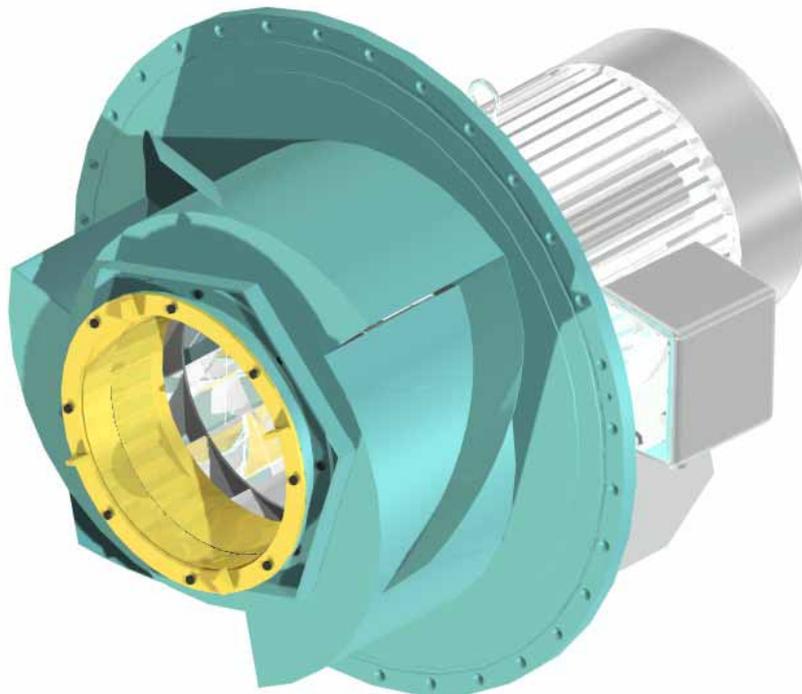


INSTRUCTION MANUAL
FOR
AUXILIARY BLOWER WITH MOTOR



- C O N T E N T S -

AUX - BLOWER

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AUXILIARY BLOWER

A. OPERATION

1. PREPARATION FOR OPERATION

After the fan is left at rest for a long time or subjected to dis - assembly and assembly, carry out the following inspection.

- (1) Make sure that there is no foreign matter in the casing.
- (2) Examine if there is a piece of cloth or another thing which may easily be sucked in, near the suction port.
- (3) Inspect the rotating parts for any contact with fixed parts.
- (4) Check the power source (Voltage, Cycle). Don't supply different cycle, power source with motor specification.

2. STARTING INSPECTION

After starting the fan, carry out the following checks.

- (1) Check to see if the rotating direction is correct.
(This check is not necessary when no reassembling has been carried out.)
- (2) Check for abnormal noise.
- (3) Check for abnormal vibration.

3. TROUBLESHOOTING

When the fan is out of order, care for the fan according to the following table.

No.	Trouble	Probable cause	Remedy
1	Impossible or difficult to start	Mechanical restraint Seizure of bearings Trouble of the motor	Inspect the impeller and related parts to locate the cause. Replace with spare bearings. Check for motor winding disconnection, insufficient voltage, cable disconnection, faulty starter connection, etc.

No.	Trouble	Probable	Remedy
2	Insufficient capacity or motor overload	Dirt and other foreign matter attached to the impeller.	Clean the impeller.
		Rotation reversed.	Correct the rotating direction.
		Air leakage.	Check the air duct connections ect.
		Impeller damaged.	Replace the impeller.
		Insufficient or excessive rotating speed.	Check the motor.
3	Abnormal vibration and noise	Abnormal speed Foreign matter Loose installing bolts Bearing damaged	Check the motor. Remove the foreign matter. Tighten the installing bolts. Replace with spar parts.

4. IF YOU HAVE ANY DOUBTS, PLEASE DO NOT HESITATE TO CONTACT.

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B. MAINTENANCE

1. T/C REAR SIDE MOUNT TYPE FOR B & W ENGINE

(1) MOUNTING OF ELECTRIC MOTOR ON B & W AUXILIARY BLOWER

All item numbers refer to drawing No. H - REAR - 01/02

- 1) Place the motor on a table or flat so that shaft is in a horizontal position and motor shaft is sticking out of the foundation.
- 2) Remove the groove from the motor.
- 3) Lubricate the motor shaft with oil or grease.
- 4) The sealing ring to be pushed over the shaft.
- 5) The motor to be bolted onto the motor plate. The motor bolts should be packed carefully with teflon or fluid packing substance. Do not forget to place the terminal box of the motor correctly in proportion to the drain hole.
- 6) Mount the gaslock - seal (item 11) in the stuffing box (item 7) the lip towards the impeller.
If the Gaslock - seal has already been mounted - check the seal lip.
- 7) Place the Gasket (item 8) between motor plate and stuffing box (item 7) Carefully push the stuffing box over motor shaft and sealing ring without damaging the Gaslock - seal. The stuffing box will automatically centre and then be mounted by means of 6 bolts with washers made of carbon steel. Lubricate the lip carefully with grease from both sides.
- 8) The groove should be shortened to fit the projecting part of the motor shaft.
- 9) The impeller should now be carefully pushed over the shaft, while taking care that the groove and the key way are next to each other.

When the impeller cannot be pushed up any further, it should be pulled into right position by means of a bolt.

- 10) The impeller should be tightened by using a thin washer(5 - 6mm), a lock washer, and a bolt.

NB : The impeller has been dynamically and statically balanced from the factory and must not be damaged in any way

- 11) The inlet cone to be dismantled.

