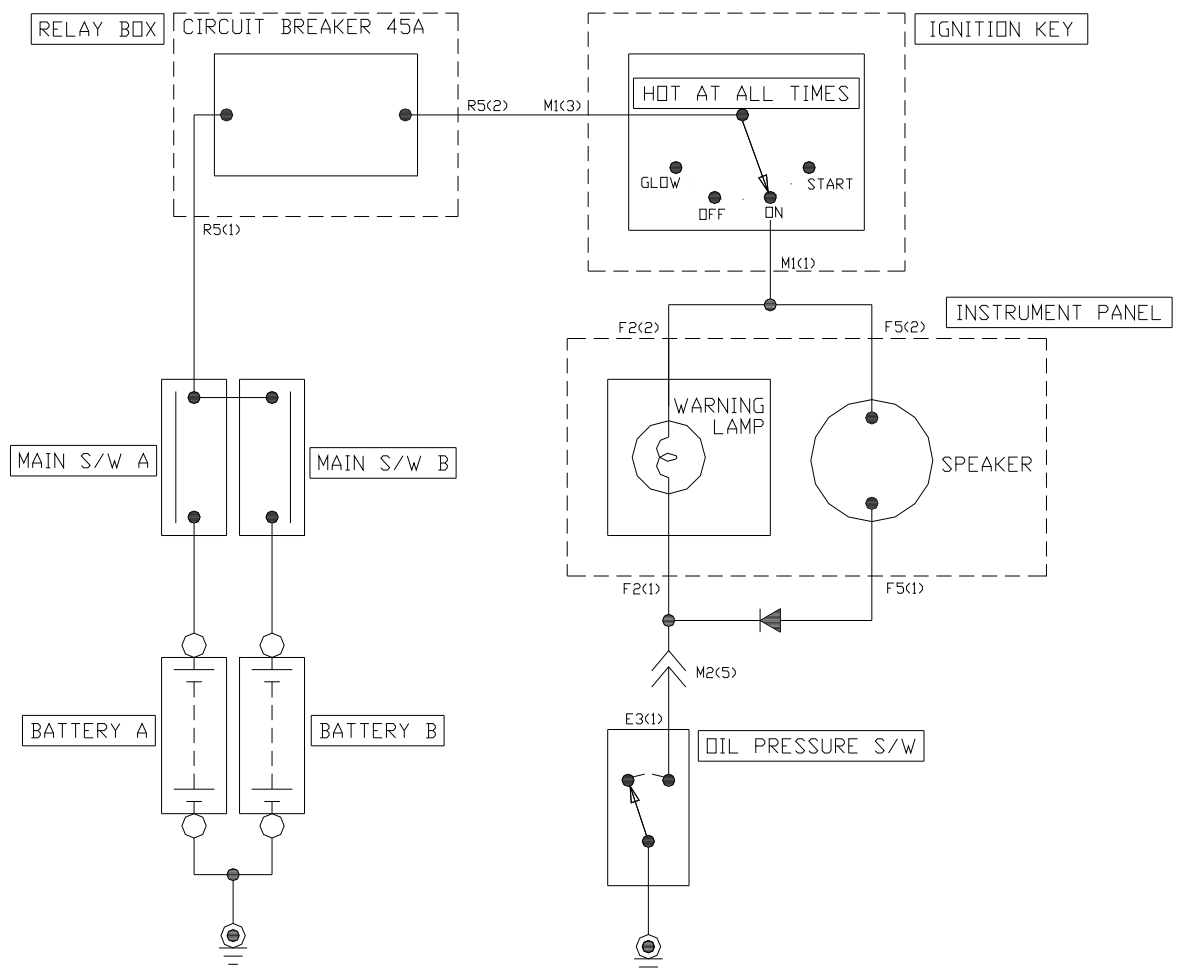


E2	F3	M1	M2	R5
1 2	1 1	12 34	123 456	1 2

GLOW SYSTEM (TURN KEY TYPE)



OIL WARNING SYSTEM (TURN KEY TYPE)



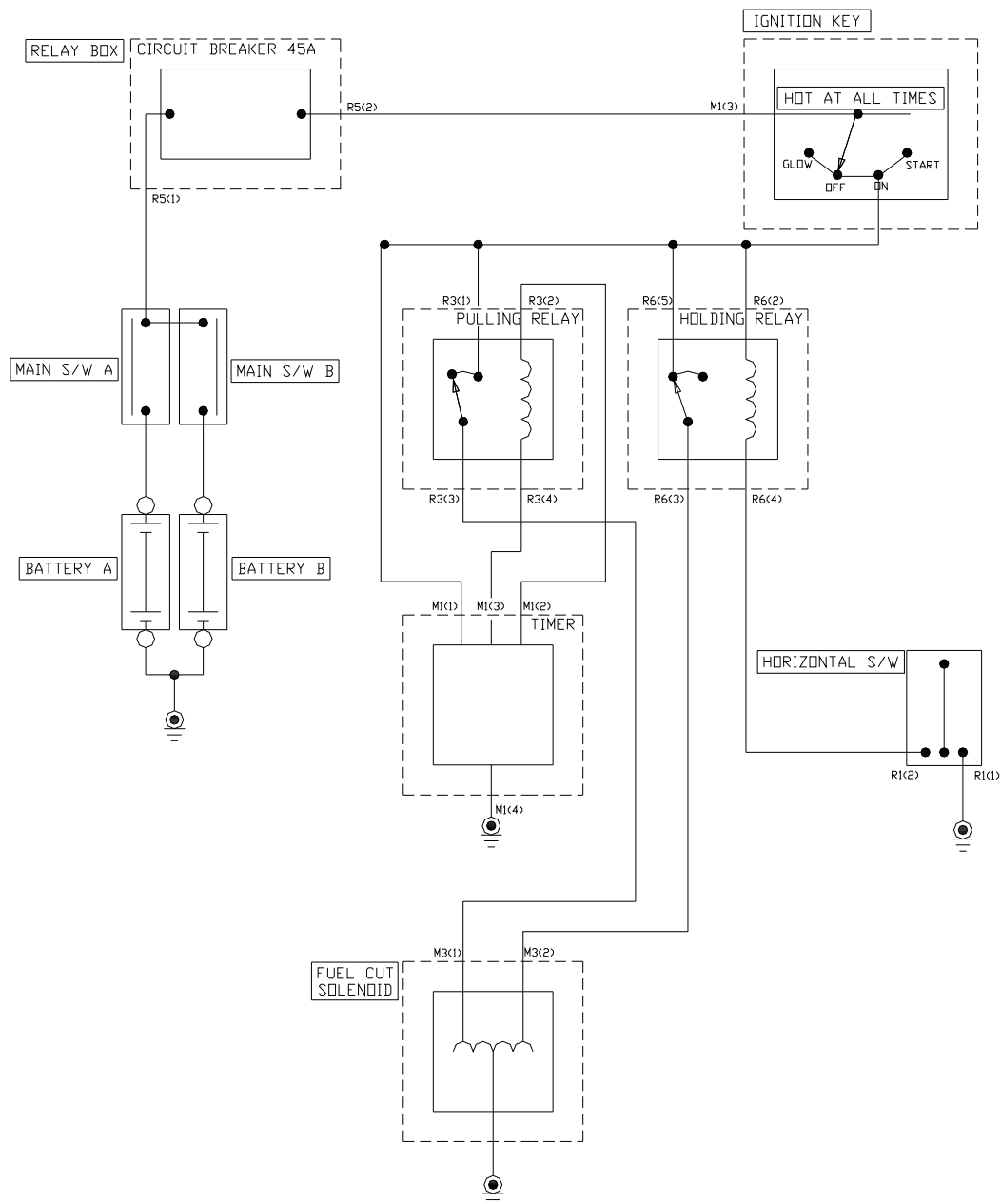
E3	F2,F5	M1	M2	R5

The diagram illustrates the electrical system of a vehicle, showing the flow of power from two batteries (A and B) through various components including a main switch, circuit breaker, relay box, ignition key, instrument panel, and water temperature switch. The system is grounded to a common ground symbol.

Legend:

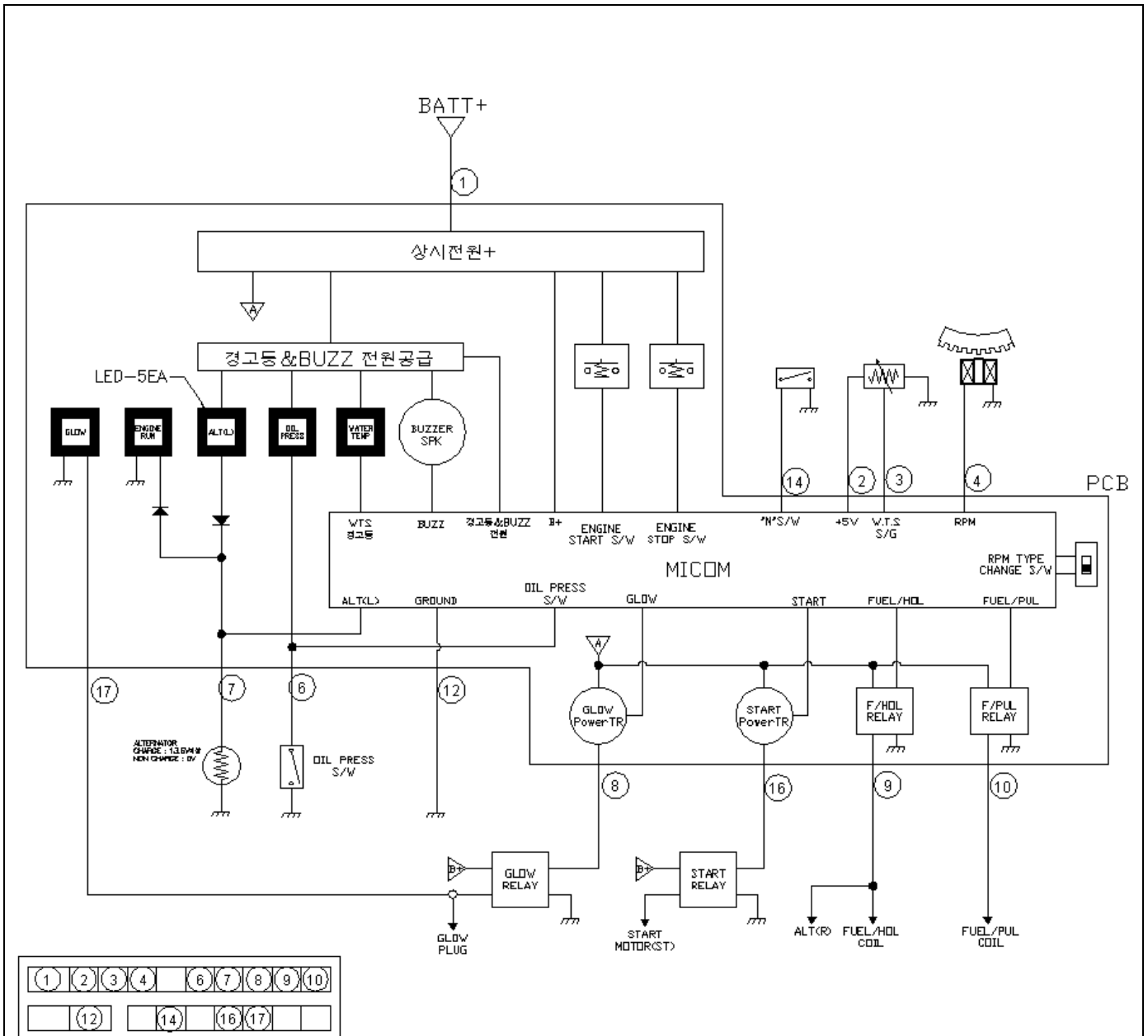
E1	F4, F5	M1	M2	R5

ENGINE STOP SYSTEM (TURN KEY TYPE)



E4 	E5 	F6 	M1,R2 	M2 	R1 	R5 
---	---	---	--	--	---	---

ENGINE CIRCUIT DIAGRAM (BUTTON TYPE – SMART KEY)



※ NOTE

When check of engine circuit diagram, use the multimeter – Do not use the checkclamp

REPLACEABLE PARTS LIST

REF.NO	PART.NO	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
6	E5640-72531	BELT	1	1	
7	08900-M1040	FILTER – FUEL	1	1	
8	E6201-32443	FILTER – OIL	1	1	
9	T2368-69951	RELAY – GLOW	1	1	
10	95101-M1040	RELAY – STARTER / FUEL CUT	1	1	Only turn key type

PERIODIC CHECKS

	WEEKLY	MONTHLY	YEARLY	5-YEARLY	REMARKS
CHECKS:					Renew every 2 years
Engine oil level	0				
Marine gear oil level	0				
Cooling liquid level	0				
Anti-freeze content			0		
Controlcables engine/gearbox			0		
battery	0				
stern tube lubrication		0			
Electric starter drive			0		Protect for rust
CHANGE:					
Lubrication oil			0		
Gear oil			0		
Lubricating oil filter (E6201-32443)			0	0	
Fuel filter(08900-M1040)				0	
CLEAN:					
Air filter			0		
ADJUST: (If necessary)					
V-belt		0			

※ Required replacement at 5-Yearly inspection : Oil filter, Fuel filter

TROUBLESHOOTING

PROBLEM: ENGINE WILL NOT START OR IS DIFFICULT TO START

Possible Cause	Corrective Action
Engine doesn't crank Or crank slowly.	• Change oil level by whether (temperature). • Check battery and cables
Insufficient fuel flow	• Ensure that there is fuel in the tank. • Clean the fuel system and replace fuel if water, dirt or other impurities are present. • Check the fuel filter. Clean or replace as required. • Check and bleed air from fuel filter, injection pump and fuel lines. • Check and clean injection nozzles, being careful not to damage the orifice. • Replace injection nozzle(s) if not working properly after cleaning.
Improper valve clearance	• Check and adjust valve clearance when the engine is cold. HB29D1, HB36D1 : intake 0.25mm, exhaust 0.30mm
Low compression	• Check valves for leakage – grind valves to correct. • Check for bad valves, piston wear, ring damage or wear, or liner wear. Have parts replaced.
Incorrect fuel injection timing	• Proper injection timing (crank angle before top dead center) : 18°

PROBLEM: ENGINE SUDDENLY STOPS RUNNING

Possible Cause	Corrective Action
Lack of fuel	• Check fuel level and refill. • Check the fuel system. Repair leaks and bleed air from the system.
Clogged or faulty fuel injector(s)	• Clean or replace as needed.
Seizure due to lack of lubrication	• Check for and repair leaks. Fill to correct oil level. • Check for clogged oil filter and replace. • Check oil pump and lubrication system. • Check to see if engine bearing clearance is within specifications. • Follow oil and filter service instructions to prevent future occurrences.

PROBLEM: LOW ENGINE POWER OUTPUT

Possible Cause	Corrective Action
Clogged or faulty fuel injector	• Check and clean injection nozzles, being careful not to damage the orifice. • Replace injection nozzle(s) if not working properly after cleaning.
Low compression	• Check valves for leakage – grind valves to correct. • Check for bad valves, piston wear, ring damage or wear, or liner wear. Have parts replaced.
Insufficient fuel flow	• Check and service fuel system
Seizure of Moving parts	• Check for and repair leaks. Fill to correct oil level. • Check for clogged oil filter and replace. • Check oil pump and lubrication system. • Check to see if engine bearing clearance is within specifications. • Follow oil and filter service instructions to prevent future occurrences.
Incorrect fuel injection timing	• Proper injection timing (crank angle before top dead center) : 18°
Improper valve clearance	• Check and adjust valve clearance when the engine is cold. HB29D1, HB36D1 : intake 0.25mm, exhaust 0.30mm
Fuel injection Pump wear	• Check the injection pump and valve assembly. Replace as required. • Poor quality fuel or improper fuels will accelerate injection pump wear. • Adjust to proper injection pressure HB29D1, HB36D1 : 150~160 kgf/cm²

PROBLEM: EXHAUST SMOKE OR DARK EMISSIONS

Possible Cause	Corrective Action
Fuel governor malfunction	• Contact HLB CO., LTD. for repairs.
Poor quality fuel	• Drain and replace with proper fuel. DIESEL ONLY
Faulty fuel injector	• Clean or replace as required.
Incomplete fuel combustion	• Check injection timing, injection pump, valve adjustment and typical causes of low compression. Make adjustment or repairs as needed.

THE ENGINE MUST BE STOPPED IMMEDIATELY IF:

Possible Cause	Corrective Action
Engine speed suddenly changes	• Check the fuel system and injection timing.
Unusual sound occurs	• Check all moving parts
Exhaust smoke or dark emissions appear	• Check for loose or damaged parts
Bearing overheated	• Check for lubricating system leaks
Oil pressure warning light comes on	• Check for lubricating system leaks • Check for proper oil level • Check the oil pressure relief valve • Check the oil pressure switch

PROBLEM: ENGINE OVERHEATS

Possible Cause	Corrective Action
Low coolant level	• Check for and repair leaks. Add coolant.
Loose or broken fan belt	• Adjust or replace belt as required.
Anti-freeze concentration too high	• Add water or replace coolant to achieve proper mix.
Cooling system dirty	• Flush and clean system.
Defective coolant tank cap	• Replace defective cap.
Faulty thermostat	• Check and replace thermostat
Defective temperature gauge or sending unit	• Calibrate using thermometer and replace, if necessary.
Engine overload	• Reduce load. If overheating persists, check other causes.
Low oil level	• Check for oil system leaks. Check and adjust oil level.
Leaking head gasket	• Replace head gasket.
Fuel injection timing	• Check and adjust timing.
Unsuitable fuel	• Replace fuel with the clean fuel of the proper type and grade.