- 12) The GASKET (item 5) to be placed in its right position.

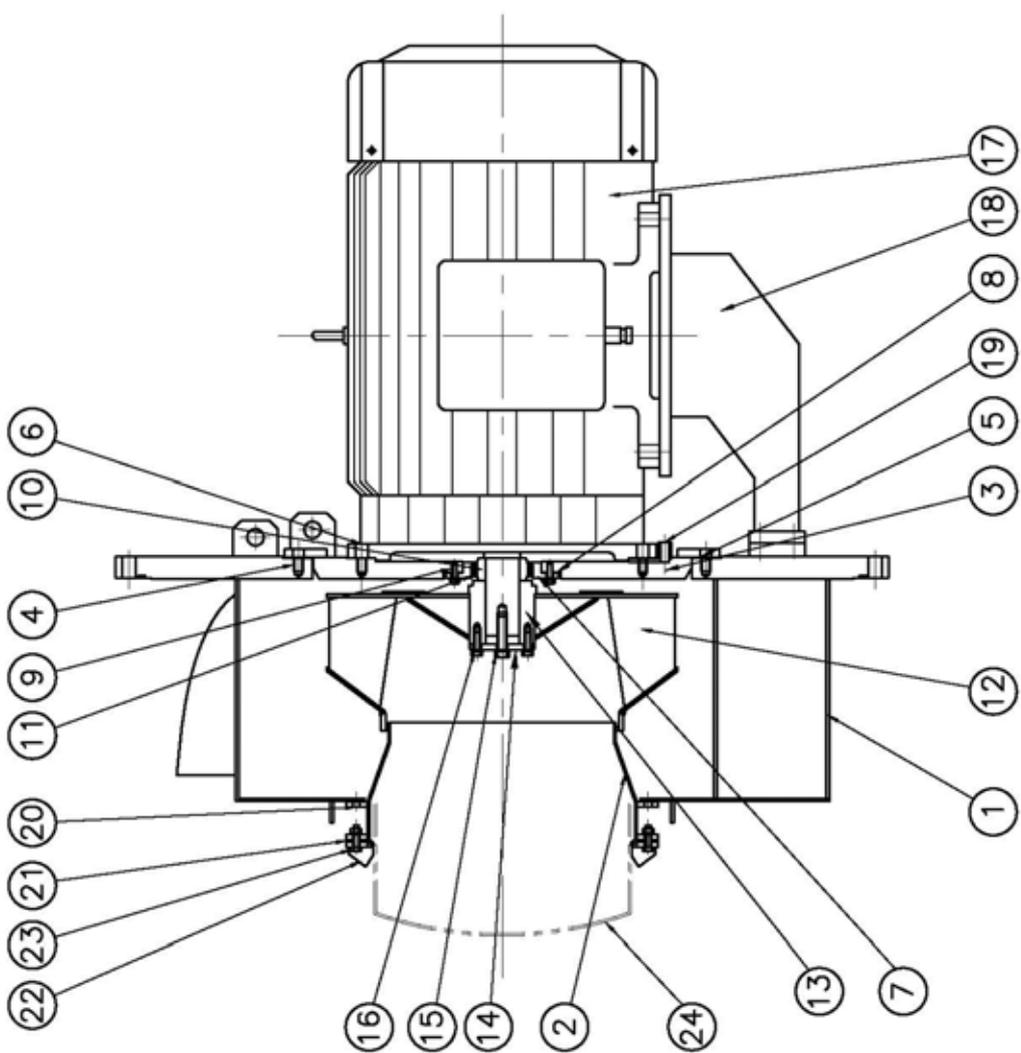
- 13) The motor plate to be lowered onto the fan housing and tightened by means of bolts with washers made of Carbon Steel.

- 14) Mount the inlet cone. Take care, however, that the distance between the impeller and the inlet cone is the same all the way round.

- 15) Turn the impeller manually in order to check that it runs smoothly.

- 16) The motor may now be started in order to check the fan for excess vibration and jarring sounds. With an accelerometer it should be checked that the motor has an effective frequency below 2 mm/sec. Measurements should be made horizontally and vertically on a level with the motor bearings. The impeller has been balanced in accordance with ISO 1940 and with quality class Q better than 6.3.

Testing period 15 - 20 minutes.



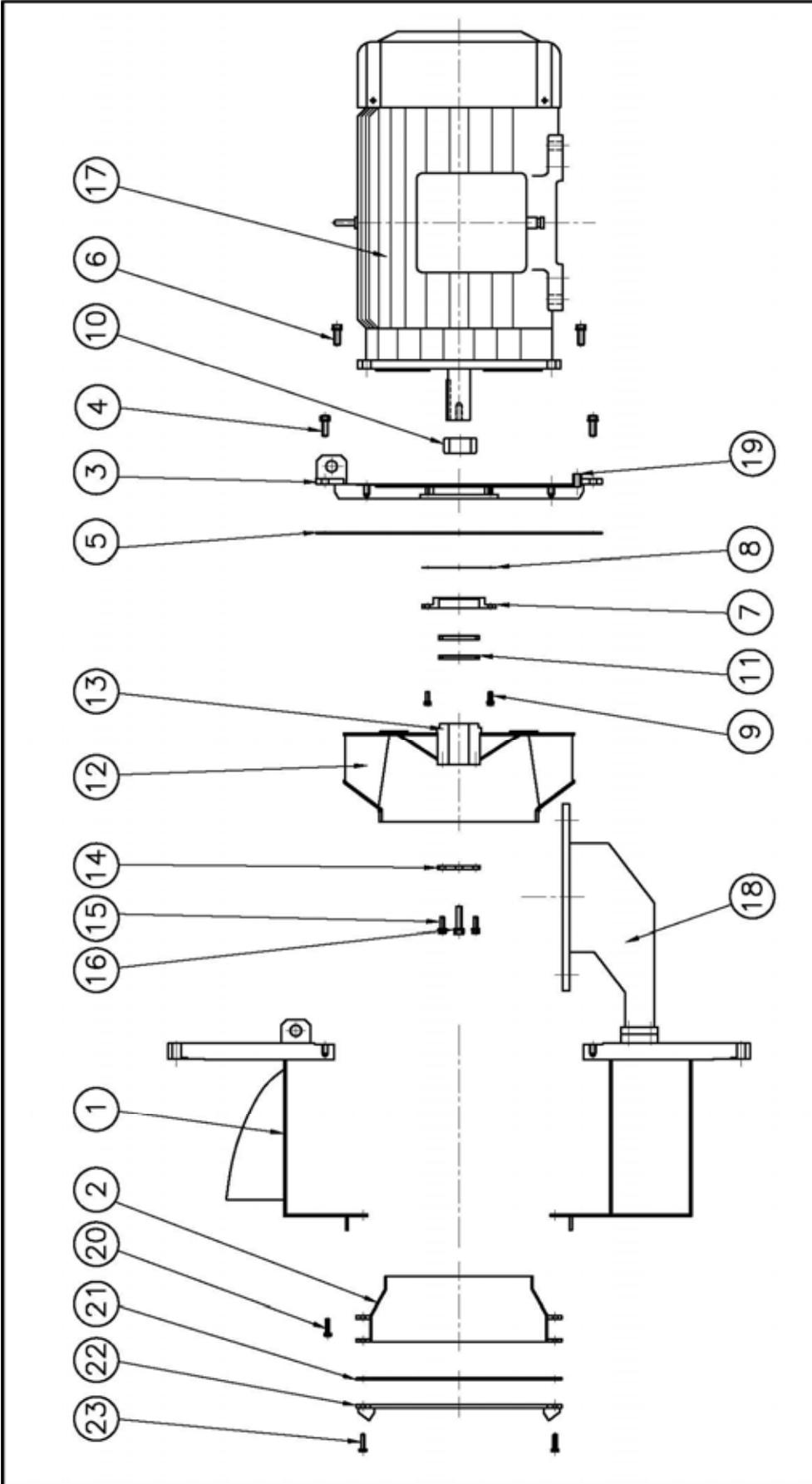
REAR

24	SUCTION DUCT	1			
23	BOLT,S/W	8.8T 8			
22	GUIDE RING	SS400 1			
21	GASKET	RUBBER 1			
20	BOLT,NUT,S/W	8.8T 8			
19	DRAIN	SS400 1			
18	MOTOR BED	SS400 1			
17	MOTOR	1			
16	BOLT,S/W,D,L/W	8.8T 2			
15	BOLT,S/W,D,L/W	8.8T 1			
14	SHAFT CAP	SS400 1			
13	IMPELLER BOSS	A6061P 1			
12	IMPELLER	A5083P 1			
11	GASLOCK SEAL	SS400 2			
10	SEALING RING	SM45C 1			
9	BOLT,S/W	8.8T 6			
8	GASKET	NON-ASBESTOS 1			
7	STUFFING BOX	SS400 1			
6	BOLT, S/W	8.8T 8			
5	GASKET	NON-ASBESTOS 1			
4	BOLT,S/W	8.8T 20			
3	MOTOR SEAT	SS400 1			
2	SUCTION CONE	SS400 1			
1	CASING	SS400 1			
NO.	DESCRIPTION	MAT'L	QTY	SPECIFICATION	REMARKS
MFG. NO.	DATA	CUSTOMER			
DATE	04.03.22	SECTIONAL DWG OF AUX. BLOWER			
QTY	SCALE	TITLE			
	1=12				

H-REAR-01
 DWG. NO.
 3RD ANGLE PROJECTION
 04.03.22 04.03.22 04.03.22

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 Hyundai Marine Machinery Co., Ltd.
 Incheon Korea

DATE	CODE	M E M O	SIGN



NO.	DESCRIPTION	MAT'L	QTY	SPECIFICATION	REMARKS
MPG. NO.	DATA	CUSTOMER			
	04.03.22				
QTY	SCALE	TITLE			
	1/15	MAINTENANCE DWG. OF AUX. BLOWER			
DWG. NO.	SID ANGLE	DATE			
H-REAR-02	30°	04.03.22			



Hyundai Machine Machinery Co., Ltd.
Inchon Korea

DATE	CODE	MEMO	SIGN
	△		
	△		
	△		

2. T/C AFT SIDE MOUNT TYPE FOR B & W ENGINE

(1) MAINTENANCE OF B&W AUXILIARY BLOWERS

The auxiliary blowers usually consist of the following main components which are shown on drawing No. H - AFT - 01/02/03

- 1) Blowers.
- 2) T - connection.
- 3) Electric motors.

Your attention is drawn to the fact that some of the minor types of diesel engines do not require compensator and suction box.

1) Blower.

The blower part consists of the following.

Scroll housing made of heavy steel plate.

Impeller in special welded alu. - alloy.

Suction cone.

Tightening device, intended for pressure of up to 5 Bar

Motor plate.

Motor.

2) T - connection.

The T - connection, which is made of heavy steel plate, serves as connection piece between the two blowers as well as connection to the outlet pipe of the air cooler.