4. TECHNICAL DATA

ENGINE SYSTEM

		HB29D1	HB36D1
TYPE		Vertical, water-cooled 4cycle diesel engine	
Working principle		4 stroke	
Number of Cylinder	Cylinder	3	
Cylinder volume	cc	1393	1647
Bore and Stroke	ϕ X mm	80 X 92.4	87 X 92.4
Combustion Chamber		Spherical type	
Compression ratio		22:1	
output	2800rpm	29	36
Idling speed		950	
Fuel Injection Pump Type		Bosch K type pump	
Rate of fuel Combustion	g/psh	Under 200	
Starting system	ℓ	Electric starting with starting motor	
Rotation direction	From the side of F/W	C.C.W (Counter clockwise)	
weight	kgf	193	199
Max air consumption	Litres/min	1950	2306

VALVE TIMING AND INJECTION POINT

		HB29D1 / HB36D1
Inlet valve opens	Before TDC	8°
Inlet valve closes	After BDC	35°
Exhaust valve opens	Before BDC	45°
Exhaust valve closes	After TDC	8°
Valve clearances (cold engine)	INLET	0.25mm
	EXHAUST	0.30mm

FUEL SYSTEM

		HB29D1 / HB36D1
Injection pressure	Kgf/cm ²	150~160
Injection timing	BTDC	18°

LUBRICATING SYSTEM

		HB29D1 / HB36D1
Type of lubrication oil		Gear pump
Lubrication oil pressure : warm engine, minimum	Kg/cm ²	0.5
Lubrication oil viscosity		SAE 15W-40
Lubrication oil content	ℓ	5.8

MARINE GEAR (HBG200)

Lubrication oil viscosity	GRADE	ATF
Lubrication oil temperature	°C	140
Lubrication oil content	liter	0.6

COOLING WATER SYSTEM

		HB29D1 / HB36D1
Cooling water temperature	°C	70~95
Cooling water capacity	ℓ	6.3

ELECTRICAL SYSTEM

		HB29D1 / HB36D1
Battery voltage	VOLT	12
Battery output	AH	60
Starting output	KW	1.7
Alternator	A	50
Water Temp Sensor	°C	110
Oil press SW	Kg/cm ²	0.5
Glow plug	W	163 X 3
Buzzer	DB	80
Warning lamp	W	3

TORQUES

		HB29D1 / HB36D1
Cylinder head bolts	Kgf.m	10.5 ~ 11
Connecting rod bolts	Kgf.m	4.5 ~ 5.0
Flywheel / counterweights	Kgf.m	10 ~ 11
Gearbox	Kgf.m	3 ~ 3.5
Flexible coupling between	Kgf.m	9 ~ 9.5
Head cover	Kgf.m	0.9 ~ 1.2
Glow plug	Kgf.m	2.0 ~ 2.5
Crankshaft nut	Kgf.m	14 ~ 16
Nozzle holder	Kgf.m	5.0 ~ 7.0
Injection pipe nut	Kgf.m	2.5 ~ 3.5
Oil pressure SW	Kgf.m	1.5 ~ 2.0

LUBRICATION OIL CHART FOR HB29D1, HB36D1

OIL COMPANY	OIL TYPE	ENGINE OIL
BP OIL www.bp.com	Vanellus C6 Multi grade	☉
CHEVRON TEXACO / FAMM www.fammlc.com	Ursa Marine 15W-40	☉
CALTEX www.caltexoils.com	Delo 400 Multigrade	☉
TOTAL / FINA / ELF www.lubmarine.com www.elf.com	DIAOLA W (15W 40)	☉
SHELL www.shell.com www.shell-lubricants.com	RIMULA (SAE 15W-40)	☉
EXXON / MOBIL www.exxonmobil.com www.mobil.com	Mobilgard HSD	☉
	Mobil Delvac MX (SAE 15W-40 API CI-4)	☉
SK ENERGY http://www.skenergy.com/	SD 5000 GOLD (SAE 15W-40 API CI-4)	☉

RECOMMENDATIONS

OIL TYPE	SAE Grade	Lubricants
ENGINE OIL	15W-40	Diesel engine
TRANSMISSION OIL (HBG200)	ATF	Cone clutch type transmission

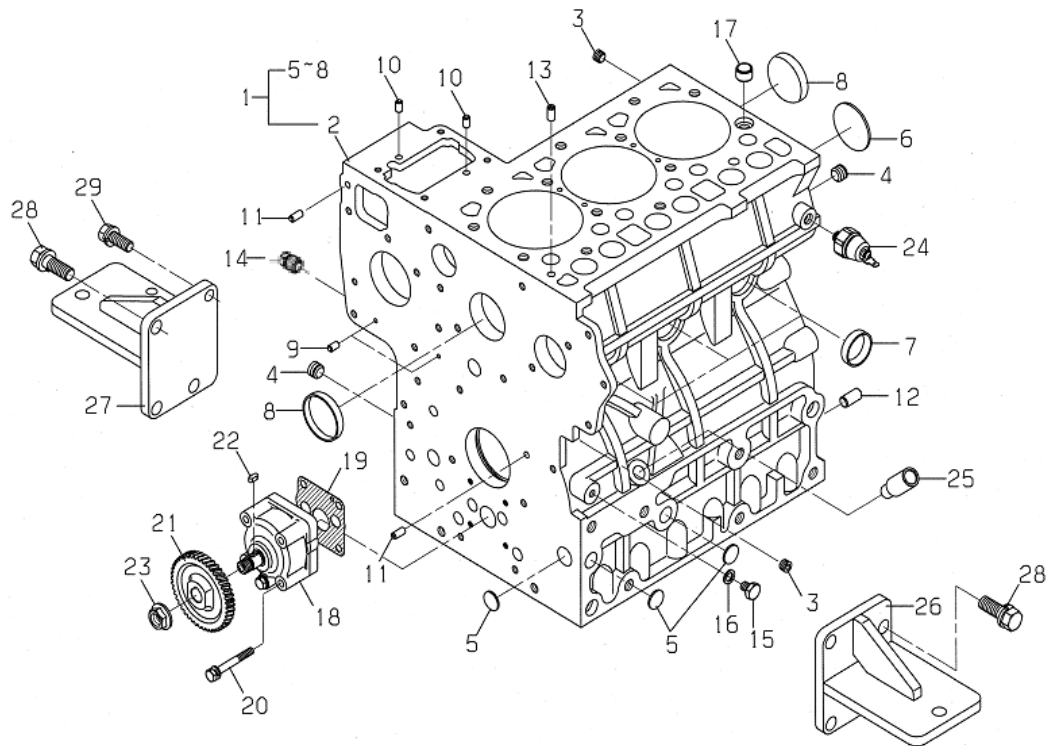
ENGINE PART LIST

(TYPE HB29D1, HB36D1)

TABLE OF CONTENTS

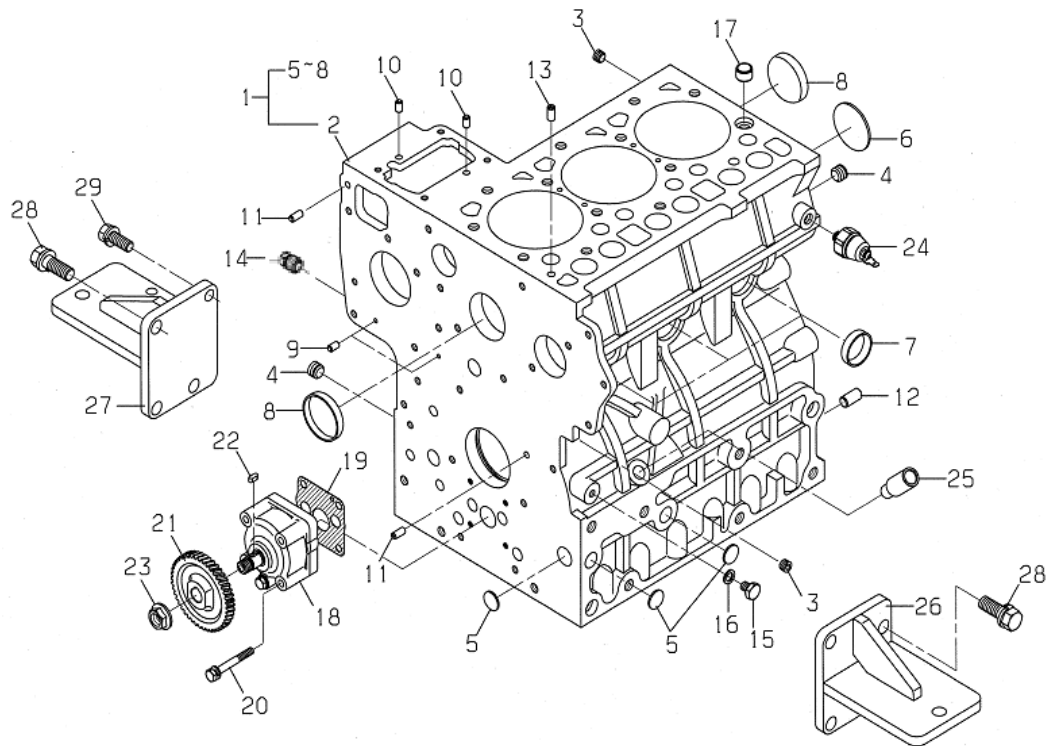
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E 0 4 0	G E A R C A S E 	3 7
E 0 5 0	C R A N K S H A F T B E A R I N G C A S E 	3 9
E 0 6 0	V A L V E , R O C K E R A R M 	4 0
E 0 7 0	C Y L I N D E R H E A D C O V E R 	4 1
E 0 8 0	C A M S H A F T 	4 2
E 0 9 0	P I S T O N , C R A N K S H A F T 	4 3
E 1 0 0	F L Y W H E E L 	4 5
E 1 1 0	N O Z Z E L H O L D E R 	4 7
E 1 2 0	F U E L C A M S H A F T 	4 8
E 1 3 0	S P E E D C O N T R O L P L A T E 	5 0
E 1 4 0	E N G I N E S T O P L E V E R 	5 1
E 1 5 0	G O V E R N O R 	5 3
E 1 6 0	W A T E R P U M P 	5 4
E 1 7 0	W A T E R P I P E 	5 5
E 1 8 0	A L T E R N A T O R 	5 6
E 1 9 0	M A N I F O L D 	5 7
E 2 0 0	C O O L A N T R E S E R V E T A N K 	5 8
E 2 1 0	I N S T R U M E N T P A N E L 	5 9
E 2 2 0	R E L A Y B O X 	5 9
E 2 3 0	W I R I N G 	6 0
E 2 4 0	S W I T C H , I S O L A T O R 	6 0

E010 CYLINDER BLOCK



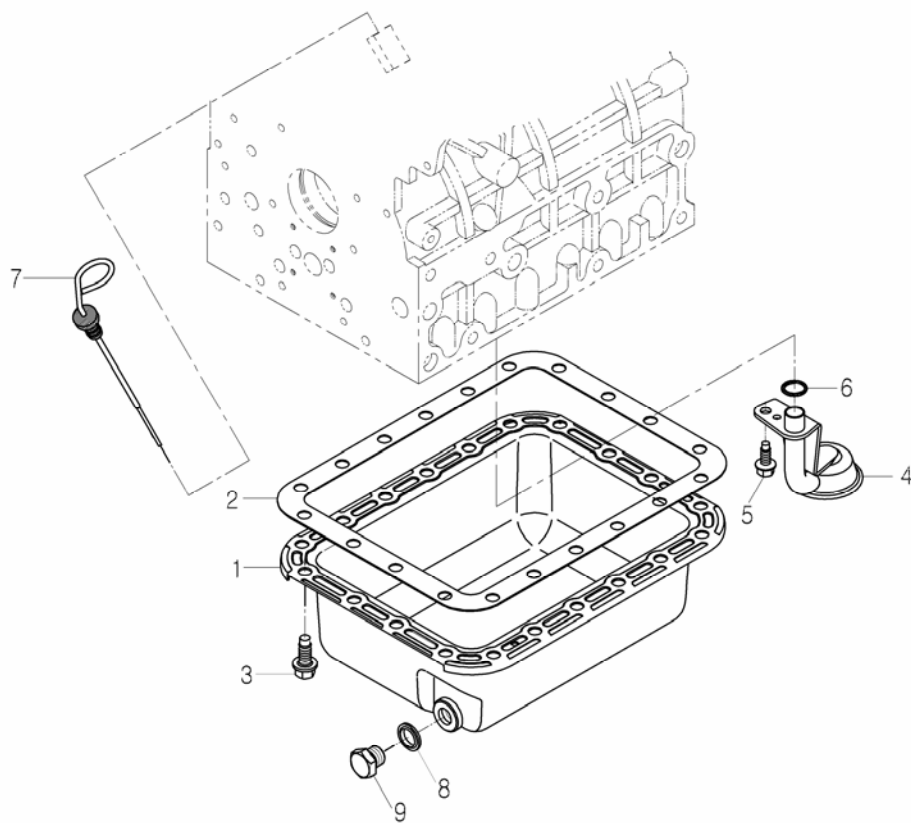
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5803-A1013	CYLINDER BLOCK ASS'Y	1		
01	E5640-A0013	CYLINDER BLOCK ASS'Y		1	
02	E5803-01113	CYLINDER BLOCK	1		
02	E5640-01113	CYLINDER BLOCK		1	
03	E5900-96031	PLUG	5	5	
04	E5900-96021	PLUG	2	2	
05	06311-75018	PLUG	3	3	
06	06311-75045	PLUG	1	1	
07	15221-0338-3	CAP, SEALING	5	5	
08	15221-0339-2	CAP, SEALING	2	2	
09	05012-00408	PIN, STRAIGHT	2	2	
10	05012-00609	PIN, STRAIGHT	2	2	
11	05012-00612	PIN, STRAIGHT	2	2	
12	05012-01018	PIN, STRAIGHT	1	1	
13	15221-3365-1	PIN, PIPE	1	1	
14	06312-10020	PLUG	1	1	
15	15221-3361-1	PLUG	1	1	

E010 CYLINDER BLOCK



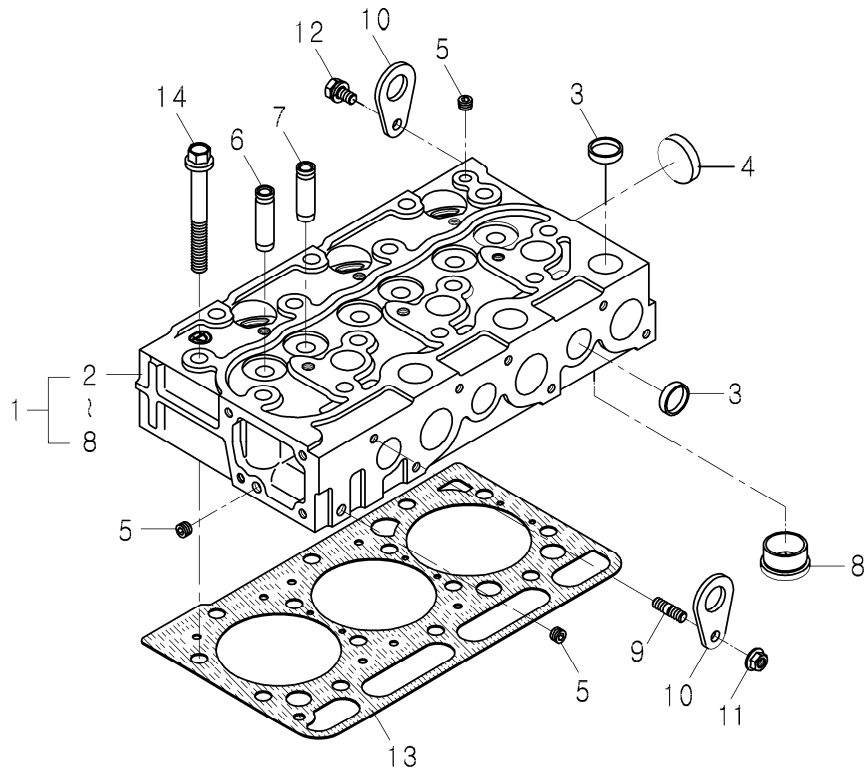
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
16	15021-3366-1	GASKET	1	1	
17	E6301-33812	PIN, PIPE	1	1	
18	E6200-35013	OIL PUMP ASS'Y	1	1	
19	E5500-35154	GASKET, OIL PUMP	1	1	
20	01023-50650	BOLT WITH WASHER	4	4	
21	19202-3566-1	GEAR, OIL PUMP DRIVING	1	1	
22	05712-00410	KEY	1	1	
23	E6300-35681	NUT, FLANGE	1	1	
24	E5500-39013	SWITCH, OIL	1	1	
25	E6300-35692	GUIDE, OIL GAUGE	1	1	
26	21604-M1010	BRACKET-LH	1	1	
27	21604-M1020	BRACKET-RH	1	1	
28	01133-51230	BOLT	7	7	
29	01133-51030	BOLT	1	1	