The pressure opening surfaces of the two blowers have a parallelism better than 0.1 mm. The parallelism is maintained by 8 conical guide pins, which should be treated carefully when re - mounting.

(2) MOUNTING OF AUXILIARY BLOWER

- 1) The two fans have been mounted on the T - connection from the factory and should not be separated.**

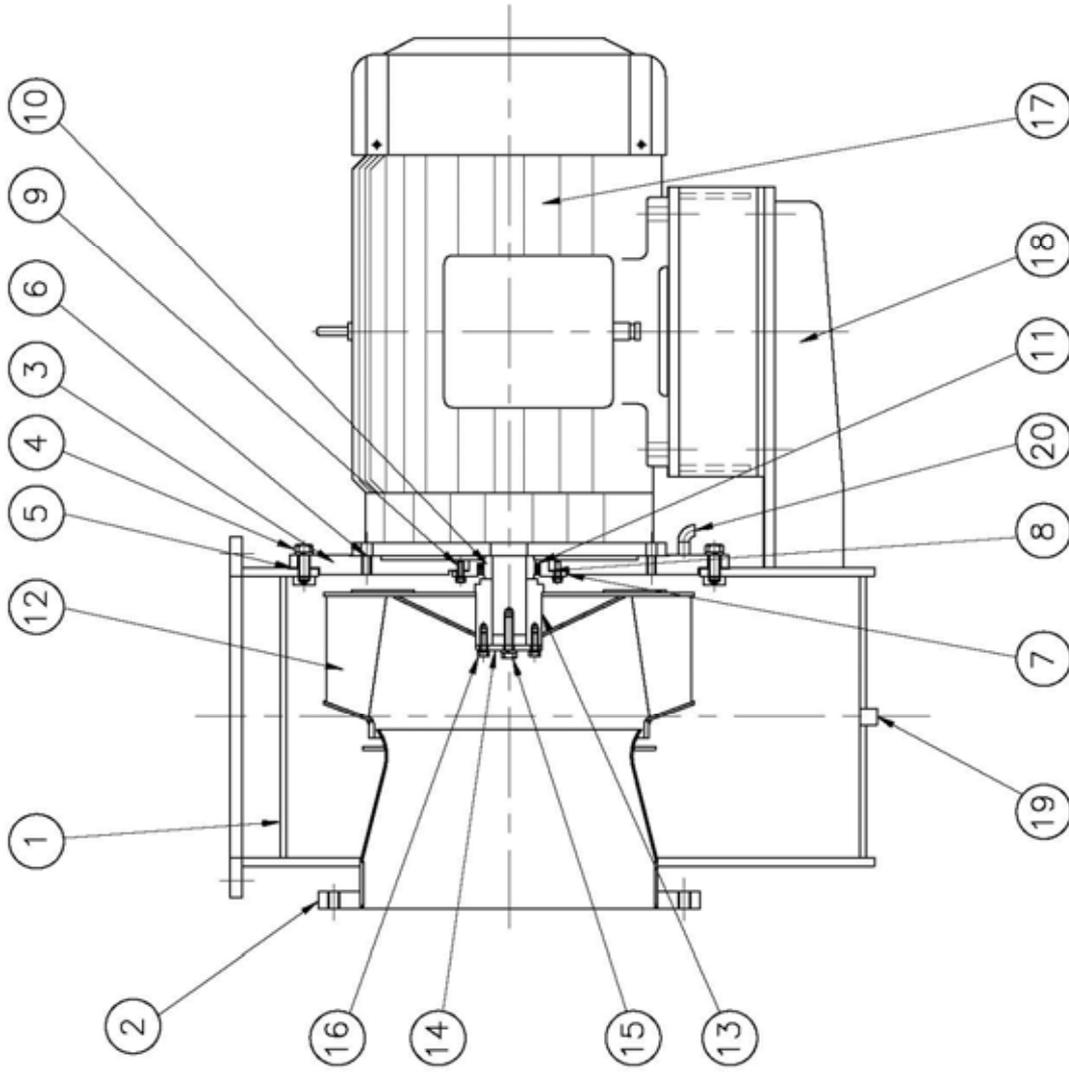
- 2) Lift the whole unit to its right place.
Tighten blowers loosely onto diesel engine.
Tighten all bolts properly.**

- 3) Mount the suction pipe from the air cooler.**

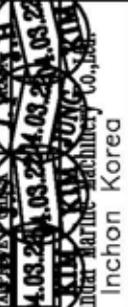
- 4) The unit is now ready to be put into operation.**

- 5) During operation the mechanical seal, which consists of Sealing ring (item 10) and Gas lock seal (item 11), will leak a bit considerable leakages indicate that the Gas lock seal is worn out and should be replaced. During this replacement the Sealing ring should be turned so that the seal gets to work at another spot on the sealing ring.**

NB : The fans are in right and left position respectively, wherefore the impellers must not be reversed. The impellers are marked with the serial number of the fan.



NO.	DESCRIPTION	MAT'L	QTY	SPECIFICATION	REMARKS
20	DRAIN	SS400	1		
19	DRAIN	SS400	1		
18	MOTOR BED	SS400	1		
17	MOTOR		1		
16	BOLT,S/W,D,L/W	8.8T	2		
15	BOLT,S/W,D,L/W	8.8T	1		
14	SHAFT CAP	SS400	1		
13	BOSS		1		
12	IMPELLER	A5083	1		
11	GASLOCK SEAL	THERMO-ELASTIC	2		
10	SEALING RING	SM45C	1		
9	BOLT,S/W	8.8T	6		
8	GASKET		1		
7	STUFFING BOX	SS400	1		
6	MOTOR FIXING BOLT,S/W	8.8T	8		
5	GASKET		1		
4	BOLT,S/W	8.8T	20		
3	MOTOR SEAT	SS400	1		
2	SUCTION CONE	SS400	1		
1	FAN CASING	SS400	1		

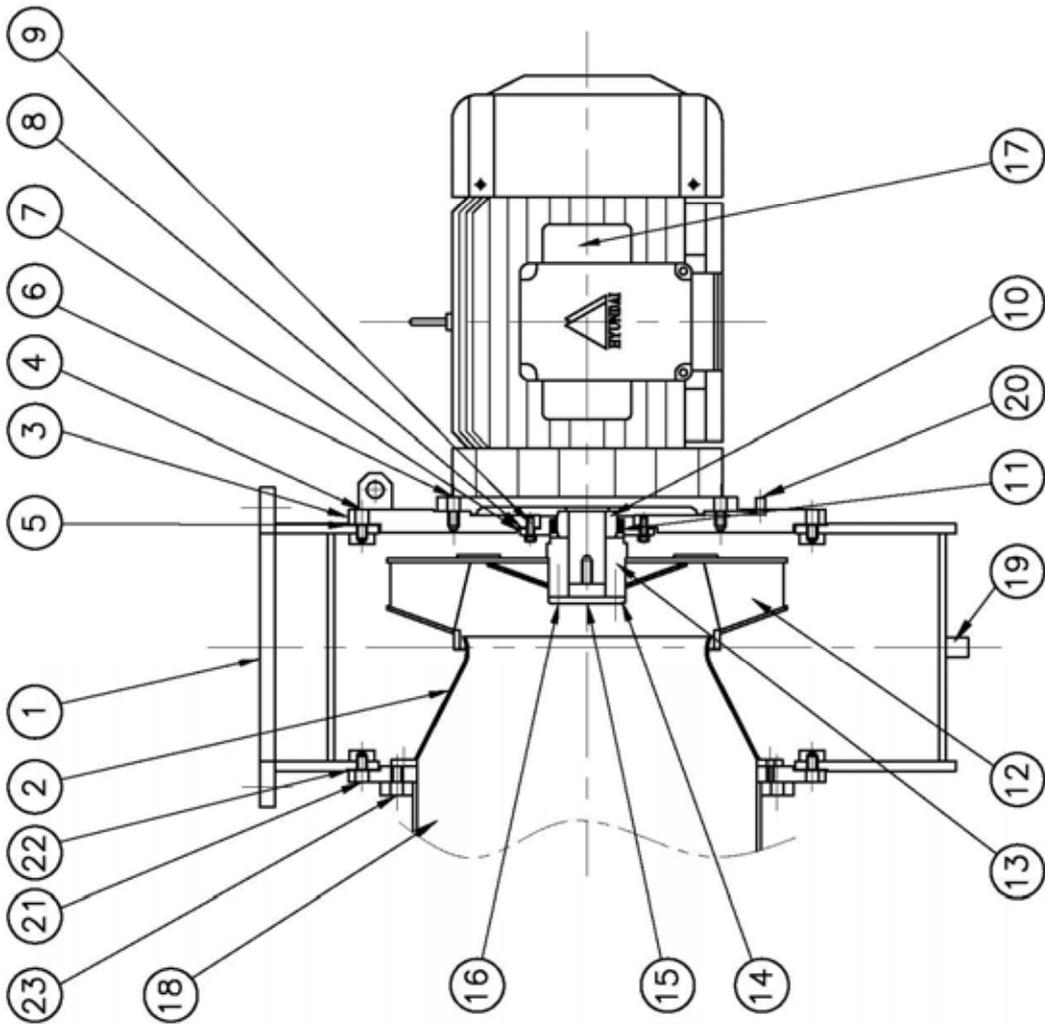
MFG. NO.		DATA		CUSTOMER	
QTY		SCALE		TITLE	
DWG. NO.		1-12		SECTIONAL DWG OF AUX. BLOWER	
H-AFT-01		3RD ANGLE		 	

AFT



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Incheon Korea

DATE	CODE	MEMO	SIGN
	A		
	A		
	A		



NO.	DESCRIPTION	MAT'L	QTY	REMARKS
23	HEXAGON WRENCH BOLT, S/W	8.8T	20	
22	GASKET		1	
21	BOLT, S/W	8.8T	20	
20	DRAIN		1	
19	DRAIN		1	
18	T-DUCT	SS400	1	
17	MOTOR		1	
16	BOLT, S/W	8.8T	2	
15	BOLT, S/W, D.L./W	8.8T	1	
14	SHAFT CAP	SS400	1	
13	BOSS	A6063P	1	
12	IMPELLER	A5083P	1	
11	GASLOCK SEAL	THERMO-ELASTIC	2	
10	SEALING RING	SM45C	1	
9	BOLT, S/W	8.8T	6	
8	GASKET		1	
7	STUFFING BOX	SS400	1	
6	MOTOR FRING BOLT, S/W	8.8T	8	
5	GASKET		1	
4	BOLT, S/W	8.8T	20	
3	MOTOR SEAT	SS400	1	
2	SUCTION CONE	SS400	1	
1	FAN CASING	SS400	1	

H-AFT-02
 SECTIONAL DWG OF
 AUX. BLOWER
 HMMCO
 Hyundai Machine Machinery Co., Ltd.
 Inchon Korea
 DATE: 03.12.03
 SCALE: 1=10
 CUSTOMER:

AFT

DATE	CODE	MEMO	SIGN

3. T/C REAR SIDE MOUNT TYPE FOR SULZER ENGINE

(1) MAINTENANCE OF SULZER AUXILIARY BLOWERS

The auxiliary blowers usually consist of the following main components which are shown on drawing No. H - WCH - 01/02/03

- 1) Blowers.
- 2) Joint duct.
- 3) Suction box.
- 4) Electric motor.