E020 OIL PAN



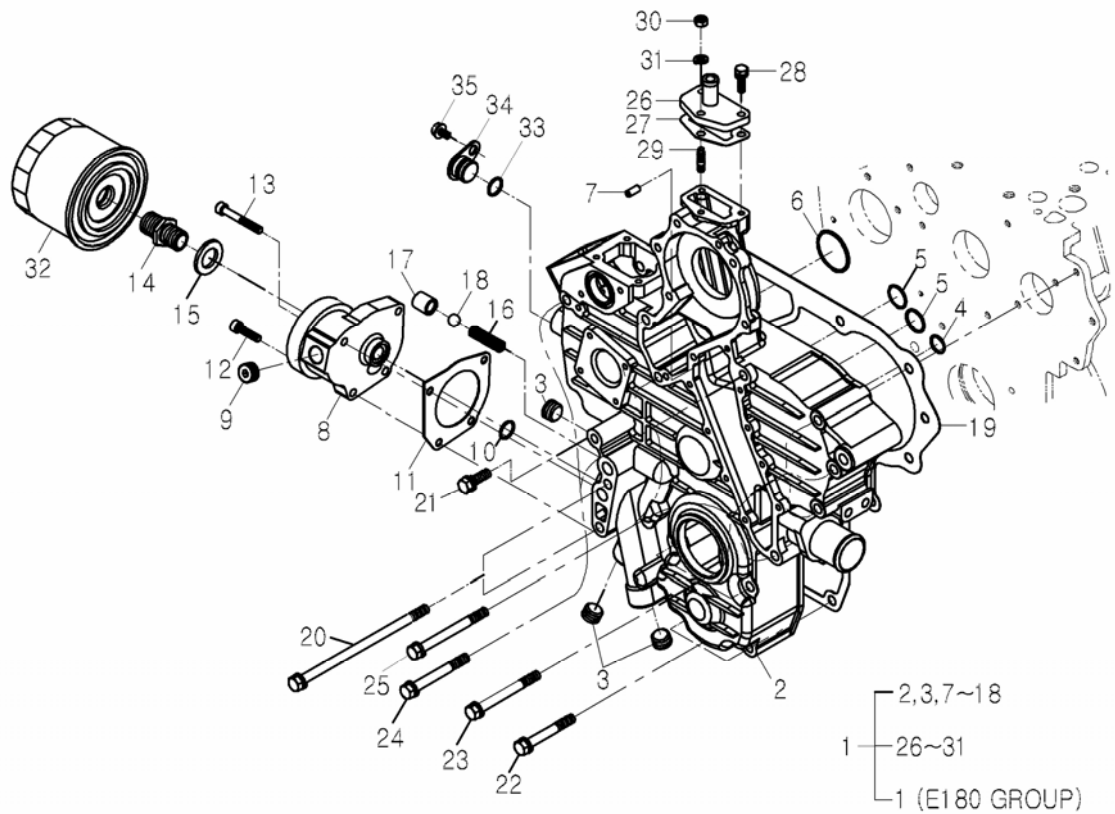
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5608-01613	OIL PAN	1	1	
02	E500-01623	GASKET, OIL PAN	1	1	
03	E6314-02033	FLANGE BOLT WITH PIN	20	20	
04	E6313-32111	FILTER 1, OIL	1	1	
05	01654-50820	FLANGE BOLT WITH PIN	1	1	
06	04811-00160	O RING	1	1	
07	E6313-36414	OIL GAUGE	1	1	
08	06331-35016	PLUG	1	1	
09	04717-01600	WASHER, SEAL	1	1	

E030 CYLINDER HEAD



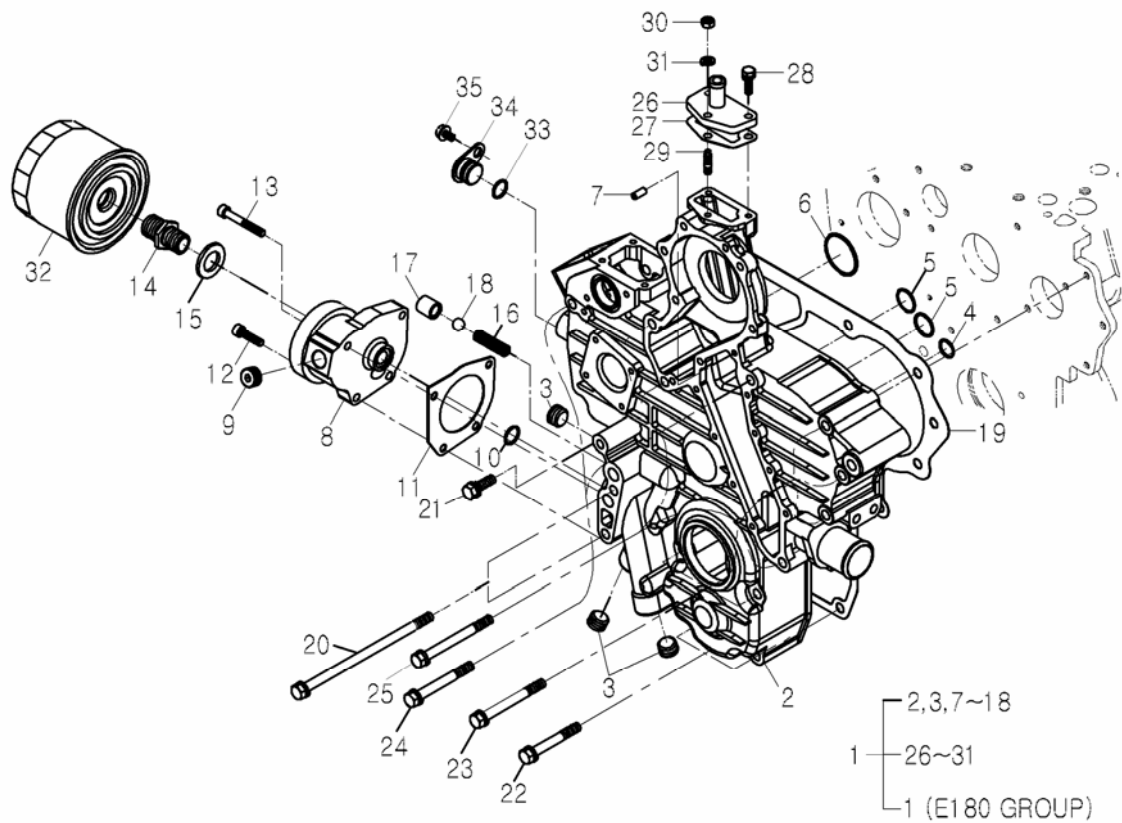
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5803-A0301	CYLINDER HEAD ASS'Y	1		
01	E5603-A0301	CYLINDER HEAD ASS'Y		1	
02	E5803-03112	CYLINDER HEAD	1		
02	E5603-03112	CYLINDER HEAD		1	
03	15221-0337-3	SEALING CAP	9	9	
04	15221-0349-3	SEALING CAP	1	1	
05	5900-96021	PLUG	3	3	
06	E6850-13581	GUIDE, INLET VALVE	3	3	
07	E6850-13561	GUIDE, EXHAUST VALVE	3	3	
08	E6301-03148	PLUG, HOT	3	3	
09	01513-50822	STUD	1	1	
10	15221-0175-1	ENGINE HOOK	2	2	
11	02763-50080	NUT, FLANGE	1	1	
12	01123-50816	BOLT WITH WASHER	1	1	
13	E5800-03315	GASKET, HEAD	1	1	
14	E6850-03451	BOLT HEAD	14	14	

E040 GEAR CASE



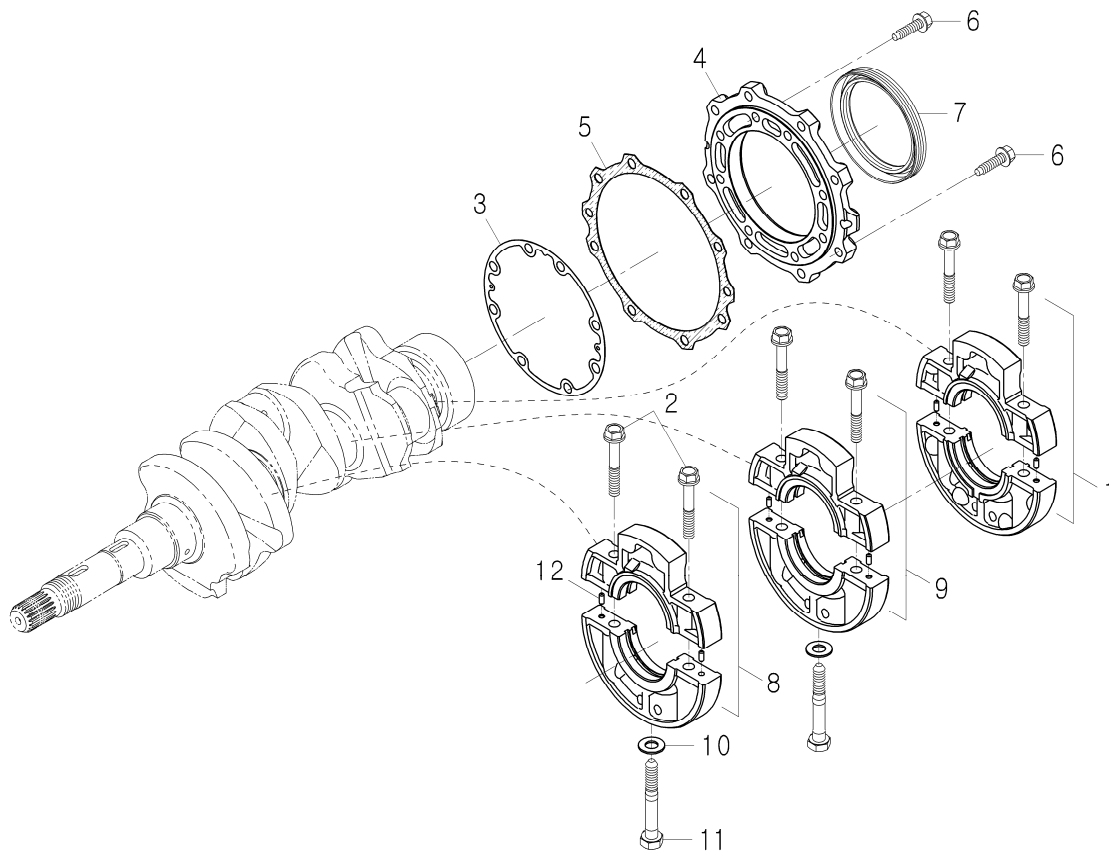
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5608-A0011	GEARCASE ASSEMBLY	1	1	
02	E5627-04116	GEARCASE	1	1	ORDER BY 1
03	E5800-96031	PLUG	3	3	
04	04811-00150	O RING	1	1	
05	04811-00220	O RING	2	2	
06	04811-00360	O RING	1	1	
07	05012-00612	STRAIGHT PIN	2	2	
08	E5627-32313	OIL FILTER SUPPORT	1	1	
09	E5800-96031	PLUG	1	1	
10	04811-00180	O RING	1	1	
11	E5627-32323	OIL FILTER SUPPORT GASKET	1	1	
12	E5627-91131	BOLT, HEXAGON SOCKET	3	3	
13	E5627-91141	BOLT, HEXAGON SOCKET	1	1	
14	15521-3229-1	JOINT PIPE	1	1	
15	04011-50180	PLAIN WASHER	1	1	
16	15241-3695-2	SPRING	1	1	
17	E5500-36932	VALVE SEAT	1	1	
18	07715-03213	STEEL BALL	1	1	

E040 GEAR CASE



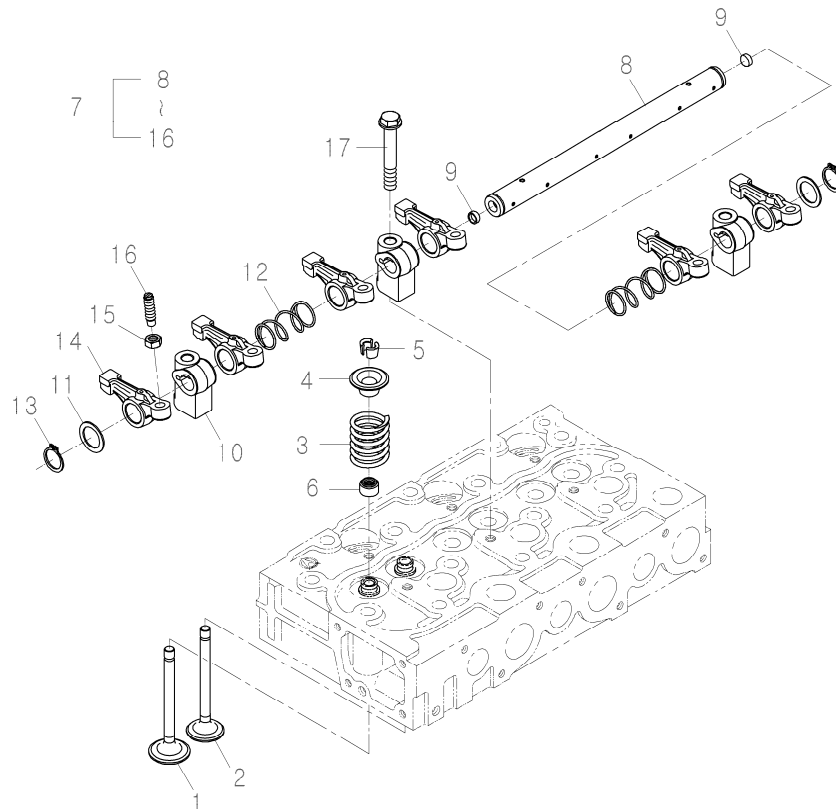
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
19	E5627-04132	GASKET, GEARCASE	1	1	
20	01123-50802	BOLT	2	2	
21	01123-50835	BOLT WITH WASHER	1	1	
22	01123-50860	BOLT WITH WASHER	2	2	
23	01123-50870	BOLT WITH WASHER	5	5	
24	01123-50875	BOLT WITH WASHER	2	2	
25	01123-50885	BOLT WITH WASHER	3	3	
26	15521-7332-1	WATER RETURN FLANGE	1	1	
27	E5500-73332	WATER RETURN FLANGE GASKET	1	1	
28	01023-50620	BOLT WITH WASHER	2	2	
29	01513-50616	STUD	1	1	
30	02056-50060	NUT	1	1	
31	04512-50060	SPRING WASHER	1	1	
32	E6201-32443	OIL FILTER	1	1	
33	04811-00160	O RING	1	1	
34	E5608-04151	COVER	1	1	
35	01754-50610	FLANGE BOLT	1	1	

E050 MAIN BEARING CASE GROUP



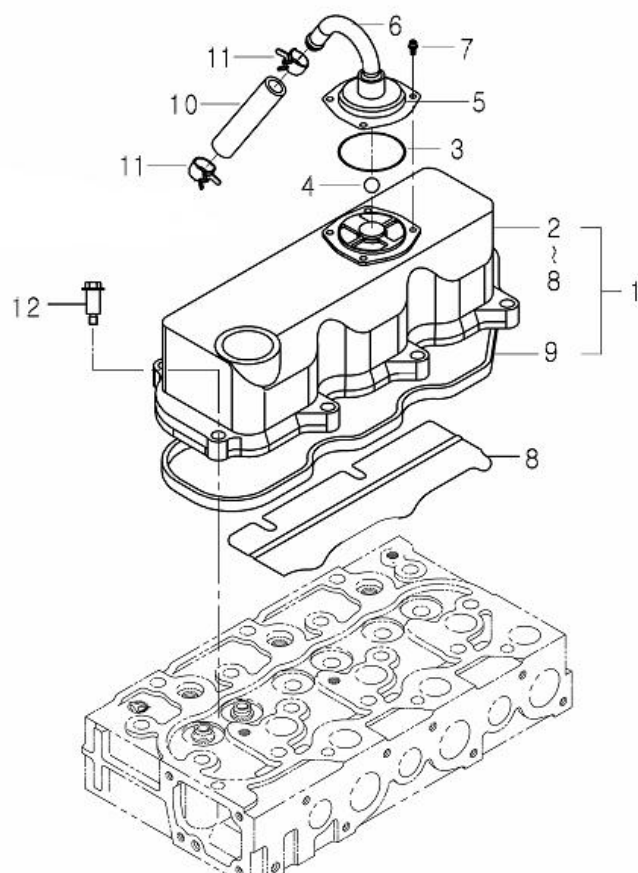
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6300-A0033	MAIN BEARING CASE ASS'Y	1	1	
02	E6300-04542	BOLT 1, BEARING CASE	6	6	
03	E6300-04362	GASKET	1	1	
04	E6300-04813	COVER BEARING	1	1	
05	E6300-04822	GASKET, BEARING COVER	1	1	
06	01654-50830	BOLT, FLANGE	16	16	
07	E5500-04464	SEAL, OIL	1	1	
08	E6300-A0043	MAIN BEARING CASE ASS'Y 1	1	1	
09	E6300-A0053	MAIN BEARING CASE ASS'Y 2	1	1	
10	04014-50100	WASHER, PLAIN	2	2	
11	15291-0456-2	BEARING CASE BOLT 2	2	2	
12	05012-00408	PIN, STRAIGHT	6	6	