Your attention is drawn to the fact that some of the minor types of diesel engines do not require compensator and suction box.

1) Blower.

The blower part consists of the following.

Scroll housing made of heavy steel plate.

Impeller in special welded alu. - alloy.

Suction cone.

Tightening device, intended for pressure of up to 5 Bar

Motor plate.

Motor.

2) Joint duct.

The joint duct consists of two mounting flanges.

3) Suction box.

The suction box consists of a heavy steel box direct mounting onto the main motor, plus an inspection cover.

The function of the suction box is to combine outlet of the air cooler with the inlet of the auxiliary blower.

(2) MOUNTING OF AUXILIARY BLOWER

1) Mount joint duct onto suction box.

(Small flange towards suction box.)

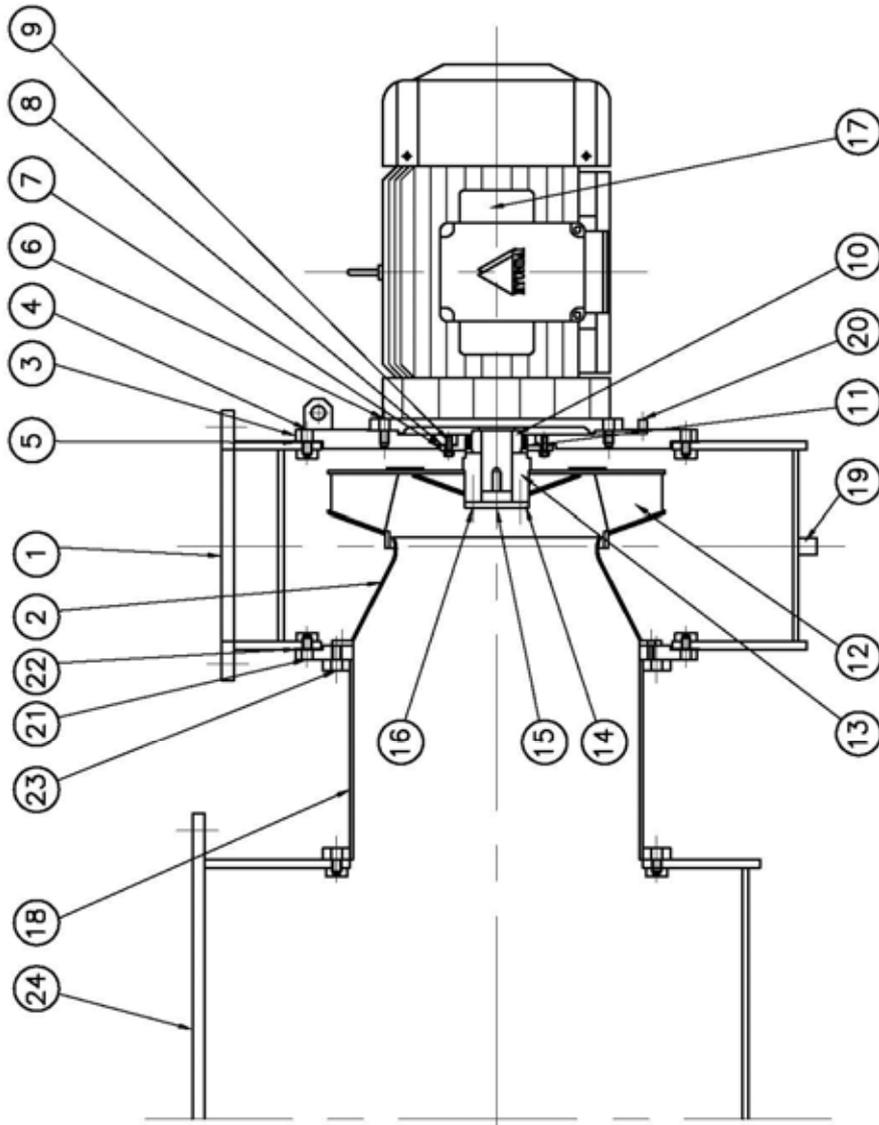
2) Mount suction box onto diesel engine.

3) Lift the blower to it's right place and push it towards the joint duct.

Tighten blower loosely onto diesel engine.

Tighten joint duct onto blower so that it does not suffer any harm.

The unit is now ready to be put into operation.



24	SUCTION BOX	SS400	1
23	HEXAGON WRENTH BOLT, S/W	8.8T	20
22	GASKET		1
21	BOLT, S/W	8.8T	20
20	DRAIN		1
19	DRAIN		1
18	SUCTION DUCT	SS400	1
17	MOTOR		1
16	BOLT, S/W	8.8T	2
15	BOLT, S/W, D.L/W	8.8T	1
14	SHAFT CAP	SS400	1
13	BOSS	A6063P	1
12	IMPELLER	A5083P	1
11	GASLOCK SEAL	THERM-ELASTIC	2
10	SEALING RING	SM45C	1
9	BOLT, S/W	8.8T	6
8	GASKET		1
7	STUFFING BOX	SS400	1
6	MOTOR FIXING BOLT, S/W	8.8T	8
5	GASKET		1
4	BOLT, S/W	8.8T	20
3	MOTOR SEAT	SS400	1
2	SUCTION CONE	SS400	1
1	FAN CASING	SS400	1