E060 VALVE, ROCKER ARM



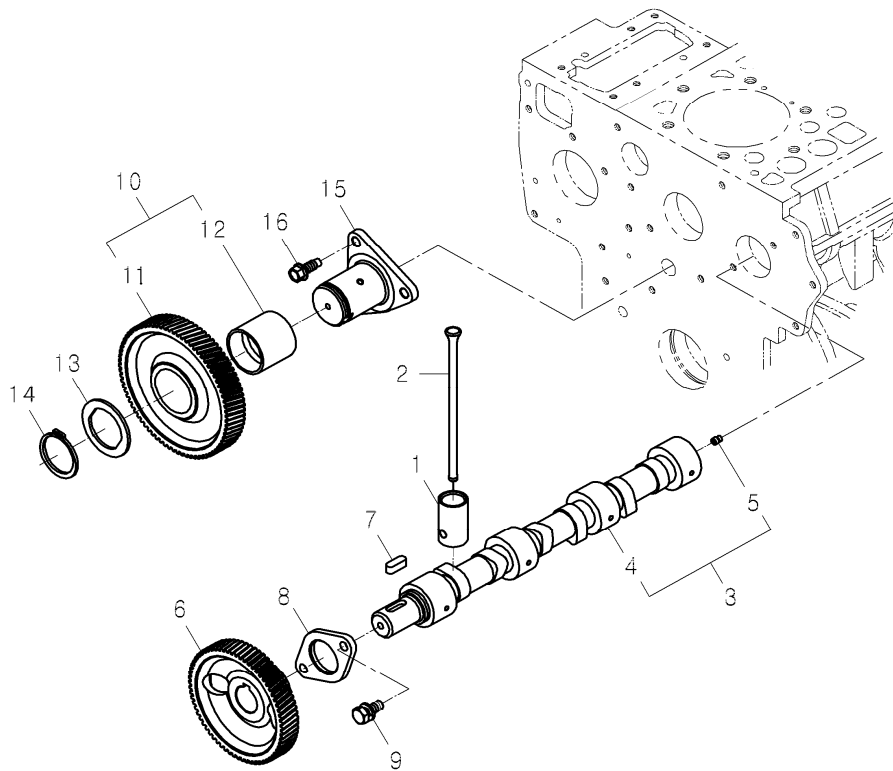
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6301-13111	VALVE, INLET	3	3	
02	E6301-13121	VALVE, EXHAUST	3	3	
03	15221-1324-2	SPRING, VALVE	6	6	
04	E5500-13332	RETAINER, VALVE SPRING	6	6	
05	E6403-13361	COLLET, VALVE SPRING	12	12	
06	E6301-13151	SEAL, VALVE STEM	6	6	
07	E5800-14001	ROCKER ARM SHAFT ASS'Y	1	1	
08	E5800-14261	ROCKER ARM SHAFT	1	1	ORDER BY 7
09	E6301-14331	CAP, SEALING	2	2	ORDER BY 7
10	E6301-14351	BRACKET ROCKER ARM	3	3	
11	E6301-14431	WASHER	2	2	
12	E6301-14311	SPRING, ROCKER ARM	2	2	
13	04612-00190	CIR - CLIP	2	2	
14	E6301-14111	ROCKER ARM	6	6	
15	15021-1424-1	NUT	6	6	
16	E5500-14232	SCREW, ADJUSTING	6	6	
17	E6510-91502	BOLT, ROCKER ARM SUPPORT	3	3	

E070 CYLINDER HEAD COVER



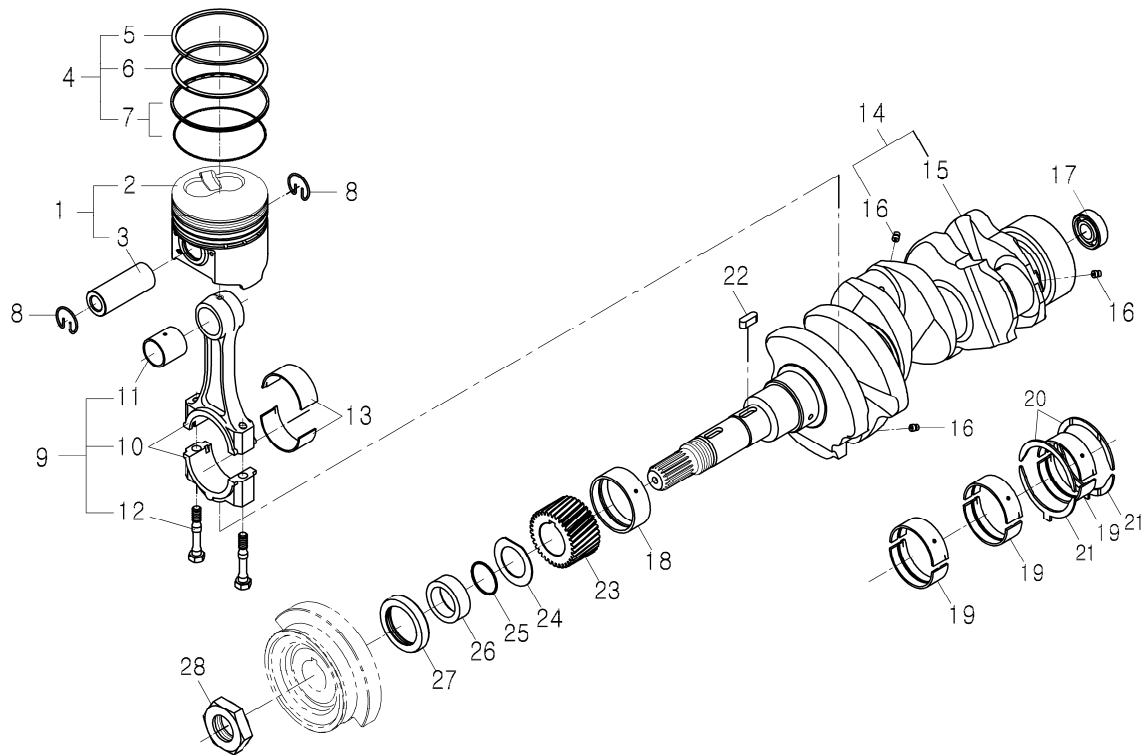
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5608-14502	CYLINDER HEAD COVER ASS'Y	1	1	
02	E5608-14511	CYLINDER HEAD COVER	1	1	
03	E6510-14671	O RING	1	1	
04	07712-01607	STEEL BALL	1	1	
05	E5608-14531	COVER-VALVE	1	1	
06	E5608-05551	CONNECTOR, AIR BREATHER	1	1	
07	03024-50510	SCREW	4	4	
08	E5850-14561	OIL PROTECTOR	1	1	
09	E5850-14521	GASKET, CYLINDER HEAD COVER	1	1	
10	E5608-05512	AIR BREATHER	1	1	
11	09318-88180	BAND	2	2	
12	E6510-33661	BOLT, HEAD COVER	8	8	

E080 CAMSHAFT



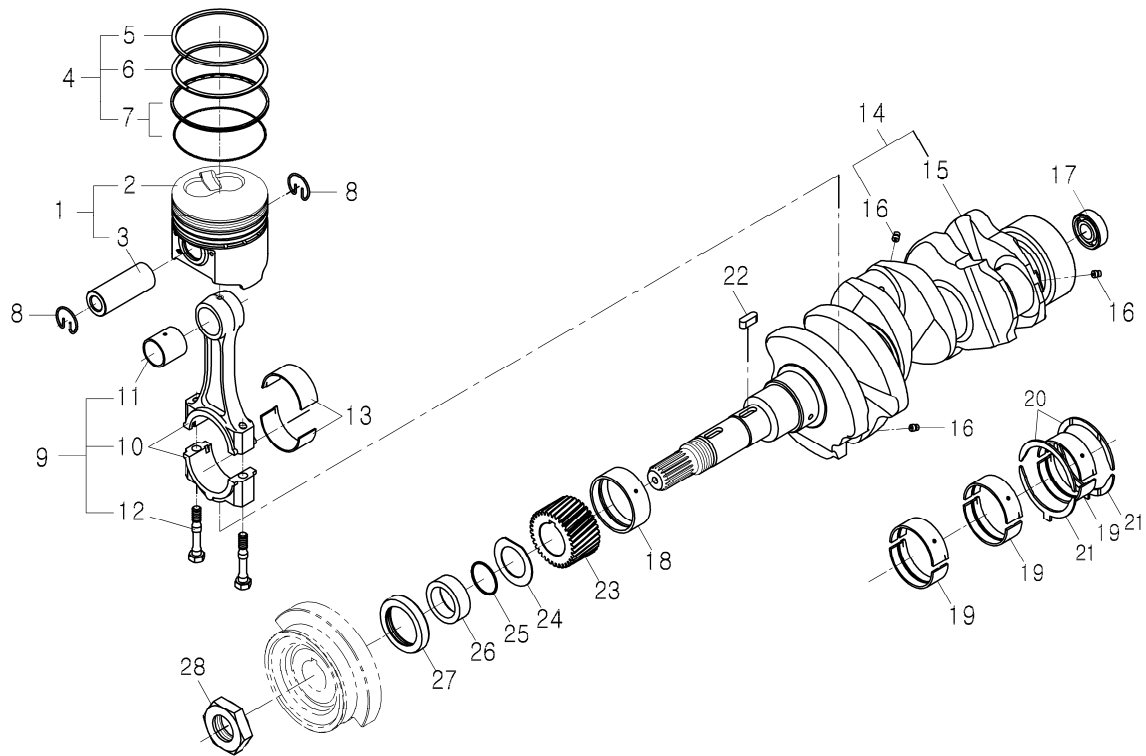
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5500-15553	TAPPET	6	6	
02	E6300-15113	ROD, PUSH	6	6	
03	E5603-A0031	CAMSHAFT ASS'Y	1	1	
04	E5603-16151	CAMSHAFT	1	1	ORDER BY 3
05	06350-00607	PLUG	2	2	
06	15521-1651-1	GEAR, CAMSHAFT	1	1	
07	05712-00720	KEY	1	1	
08	E5500-16272	STOPPER, CAMSHAFT	1	1	
09	01123-50818	BOLT	2	2	
10	E6300-24012	IDLE GEAR ASS'Y	1	1	
11	E6300-24212	GEAR, IDLE	1	1	ORDER BY 10
12	E6300-24281	BUSH, IDLE GEAR	1	1	
13	E6300-24371	COLLAR 2	1	1	
14	E6300-24321	CIR – CLIP	1	1	
15	E6300-24253	SHAFT, IDLE GEAR	1	1	
16	01754-50820	BOLT, FLANGE	3	3	

E090 PISTON, CRANKSHAFT



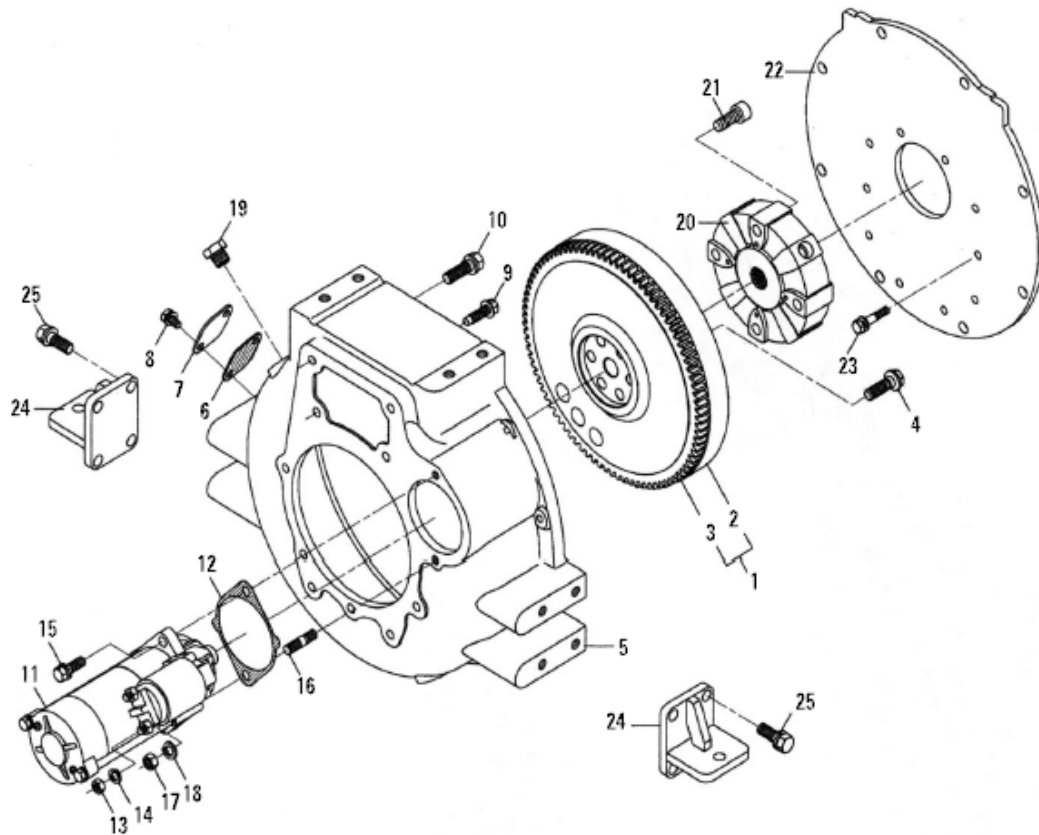
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5803-21011	PISTON ASS'Y	3		
01	E6301-21017	PISTON ASS'Y		3	
02	E5803-21111	PISTON	3		
02	E6301-21114	PISTON		3	
03	E6300-21313	PIN, PISTON	3		
03	E6720-21312	PIN, PISTON		3	
04	E5800-21052	PISTON RING ASS'Y	3		
04	E6301-21053	PISTON RING ASS'Y		3	
05	E5800-21152	RING 1 PISTON	3		
05	E6301-21152	RING 1 PISTON		3	
06	E5800-21162	RING 2 PISTON	3		
06	E6300-21162	RING 2 PISTON		3	
07	E5800-21202	RING, OIL	3		
07	E6301-21202	RING, OIL		3	
08	E6300-21332	CIR – CLIP	6	6	
09	E6300-22027	ROD, CONNECTION ASS'Y	3	3	
10	E6300-22114	ROD, CONNECTING	3	3	ORDER BY 9

E090 PISTON, CRANKSHAFT



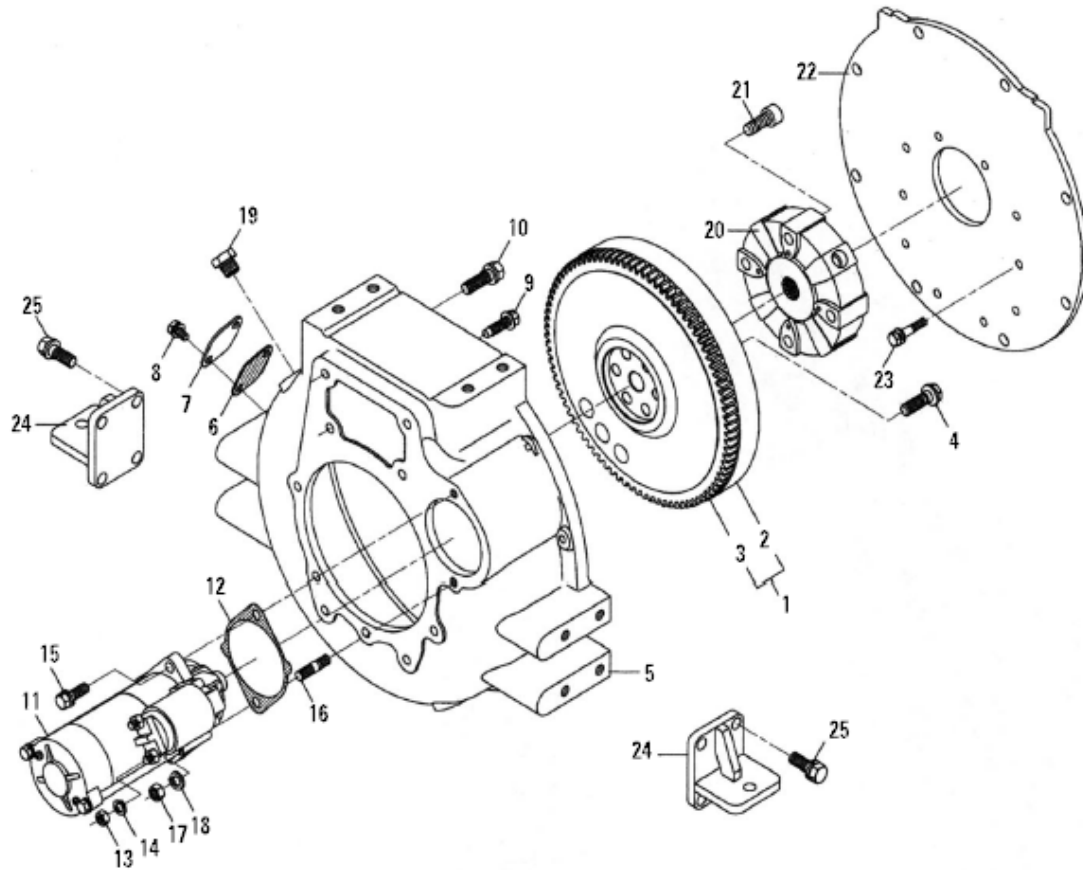
REF.NO	PART.NO	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
11	E6300-21353	BUSHING	3	3	
12	E5800-22141	BOLT, CONNECTING ROD	6	6	
13	E6300-22312	BEARING, CONNECTING ROD	6	6	
14	E5800-A0100	CRANK SHAFT ASS'Y	1	1	
15	E5800-23115	CRANK SHAFT	1	1	ORDER BY 14
16	06350-00708	PLUG	3	3	
17	08121-06002	BEARING, BALL	1	1	
18	E6200-23472	CRANKSHAFT METAL 1	1	1	
19	E6200-23482	CRANKSHAFT METAL 2	6	6	
20	15521-2353-1	SIDE METAL 1	2	2	
21	19202-2354-1	SIDE METAL 2	2	2	
22	05712-00720	KEY	1	1	
23	E6200-24112	GEAR, CRANKSHAFT	1	1	
24	15471-2331-1	SLINGER, OIL	1	1	
25	04811-10300	O-RING	1	1	
26	E6510-23251	COLLAR, CRANKSHAFT	1	1	
27	E5500-11302	SEAL, OIL	1	1	
28	15221-2336-1	CRANK SHAFT NUT	1	1	

E100 FLYWHEEL



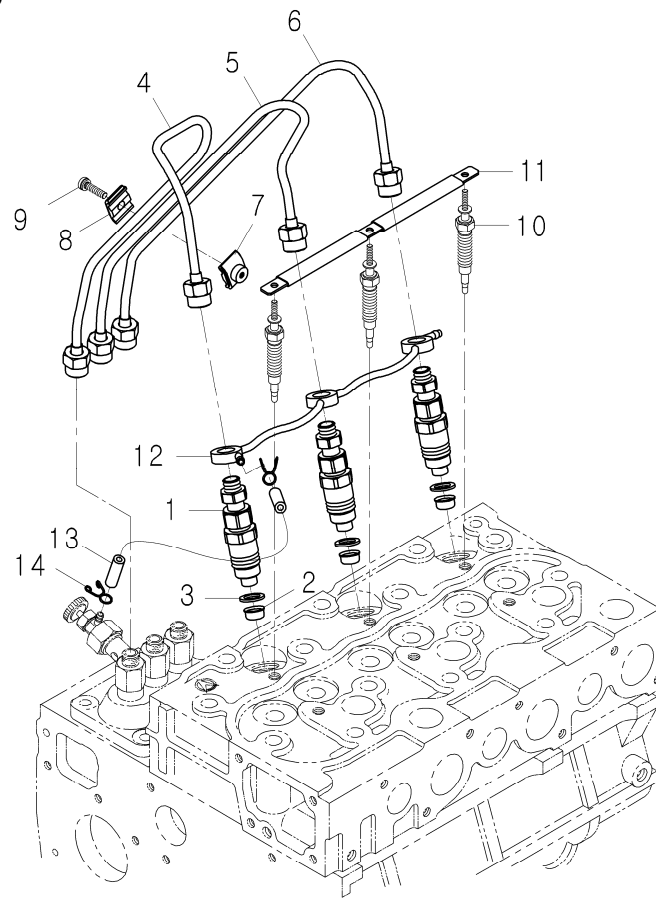
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5806-25011	FLYWHEEL ASS'Y	1	1	
02	E5806-25111	FLYWHEEL	1	1	ORDER BY 1
03	15221-6382-4	GEAR, RING	1	1	ORDER BY 1
04	E5500-25164	BOLT, FLYWHEEL	6	6	
05	E5608-04611	HOUSING, FLYWHEEL	1	1	
06	15521-0479-2	GASKET	1	1	
07	15521-0468-2	COVER, TIMING MARK	1	1	
08	01123-50816	BOLT	2	2	
09	01674-51032	BOLT, FLANGE	11	11	
10	01133-51240	BOLT	2	2	
11	E6530-63012	STARTER	1	1	
12	E6200-04623	GASKET	1	1	
13	02114-50080	NUT	1	1	
14	04512-50080	WASHER, SPRING	1	1	
15	01133-51030	BOLT	1	1	

E100 FLYWHEEL



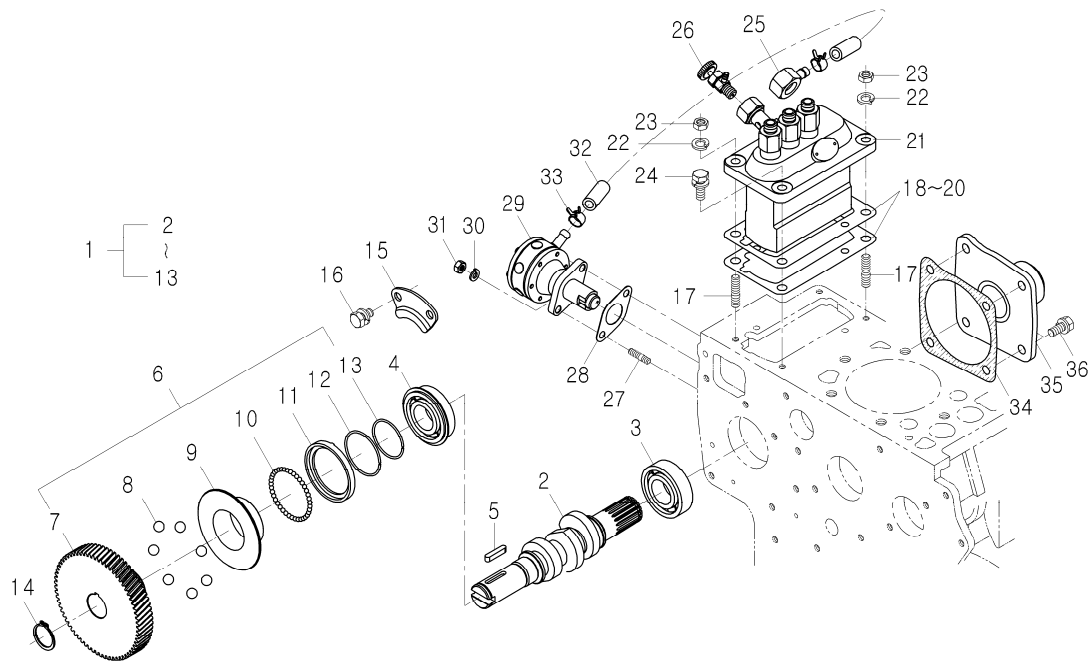
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
16	01517-51028	STUD	1	1	
17	02176-50100	NUT	1	1	
18	04512-50100	WASHER, SPRING	1	1	
19	06331-35016	PLUG	1	1	
20	43504-M1010	COUPLING, TRANSMISSION	1	1	
21		BOLT	8	8	ORDER BY 20
22	43504-M1020	COVER, MISSION HOUSING	1	1	
23	11403-08253	BOLT	10	10	
24	21604-M1030	BRKT-REAR	2	2	
25	01133-51230	BOLT	8	8	

E110 NOZZLE, HOLDER



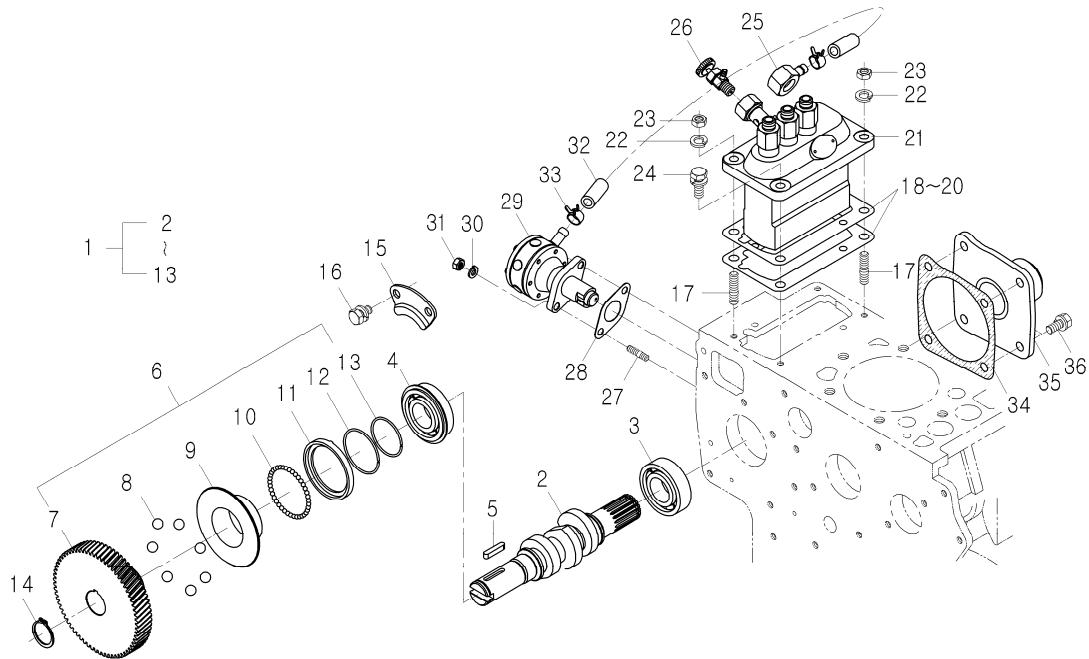
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6300-53005	NOZZLE HOLDER ASS'Y	3	3	
02	E6300-53651	SEAL, HEAT	3	3	
03	E6300-53621	GASKET	3	3	
04	E5610-53714	PIPE 1, INJECTION	1	1	
05	E5610-53723	PIPE 2, INJECTION	1	1	
06	E5610-53734	PIPE 3, INJECTION	1	1	
07	15121-5385-2	CLAMP 1, PIPE	2	2	
08	T4815-67371	CLAMP 2, PIPE	2	2	
09	03024-50520	SCREW	2	2	
10	E6301-65512	PLUG, GLOW	3	3	
11	E5800-65562	CORD, GLOW PLUG	1	1	
12	E5800-42501	OVERFLOW PIPE ASS'Y	1	1	
13	09661-40300	TUBE, FUEL	1	1	
14	09318-88080	BAND	2	2	

E120 FUEL, CAMSHAFT



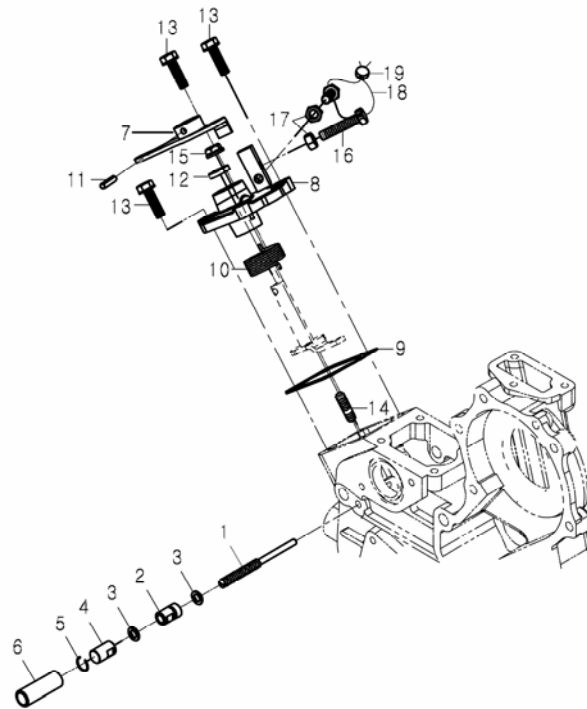
REF.NO	PART.NO	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5610-16022	CAMSHAFT, FUEL ASS'Y	1	1	
02	E5610-16171	CAMSHAFT, FUEL	1	1	
03	08240-00001	BEARING, BALL	1	1	
04	08153-06205	BEARING, BALL	1	1	
05	05712-00525	KEY	1	1	
06	E6300-51052	GOVERNOR SLEEVE ASS'Y	1	1	
07	E6300-51153	GEAR, INJECTION PUMP	1	1	Order by 5
08	07715-00403	BALL	7	7	
09	E6300-55453	SLEEVE GOVERNOR	1	1	
10	07715-03205	BALL	39	39	
11	15221-5569-2	CASE, GOVERNOR BALL	1	1	
12	15221-5574-1	CIR-CLIP, BALL CASE	1	1	
13	15221-5547-1	CIR-CLIP	1	1	
14	04612-00240	CIR-CLIP	1	1	
15	15221-1632-1	STOPPER FUEL CAMSHAFT	1	1	
16	01123-50814	BOLT	2	2	

E120 FUEL, CAMSHAFT



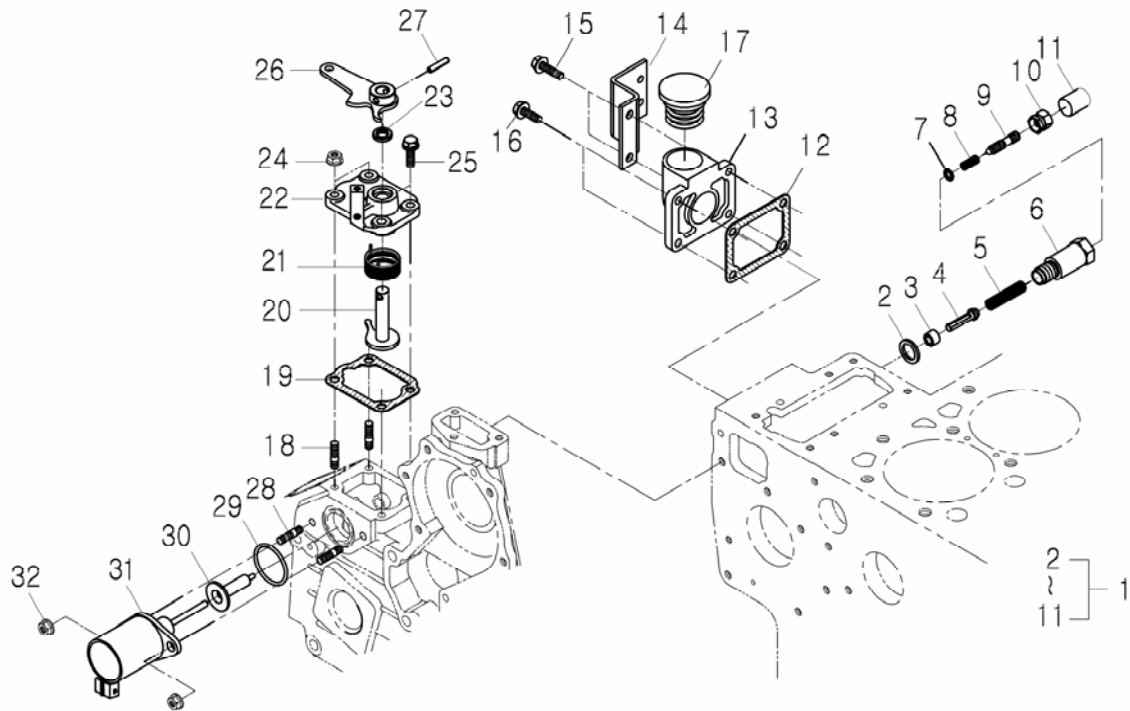
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
17	01513-50822	STUD	2	2	
18	E5500-52122	SHIM 1(T0.3) INJECTION PUMP	1	1	
19	E5500-52112	SHIM 2(T0.15) INJECTION PUMP	1	1	
20	E5800-52111	SHIM 3(T0.1) INJECTION PUMP	1	1	
21	E5800-51015	INJECTION PUMP ASS'Y	1	1	
22	04512-50080	WASHER, SPRING	2	2	
23	02156-50080	NUT	2	2	
24	01123-50822	BOLT	2	2	
25	E6500-42412	JOINT, FUEL PIPE	1	1	
26	E5629-24401	EYE BOLT	1	1	
27	01513-50618	STUD	2	2	
28	E6200-52142	GASKET FUEL PUMP	1	1	
29	15381-5203-0	FUEL PUMP ASS'Y	1	1	
30	04512-50060	WASHER SPRING	2	2	
31	02056-50060	NUT	2	2	
32	15371-4217-0	HOSE 1, FUEL	1	1	
33	14911-4275-1	CLIP, PIPE	2	2	
34	T4240-36332	PACKING	1	1	
35	E6200-16213	COVER, FUEL CAMSHAFT	1	1	
36	01123-50818	BOLT WITH WASHER	4	4	