NO.	DESCRIPTION	MAT'L	QTY	SPECIFICATION	REMARKS
MPG. NO.	DATA	CUSTOMER			
QTY	SCALE	SECTIONAL DWG OF AUX. BLOWER			
	1=12				
DWG. NO.	H-WCH-02				
DATE	04.03.22				
DATE	05.12.01				
DATE	05.12.01				
DATE	05.12.01				

WCH



Hyundai Marine Machinery Co., Ltd.
Inchon Korea



DATE	CODE	MEMO	SIGN

4. INSTRUCTION FOR DISMOUNTING & MOUNTING OF IMPELLER

(1) INSTRUCTIONS FOR DISMOUNTING OF IMPELLER ON AUXILIARY BLOWER

In the following it is recommended to see drawing No.

H - REAR - 01/02, H - AFT - 01/02/03, H - WCH - 01/02/03

- 1) The electric connection of the motor to be dismantled.
- 2) The bolt on the motor to be loosened, and motor, motor plate, and impeller to be raised from the scroll casing by means of a stable lifting device.
- 3) The bolt on the motor shaft to be loosened and removed together with the spring plate.
- 4) Dismounting tool - as shown on the enclosed sketch No. H - TOOL - 01 to be mounted on the hub of the impeller by means of 2 bolts which are screwed into the belonging threaded holes.
- 5) A strong disk is to be placed between the motor shaft and the dismantling tool in order not to damage the threaded hole in the motor shaft.
- 6) The impeller to be carefully drawn out by means of tightening the middle bolt.
- 7) Under normal conditions the sealing ring remains on the motor shaft. However, it comes off when dismantling the impeller, the motor plate must be dismantled from the motor and the sealing ring must be mounted on the motor shaft. The motor can now be mounted, however, please take care not to damage the sealing ring.

**(2) INSTRUCTIONS FOR DISMOUNTING OF IMPELLER ON AUXILIARY BLOWER
FOR MAIN DIESEL ENGINES**

In the following it is recommended to see drawing No.

H - REAR - 01/02, H - AFT - 01/02/03, H - WCH - 01/02/03

Please note that the new impeller has been statically and dynamically balanced from the factory, and therefore the impeller must not be exposed to thrust or other overload.

- 1) Grease the motor shaft with oil.
- 2) The impeller to be pressed over the motor shaft by means of a bolt and a washer plate. Please make sure that the groove fire opposite the key groove.
- 3) The impeller to be held by means of the original spring plate and bolt.
- 4) Motor plate to be lifted up carefully from the foundation and to be turned horizontally
- 5) The packing between the scroll casing plate and the motor plate to be examined for porosities and cracks. In case of a defect packing has to be replaced. Please use a corresponding quality.
- 6) Impeller, motor, and motor plate to be mounted on the scroll casing plate once more. Please or take precautionary measures in order not to damage motor or impeller resulting in unbalance.
- 7) The motor can now be electrically connected again.

ELECTRIC MOTOR

A. OPERATION

1. PREPARATION FOR OPERATION

If the motor to be operated has been at rest for a long time or disassembled and reassembled, pay attention to the following.

- (1) Check to see that rotary parts such as fan are secured positively, motor installation is satisfactory, and there is no abnormality on the machine to be driven by the motor.
- (2) Check to see that terminal connections of the motor are sufficiently tight, and insulation distance between dissimilar poles and ground is not badly small.
- (3) Check to see that there is no contact between rotary and stationary parts.
On such motor that has small gaps between the rotor and the stator, both may be brought into contact by wear of the bearing, and the stator coil burned out by the resulting heat generation.
- (4) Check to see that bearings are normal.
- (5) Check to see that there is no ingress of dust or dirt or foreign matter in the apparatus.
- (6) Check to see that there is no part of deteriorated insulation.
- (7) Measure the insulation resistance. If the measurement is lower than specified, dry by proper method.
- (8) Check to see that the machiner to be driven by the motor is ready for operation.
- (9) Check to see that the direction of rotation of the motor is correct. If the rotating direction is reverse in the case of the 3 phase motor, change the connection of wires for two phases with each other.

2. STARTING

After finishing the preparation for operation, confirm the load to be ready for starting. Then, turn on the power switch, and after signalling to the rotary part, operate the operate switch to start the motor points requiring attention during operation are as follows.

(1) The condition of load, and temperature measurement.

If the motor is provided with an ammeter, the condition of load can be known by use of meter. If no ammeter is available.

Hear sound or know the temperature of the stator frame.

Note that if an overload is sustained, the temperature of various parts exceeds the specified value.

Table 1

Temperature Rise at AC Machine Stator Windings Rated below 1,000V

(° C)

RULE	MEASUREMENT	TYPE OF MACHINE					
		Not totally enclosed			Totally enclosed		
		CLASS OF INSULATION					
		F	E	B	F	E	B
NK (1979)	T	75	55	60	80	60	65
	R	90	65	70	90	65	70
ABS (1978)	R	95	60	70	100	65	75
LRS (1979)	T	80	55	60	80	55	60
	R	90	65	70	90	65	70
NV (1980)	T	75	55	60	75	55	60
	R	90	65	60	90	65	70

T=Measurement by thermometer

R=Measurement by resistance

(2) Sound

The sound of the motor gives a good indication of the condition of rotation. Especially, the sound of the bearing part is useful in determining troubles. To hear the sound of the bearing part correctly, apply a metal bar, one end to the bearing part and the other to the ear.