E130 SPEED CONTROL PLATE



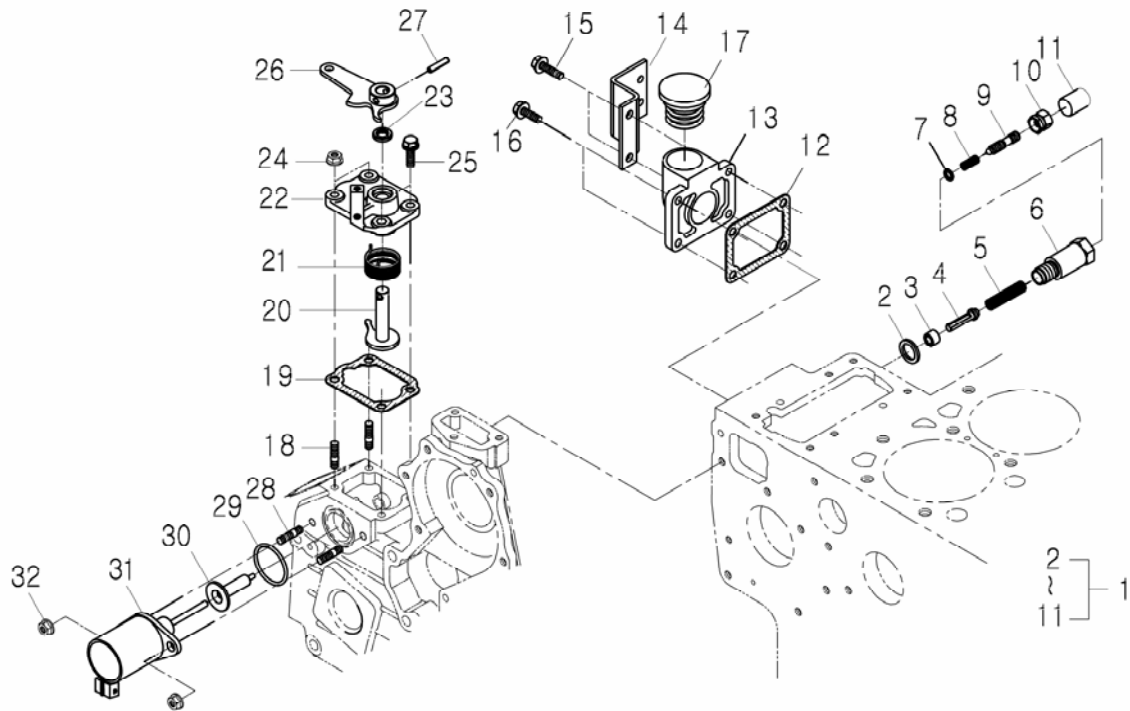
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6301-54122	ADJUSTING BOLT	1	1	
02	E6305-92021	NUT	1	1	
03	E6305-96652	GASKET	2	2	
04	E6305-54221	NUT, GAP	1	1	
05	E6305-54281	RING SNAP	1	1	
06	E6305-54421	CAP	1	1	
07	E6858-57151	LEVER, SPEED CONTROL	1	1	
08	E5850-57112	SPEED CONTROL PLATE	1	1	
09	E5850-57212	GASKET, SPEED CONTROL	1	1	
10	E5850-57921	SPRING	1	1	
11	05411-00420	PIN, SRPING	1	1	
12	15471-5798-1	OIL SEAL	1	1	
13	01754-50620	BOLT, FLANGE	3	3	
14	15221-8821-1	STUD	1	1	
15	02761-50060	FLANGE NUT	1	1	
16	15108-5728-4	STOPPER	2	2	
17	02056-50060	NUT	2	2	
18	07811-10820	WIRE	1	1	
19	07918-00001	SEALING LEAD	1	1	

E140 ENGINE STOP LEVER



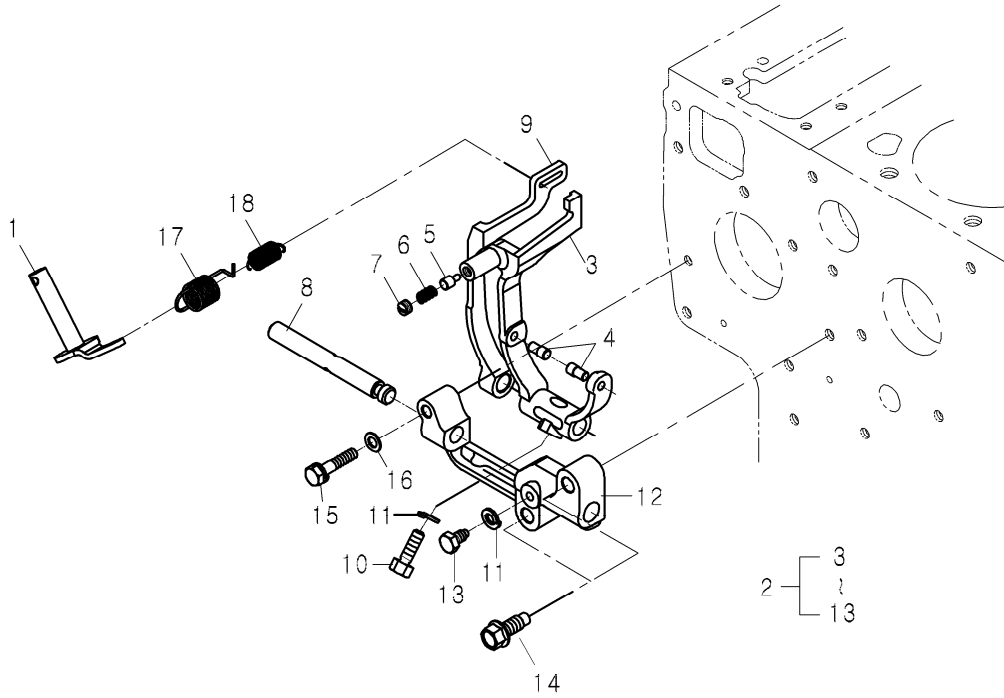
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS.
			HB29D1	HB36D1	
01	E5850-54093	IDLE APPARATUS ASSEMBLY	1	1	
02	04724-00140	PACKING	1	1	
03	E5850-54282	BUSH	1	1	
04	E5850-54272	SHAFT	1	1	
05	E5850-54261	SPRING	1	1	
06	E5850-54291	IDLE ADJUSTMENT BODY	1	1	
07	04811-00060	O RING	1	1	
08	15521-5426-1	SPRING	1	1	
09	E5850-54252	IDLE ADJUSTING BOLT	1	1	
10	E5850-92011	NUT	1	1	
11	E5205-54271	CAP	1	1	
12	E5500-51662	GASKET	1	1	
13	E5608-57481	OIL FILLER COVER	1	1	
14	E5608-57481	CABLE BRACKET	1	1	
15	01754-50620	BOLT WITH WASHER	2	2	
16	01754-50616	BOLT WITH WASHER	2	2	
17	E5800-33144	OIL FILLER PLUG	1	1	
18	15221-8821-1	STOP LEVER 2	2	2	

E140 ENGINE STOP LEVER



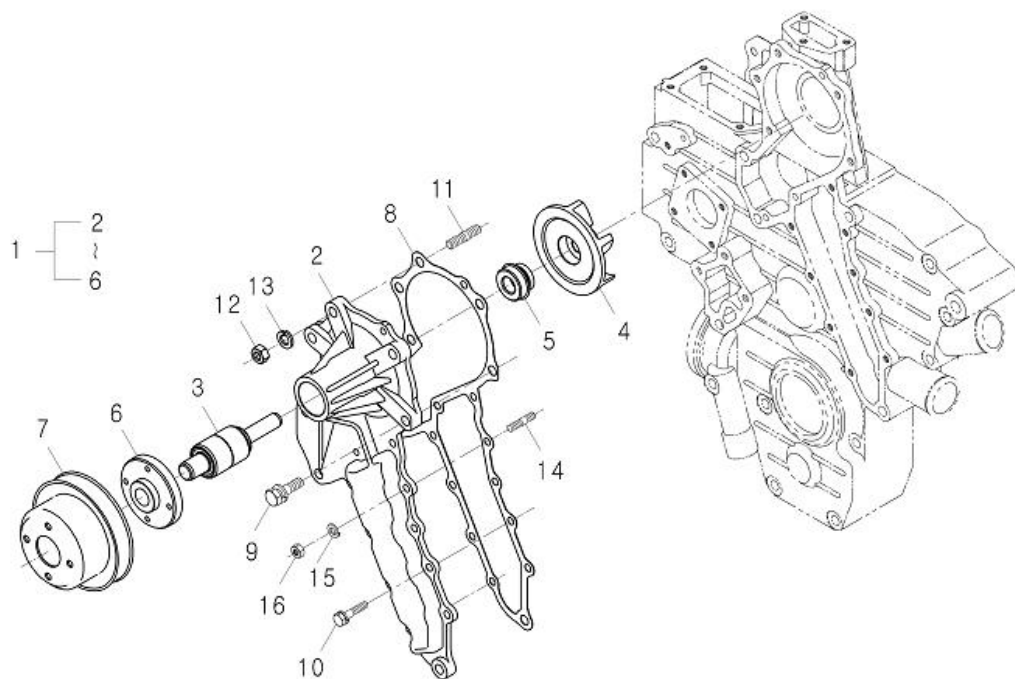
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS.
			HB29D1	HB36D1	
19	E5850-57212	SPEED CONTROL PLATE GASKET	1	1	
20	E5850-57712	STOP LEVER 2 ASSEMBLY	1	1	
21	E5850-57921	SPRING	1	1	
22	E5850-57112	SPEED CONTROL PLATE	1	1	
23	15471-5798-1	OIL SEAL	1		
24	02761-50060	FLANGE NUT	2	2	
25	01754-50620	BOLT, FLANGE	2	2	
26	E5850-57731	ENGINE STOP LEVER 1	1	1	
27	05411-00420	SPRING PIN	1	1	
28	01513-50614	STUD	2	2	
29	04814-06310	O RING	1	1	
30	E5850-56604	STOP SOLENOID GUIDE	1	1	
31	E5850-60012	STOP SOLENOID ASSEMBLY	1	1	
32	02761-50060	FLANGE NUT	2	2	

E150 GOVERNOR



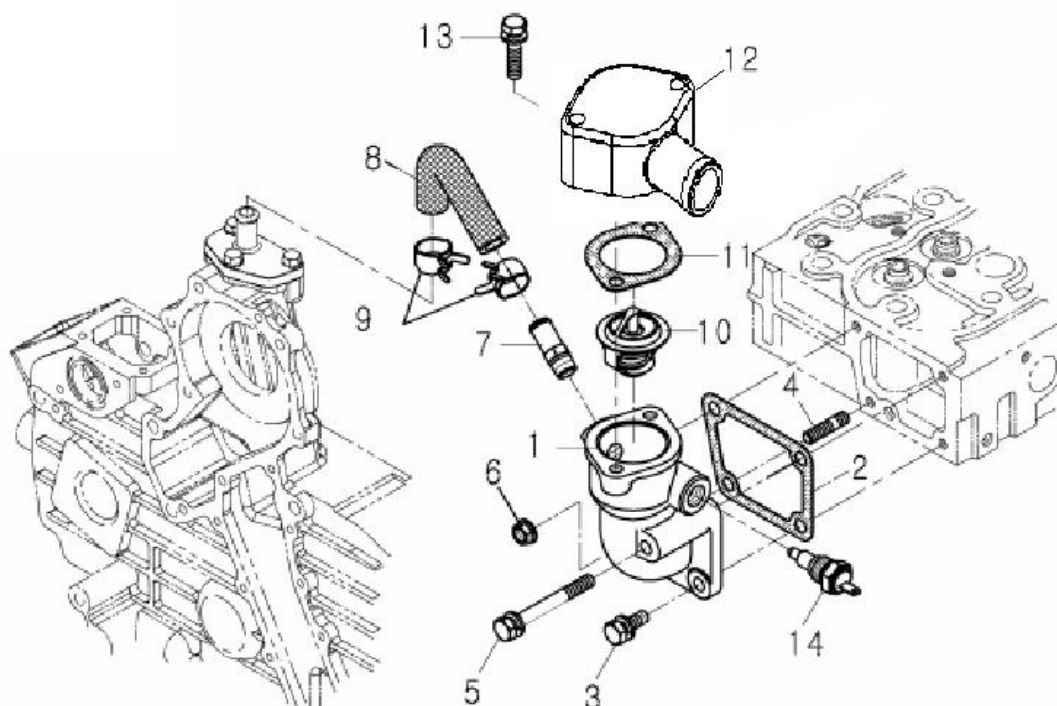
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E5850-56021	GOVERNOR LEVER ASSEMBLY	1	1	
02	E5627-56051	FORK LEVER ASSEMBLY	1	1	
03	E5627-56121	FORK LEVER 1	1	1	
04	15021-5616-4	FORK LEVER PIN 1	2	2	
05	E6200-54172	PIN	1	1	
06	E6300-54231	SPRING	1	1	
07	15601-5443-1	SET SCREW	1	1	
08	15221-5615-1	FORK LEVER SHAFT	1	1	
09	E6300-56131	FORK LEVER 2	1	1	
10	15021-5624-3	LEVER SHAFT BOLT	1	1	
11	04512-50060	SPRING WASHER	2	2	
12	15221-5623-5	FORK LEVER HOLDER	1	1	
13	15221-6641-1	BOLT	1	1	
14	01754-50830	BOLT WITH WASHER	2	2	
15	01023-50628	BOLT WITH WASHER	1	1	
16	04012-50060	PLAIN WASHER	1	1	
17	E6300-56414	GOVERNOR SPRING 1	1	1	
18	E6313-56421	GOVERNOR SPRING 2	1	1	

E160 WATER PUMP



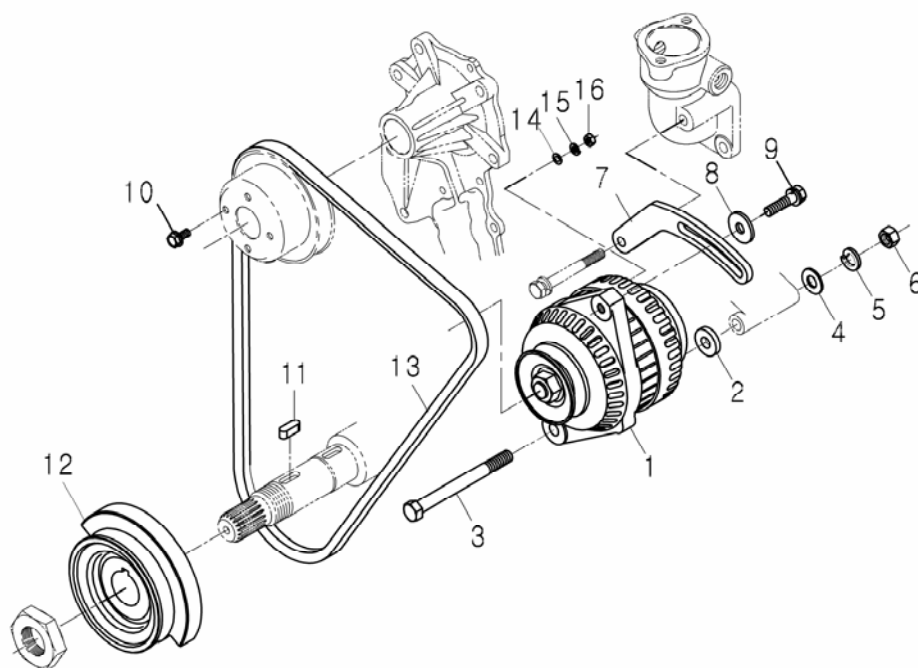
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6308-73031	WATER PUMP ASS'Y	1	1	
02	E5627-73471	BODY, WATER PUMP	1	1	
03	E5800-73551	BEARING WATER PUMP	1	1	
04	E5800-73513	IMPELLER	1	1	
05	E5800-73052	MECHANICAL SEAL ASS'Y	1	1	
06	E5800-73522	FLANGE	1	1	
07	E5616-74252	PULLEY, FAN	1	1	
08	E5627-73432	GASKET, WATER PUMP	1	1	
09	01123-50828	BOLT	4	4	
10	01023-50618	BOLT	8	8	
11	01518-50822	STUD	1	1	
12	02156-50080	NUT	1	1	
13	04512-50080	WASHER, SPRING	1	1	
14	15221-8821-1	STUD	1	1	
15	04512-50060	WASHER, SPRING	1	1	
16	02056-50060	NUT	1	1	

E170 WATER PIPE



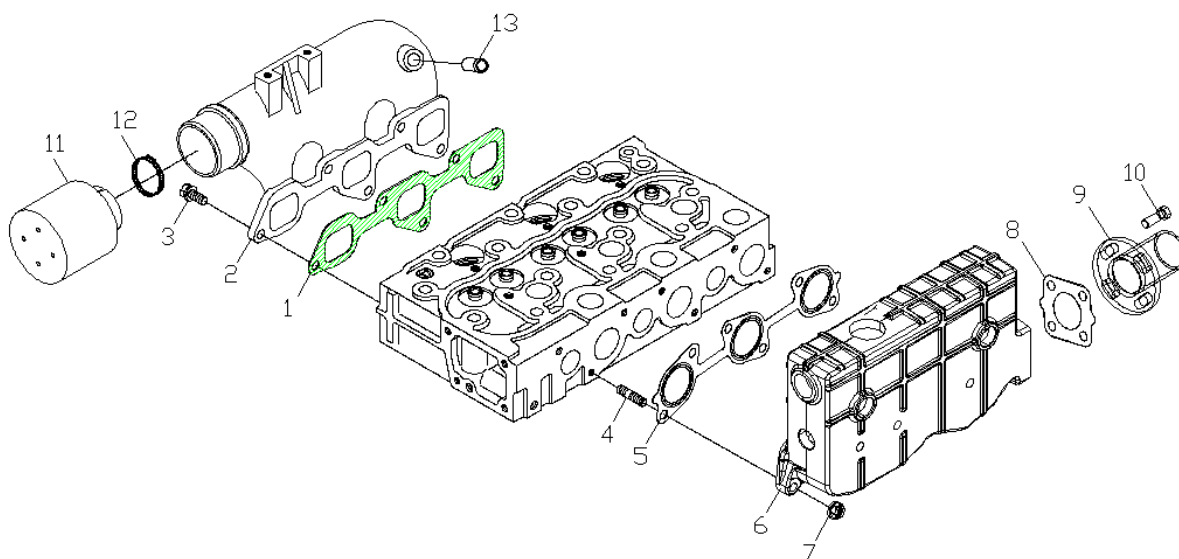
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E6304-72911	FLANGE THERMO WATER	1	1	
02	E5500-72911	GASKET WATER FLANGE	1	1	
03	01123-50822	BOLT	2	2	
04	01513-50822	STUD	1	1	
05	01123-50870	BOLT	1	1	
06	02763-50080	NUT	1	1	
07	E5500-73342	PIPE, WATER RETURN	1	1	
08	15521-7334-1	PIPE	1	1	
09	09318-88180	BAND, PIPE	2	2	
10	E5800-73011	THERMOSTAT ASS'Y	1	1	
11	E5500-73272	GASKET THERMOSTAT COVER	1	1	
12	H6308-73270	COVER-THERMOSTAT	1	1	
13	01123-50835	BOLT WITH WASHER	2	2	
14	E5743-32841	THERMOSTAT SENSOR	1	1	

E180 ALTERNATOR



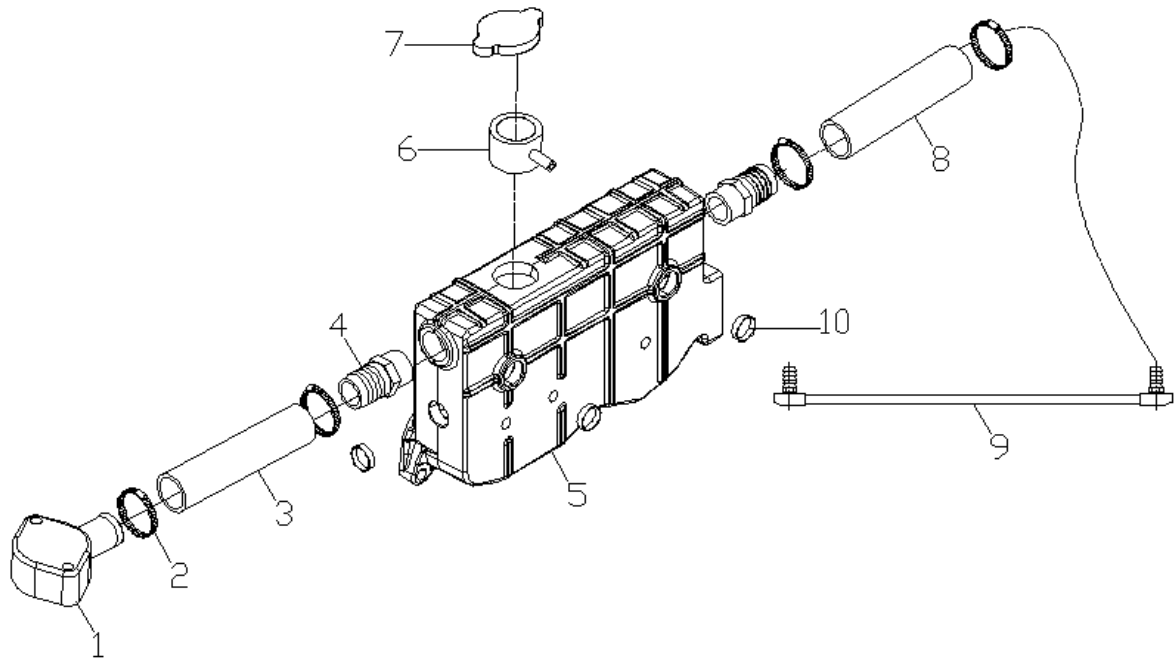
REF.NO.	PART NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	E7230-64012	DYNAMO	1	1	
02	E5800-64102	COLLAR	1	1	
03	01173-51005	BOLT	1	1	
04	04013-50100	PLAIN WASHER	1	1	
05	04512-50100	SPRING WASHER	1	1	
06	02176-50100	NUT	1	1	
07	E5800-64423	DYNAMO STAY	1	1	
08	04015-50080	PLAIN WASHER	1	1	
09	01123-50832	BOLT WITH WASHER	1	1	
10	01754-50612	FLANGE BOLT	4	4	
11	05712-00720	KEY	1	1	
12	E5620-74285	FAN DRIVE PULLEY	1	1	
13	E5640-72531	FAN BELT	1	1	
14	04012-50050	PLAIN WASHER	1	1	
15	04512-50050	SPRING WASHER	1	1	
16	02054-50050	NUT	1	1	

E190 MANIFOLD



REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D	HB36D1	
			1		
01	E5800-11821	GASKET INTAKE MANIFOLD	1	1	
02	E5800-11766	MANIFOLD, INTAKE	1	1	
03	01123-50822	BOLT	5	5	
04	01513-50822	STUD	3	3	
05	E5800-12352	GASKET, EXHAUST MANIFOLD	1	1	
06	28504-M1022	WATER COOLDED EXHAUST MANIFOLD	1	1	
07	02751-50080	NUT, FLANGE	3	3	
08	U3215-75471	GASKET	1	1	
09	28504-M1031	FLANGE, EXHAUST MANIFOLD	1	1	
10	01123-50825	BOLT	4	4	
11	28101-M1010	AIR CLEANER	1	1	
12	14000-05700	CLAMP, AIR CLEANER	1	1	
13	E6510-05552	BREATHER PIPE CONNECTOR	1	1	

E200 COOLANT RESERVE TANK



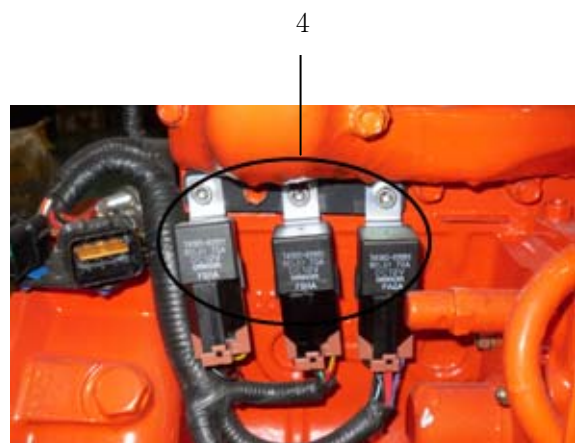
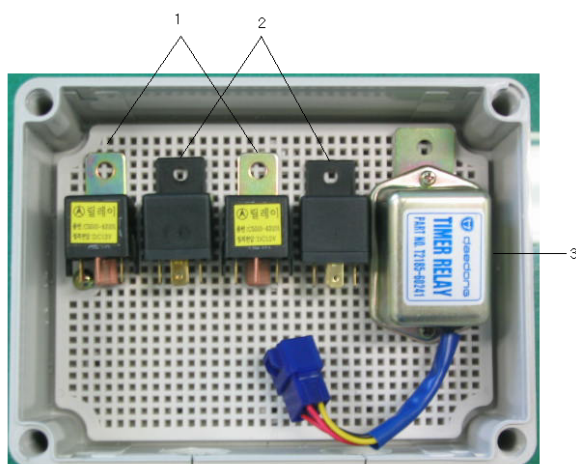
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	H6308-73270	COVER-THERMOSTAT	1	1	
02	14000-02500	CLAMP	4	4	
03	E6500-72941	HOSE, COOLANT FITTING	1	1	
04	28511-M1040	NIPPLE	2	2	
05	28504-M1022	WATER COOLED EXHAUST MANIFOLD	1	1	
06	25115-M2010	NECK-RADIATOR	1	1	
07	25111-M1010	CAP	1	1	
08	83025-0040	HOSE, EXIT	1	1	
09	25110-M1010	COOLER, KEEL	1	1	
10	99306-2000	CAP-SEALING	3	3	

E210 INSTRUMENT PANEL



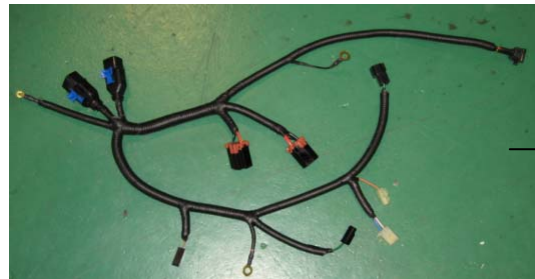
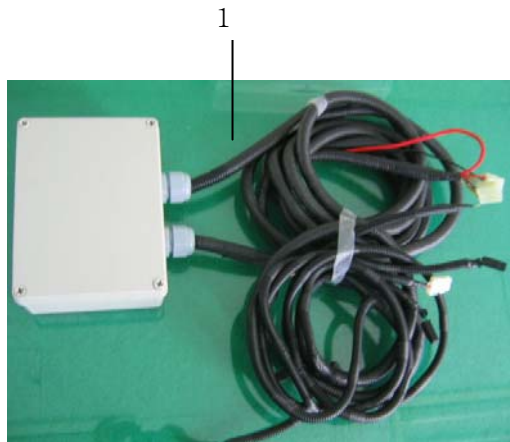
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	94114-M1011	INSTRUMENT PANEL	1	1	TURN KEY TYPE
02	95101-M1020	LAMP, WARNING	4	4	
03	95101-M1030	BUZZER	1	1	
04	95101-M1050	CIRCUIT BREAKER	1	1	
05	T2540-41133	KEY ASS'Y	1	1	
06	T2560-41151	KEY	1	1	
07	94114-M1020	SMART START KEY	1	1	SMART KEY TYPE

E220 RELAY BOX



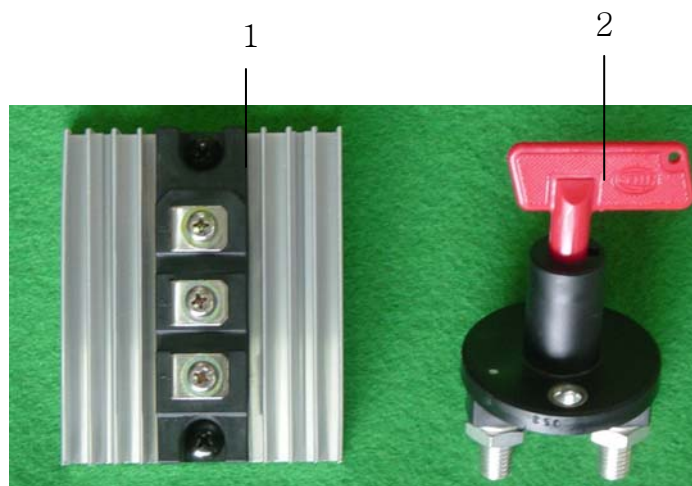
REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	T4180-69951	RELAY-GLOW, F/CUT	2	2	TURN KEY TYPE
02	DAR3-12	RELAY, START, F/CUT	2	2	
03	T2185-60241	TIMER RELAY	1	1	
04	T4180-69951	RELAY-GLOW, START	3	3	SMART KEY TYPE

E230 WIRING



REF.NO.	PART.NO.	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	91104-M1010	WIRING, ASS'Y	1	1	TURN KEY TYPE
02	E9110-50000	WIRING ASS'Y –ENG SUB	1	1	SMART KEY TYPE
03	E9120-21001	WIRING ASS'Y –ENG CONTR	1	1	

E240 SWITCH, ISOLATOR



REF.NO	PART.NO	DESCRIPTION	Q'TY		REMARKS
			HB29D1	HB36D1	
01	37201-M1010	Isolator	1	1	
02	95101-M1070	Switch, battery choice	2	2	

TRANSMISSION MANUAL

(TYPE HBG200)

INTRODUCTION

The present manual is part of the product's scope of supply and reading and understanding are essential. This manual contains guidelines and recommendations to let the owner use and safely operate the marine transmission.

This manual should always accompany the transmission and should be carefully stored in a safe and easily accessible.

GENERAL SAFETY RULES

- Do not operate or service this equipment before reading the instructions and guidelines included in this manual.
- Check, before and during the use of the equipment, against hazardous situations.
- Do not perform any equipment modifications or removal of the transmission or its parts.
- NEVER perform any servicing, adjusting, repairing or unplugging on running equipment (first stop the engine, place all controls in neutral and wait for all moving parts to stop)

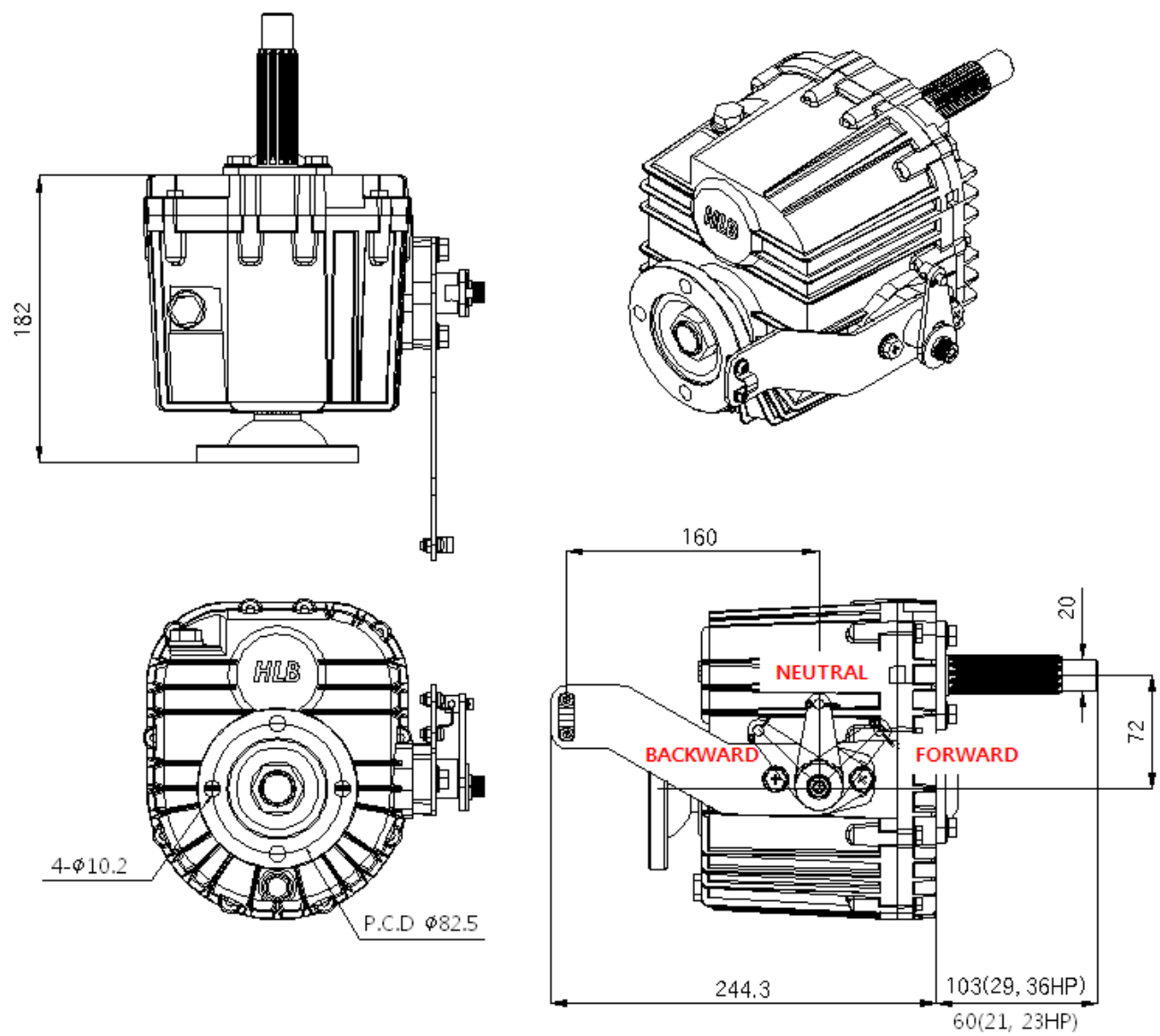


Note

The manufacturer is not liable for any damage or loss caused by wrong installation, abuse, misuse, negligent or careless maintenance of the transmission.

The customer/operator has to make sure that no external forces affect the transmission as well as vibrations or symptoms caused by torsion and bending because of the interaction between engine propeller shaft and propeller.

DIMENSION



SPECIFICATION

Ratios (forward/backward)	2.54:1 / 2.43:1
Fluid grade	ATF oil
Weight (kgf)	11.2
Oil capacity (L)	0.6

MAINTENANCE

Frequent and systematic inspection will assure to your transmission many years of trouble-free service.

Oil level checks

Weekly check oil level, using oil gauge.

With engine in OFF position, weekly check against oil leaks from the output flange.

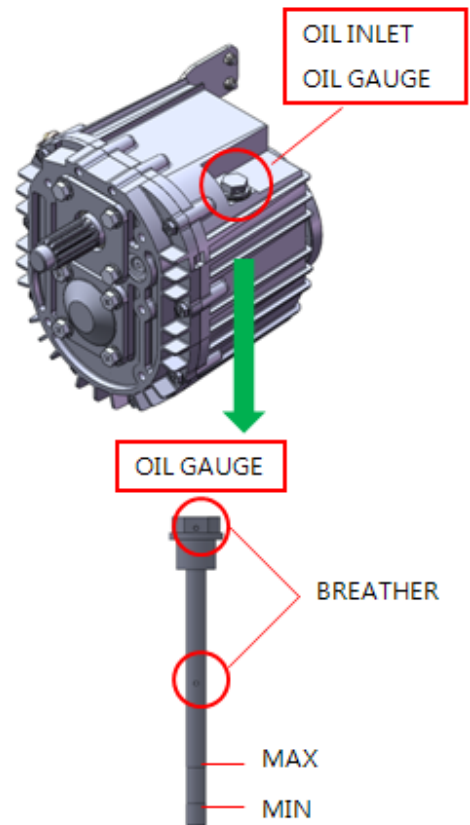
Correct oil level : index mark on dipstick.

Always use the same oil grade when refill the oil. Don't overfill the transmission oil. This will create higher operation temperatures.

Oil change

First oil change : after 25 operating hours

Oil change : every 500 operating hours or yearly (whichever occurs first)

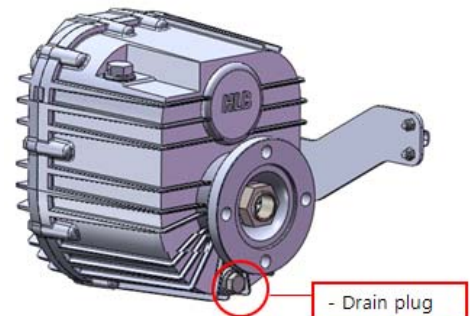


PROCEDURE

1. Remove the drain plug from cover of marine gear
2. Drain the oil
3. Reinstall the drain plug
4. Remove the oil gauge
5. Fill with the correct amount of oil.

Check and top up the oil level to the ("MAX") mark of the oil dipstick

6. Check the oil gauge breather (2 hole)
7. Reinstall the oil gauge



Note

Shifting and reversing the transmission : During normal operation, the transmission should be shifted with the engine at idle speed only.

Engine start : Start engine with gearbox in neutral only. Starting the engine with the transmission engaged may be harmful for people aboard or hazardous for the boat and people and boats in the vicinity

Inspections : Control and inspections have to be performed with engine OFF and once the transmission has cooled only.

IDENTIFICATION

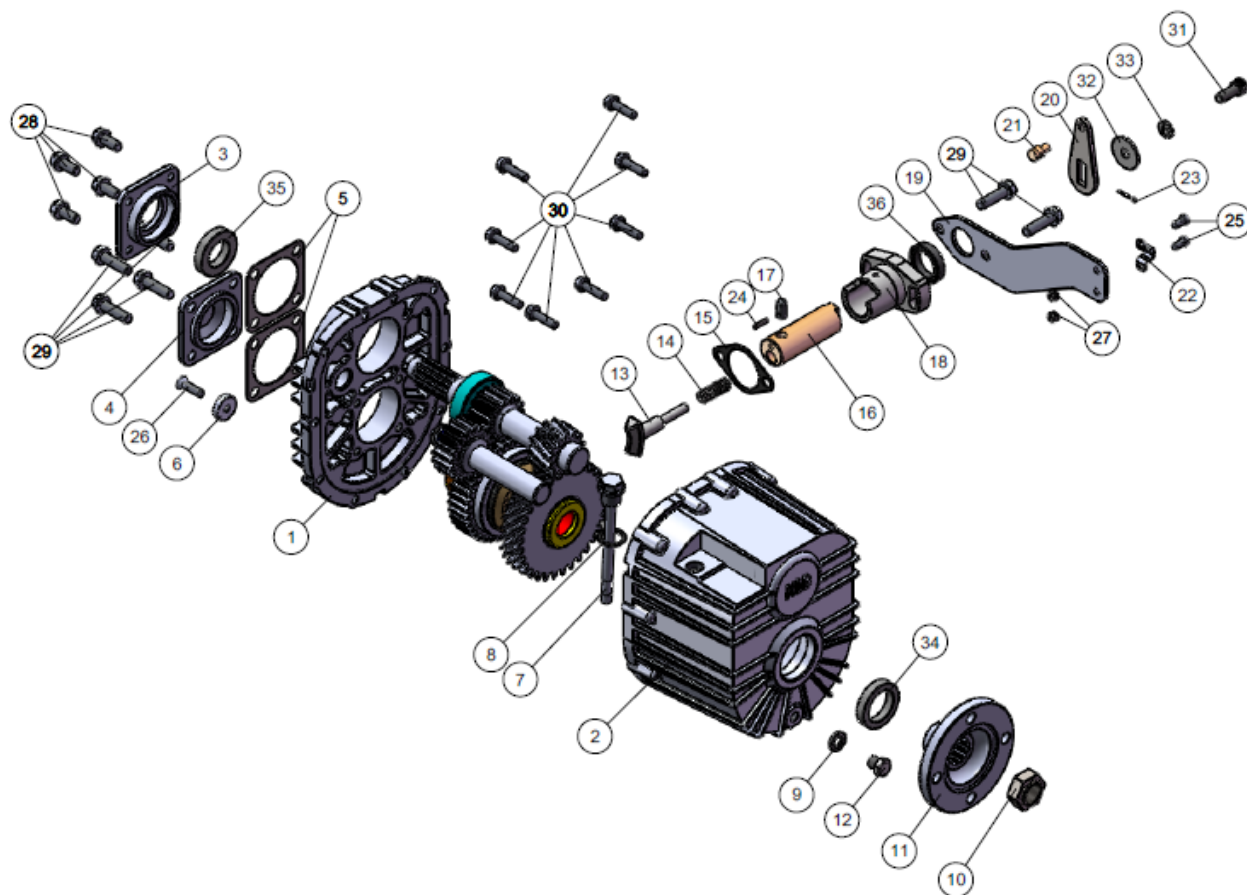
A name plate is fixed on each transmission housing : information printed on are essential for warranty and spare part ordering :

Manufacturer	HYUNDAI HYUNDAILIFEBOATS CO., LTD	MODEL : HBG200	Transmission type
Serial number	SER.NO :	GEAR RATIO F/W : 2.54 , B/W : 2.47	Forward and backward reduction ratio
		OIL : ATF	Oil type
		Made in Korea	

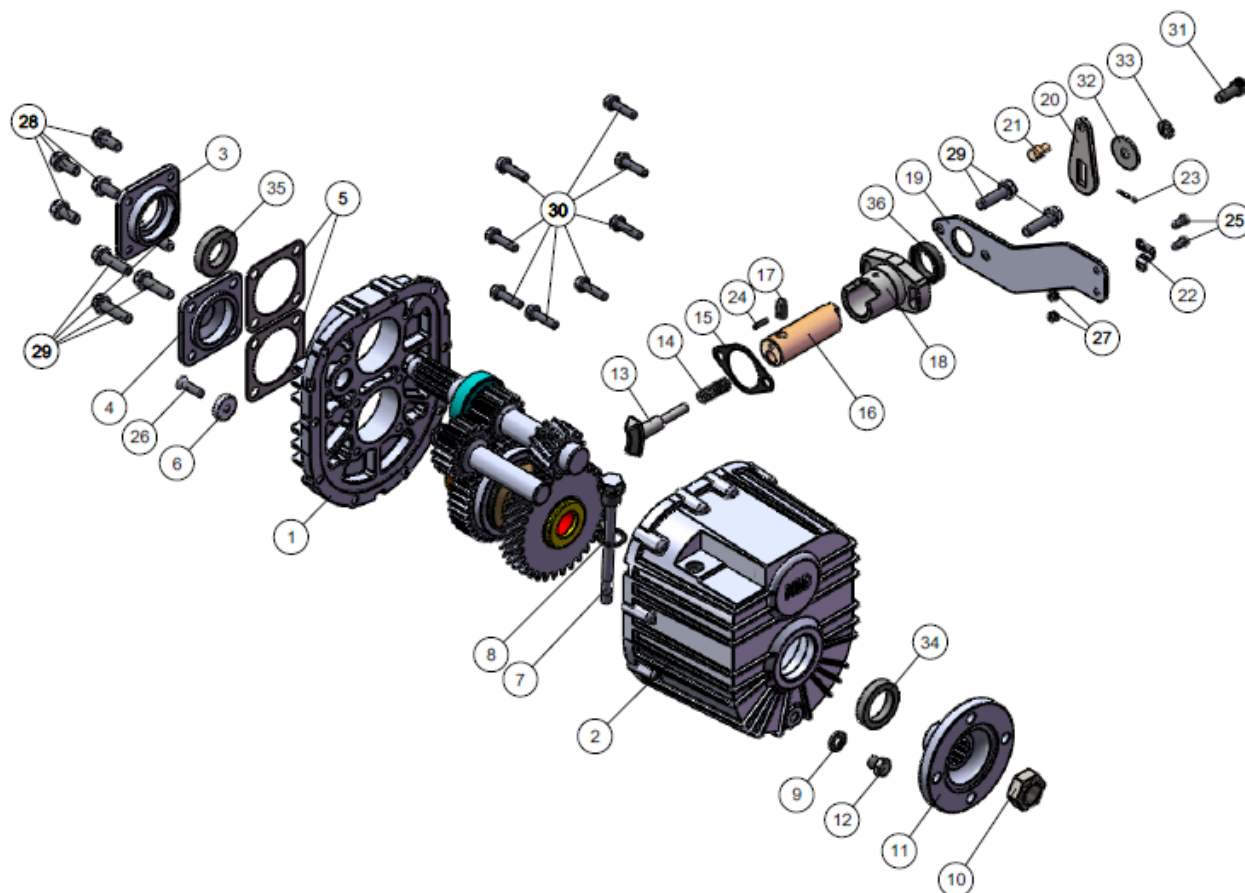
TROUBLESHOOTING

SYMPTOM	CAUSE	REMEDY
High oil temperature	- Improper oil level (high or low)	- Check and fill or drain with proper oil to the correct level.
Excessive noise	- Bearing failure - Improper alignment	- Overhaul marine transmission - Check alignment of engine and transmission and transmission output flange to propeller shaft. Correct as necessary.
Oil escaping from breather	- Oil level too high - Wrong type of oil - Clogging the breather holes	- Adjust oil level - Drain and refill with recommended oil - Remove the foreign substance in the oil gauge

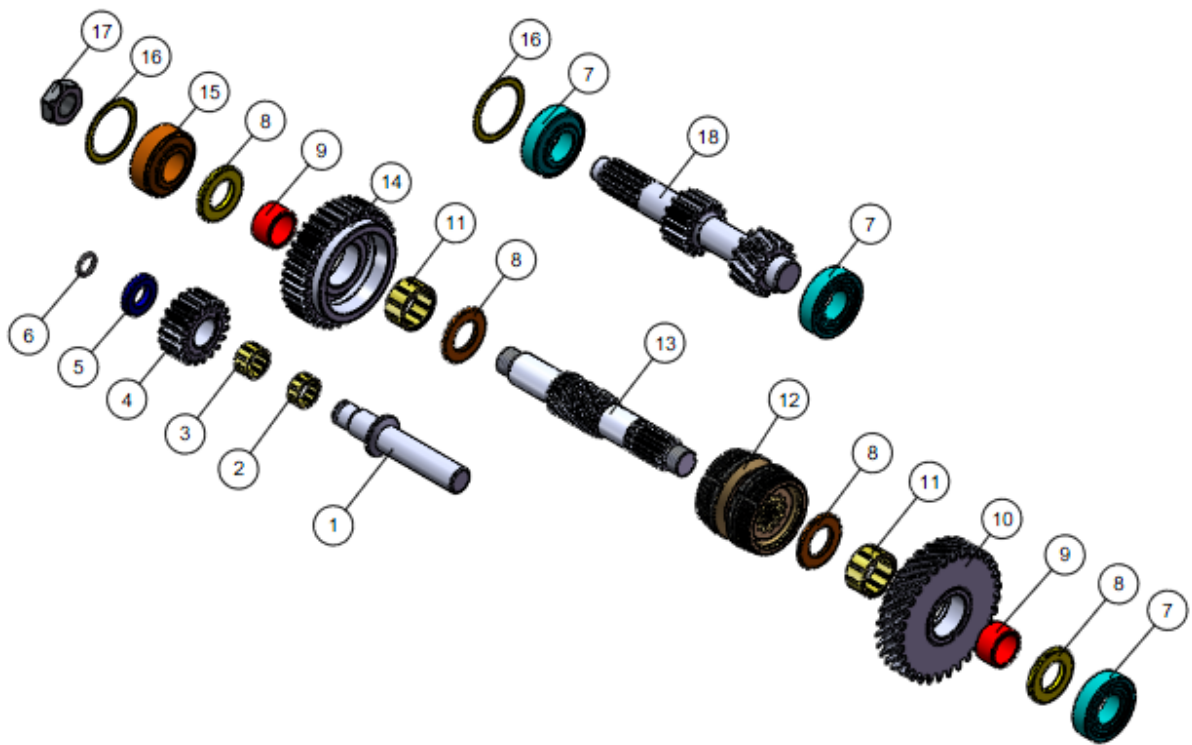
TRANSMISSION PART LIST



REF.NO.	PART NO.	DESCRIPTION	Q'TY	REMARKS.
1	E4250-31004	COVER-CASE	1	
2	E4240-31004	CASE	1	
3	E4190-31003	COVER-OIL SEAL INPUT	1	
4	E4210-31002	COVER-OUTPUT	2	
5	E4510-31000	GASKET-COVER BEARING	1	
6	E4460-31002	WASHER-FLAT HEADED BOLT	1	
7	E4290-31002	GAUGE-TM OIL	1	
8	E0216-03000	SEAL WASHER	1	
9	E0210-03000	SEAL WASHER	1	
10	E4310-31050	NUT ROCKING	1	
11	E4162-32000	FLANGE	1	
12	E1100-12510	DRAIN PLUG	1	
13	E4280-31002	FORK	1	
14	E4520-31000	SPRING	1	
15	E4350-31000	GASKET-HOUSING	1	
16	E4270-31005	SHAFT-CONTROL	1	
17	E4340-31002	PIN-LEVER CONTROL	1	
18	E4260-32000	HOSING-CONTROL	1	



REF.NO.	PART NO.	DESCRIPTION	Q'TY	REMARKS.
19	E4450-31003	BRKT-CONTROL	1	
20	E4360-31003	LEVER-CONTROL	1	
21	AB146	PIVOT	1	
22	ST9565	CLAMP	1	
23	1321-02016	SPLIT PINS	1	
24	1339-03015	SPRING PIN	1	
25	1021-05010	SLOTTED HEAD SCREWS	2	
26	1021-06020	SLOTTED HEAD SCREWS	1	
27	1012-05001	NYLON NUT	2	
28	1042-08018	HEXAGON BOLTS WITH FLANGE	4	
29	1042-08030	HEXAGON BOLTS WITH FLANGE	6	
30	1042-06025	HEXAGON BOLTS WITH FLANGE	8	
31	1003-08020	HEXAGON SOCKET HEAD CAP SCREWS	1	
32	1326-08000	PLAIN WASHERS	1	
33	1324-08000	SPRING LOCK WASHERS	1	
34	2804-30042	OIL SEAL	1	
35	2804-25042	OIL SEAL	1	
36	2804-25035	OIL SEAL	1	



REF.NO.	PART NO.	DESCRIPTION	Q'TY	REMARKS.
1	E4180-32000	SHAFT-IDLE	1	
2	E4370-31000	NEEDLE ROLLER BEARING	1	
3	E4380-31000	NEEDLE ROLLER BEARING	1	
4	E4150-32000	GEAR-IDLE	1	
5	E4220-31003	SPACE(IDLE SHAFT)	1	
6	2805-14000	O - RING	1	
7	E4320-31000	TAPER ROLLER BEARING	3	
8	E4380-31000	SPACE-GEAR	4	
9	E4370-31002	SLEEVE BEARING-GEAR	2	
10	E4112-32000	GEAR FORWARD	1	
11	E4390-31000	NEEDLE ROLLER BEARING	2	
12	E4140-32000	CONE CLUTCH	1	
13	E4171-32000	SHAFT-OUTPUT	1	
14	E4122-32000	GEAR BACKWARD	1	
15	E4330-31000	TAPER ROLLER BEARING	1	
16	E4400-31050	SPACE (END PLAY)	2	
17	E4310-31002	NUT-LOCKING	1	
18	E4131-32050	SHAFT-INPUT	1	21, 23HP
18	E4131-32000	SHAFT-INPUT	1	29, 36HP

To order spare parts for the engine and transmission, please contact HLB CO., LTD

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