(3) Vibration

The vibration give another indication of the condition of rotation. Abnormal vibration of the motor during operation is caused either magnetically or mechanically. Probable magnetic causes are an air gap unbalance between the rotor and stator which causes a magnetic attractive force to be exerted between cores resulting in a vibration of the rotor, ground or wire break which causes a current unbalance to develop, misalignment of magnetic center, ect. Probable mechanical causes are brought about a mechanical unbalance of the rotor, improper installation of the coupling between the motor and the load (improper centering), loosened motor mounting bolt, improper bearing part, ect. The rotor is fully balanced during manufacture, and with normal care it should not be unbalanced.

3. STOPPING

Confirm the load lobe ready for stopping, and after signalling, operate the operate the operating switch to stop the motor.

4. CARE AFTER STOPPING

After stopping, pay attention to the point given in the paragraph " Preparation for operation. "

5. TROUBLESHOOTING

Trouble	Cause	Remedy
Failing or difficult to start	Mechanical restriction or overload.	Disconnect the motor from the load. Try to rotate by hand and if it is difficult, the cause is a mechanical restriction. Disassemble and investigate. If the motor without the load can be started, check the load.
	Stator winding broken	Replace with a spare one.
	Switch in poor contact	Measure the motor terminal voltage and read the voltmeter on the switchboard. If it is lower than specified, raise.
	Fuse blown out	Replace with a spare one.
	Switch in poor contact	Readjust contact part or replace with a spare one.
	Connecting wire broken	Reconnect.
	Over current relay operated	Remove the cause and reset.
	Bearing binding	Replace with a spare one.
Overheating of bearing part	Grease deteriorated or contaminated	Replace with a spare one.
	Ball bearing damaged	Replace with a spare one.
	Misalignment	Alignment.
Abnormal sound or abnormal vibration	Belt too tightened	Reduce belt tension.
	Heat conducted from other part	Investigate the cause for overheating of rotor or stator.

Trouble	Cause		Remedy
Abnormal sound or abnormal vibration	Abnormal	Frequency variation	Check and adjust the line frequency to the rated value.
		Load variation	Check and adjust the machine.
	Air gap part in contact		Replace bearing with a spare part. Check for bearing of shaft.
	Ingress of foreign		Remove foreign matter.
	Vibration or rotor	Loosened mounting bolt	Retighten.
		Misalignment of direct connected machines	Realignment.
		Unbalance	Rebalance.
	Air gap in unbalance		Replace bearing with a spare part. center bracket with frame.
	Magnetic sound	Beating due to overload loosened Laminated core	Check and adjust load. Disassemble and repair.
	Abnormal sound from ball bearing	Corroision of ball with retainer	Readjust or replace bearing
		Grease deteriorated	Replace with a spare one.
		Ball surface damaged damage by electrolytic corroision	Replace with a spare one.
		Ingress of foreign matter	Clean bearing and repack with grease.

Trouble	Cause	Remedy
Overheating	Overload	Reduce load to or below rated value.
	Cooling fan defective	Disassemble and repair.
	Ventilating hole clogged	Remove dust or dirt accumulation.
	Friction between rotor and stator	Replace bearing with a spare part. Readjust air gap uniform by centering bracket with frame.
	Coil grounded	Disassemble and repair coil.
Inundation		Disassemble and water wash to remove contaminant, then reassemble and dry in the case of inundation by sea water, wash and clean in hot water at 60. C to 70. C to remove salt, then reassemble and dry.

B. MAINTENANCE

1. PERIODICAL MAINTENANCE CHART

Interval	Checking of	Standard checking procedure	Standard corrective measure
Daily	Major motor in use	Check for vibration and sound, and the temperature of bearing etc. by touching by hand.	If abnormal vibration, sound or bearing heating is noted, investigate the cause and repair. If overload or other abnormality is noted, stop at once and remove the cause.
Weekly	Major motor not in use Removal electric apparatus	Rotate the motor by hand and check for abnormality. Measure insulation resistance. Check ground connection.	If abnormality is noted, investigate the cause and repair. If insulation is deteriorated or ground connection is im and repair
Monthly	Motor and stater	Measure insulation resistance. Check stator and rotor loosened connection. Check lubrication part.	If insulation is deteriorated, investigate the cause and repair. Clean contaminated area. Add grease and replace bearing.
3 - monthly	Electric circuit	Measure insulation resistance.	If the measurement is below the allowable limit given below, dry or otherwise correct. (1) Circuit rated about 100V: 1 Mohm or greater

Interval	Checking of	Standard checking procedure	Standard corrective measure
3 - monthly	Electric circuit	Measure insulation resistance	(2) Circuit rated below 100V: 1/3 Mohm or greater
6 - monthly	Apparatus associated with motor	Check operation starter and accessory apparatus. Check contact connections.	If operation is abnormal, investigate the cause and repair. Repair defective or burned part. If necessary, replace with a spare one. Retighen loosened connection.
	Motor	Check for loosened bolt or nut in the base mounting part, joint, cover mounting part, etc. and for correction.	Retighen loosened bolt or nut. Replace defective blot or nut with a now one.
Yealy	Motor	Measure air gap between stator and rotor. Check for abnormality in bearing part.	Replace defective bearing with a spare part, Clean shaft and bearing
	Spare part	(1) Check the number. (2) Measure insulation resistance.	(1) Check with parts list. (2) If insulation is deteriorated, investigate the cause and dry or otherwise correct.

2. MAINTENANCE AND REPLACEMENT OF BALL BEARING ON THE MOTOR

The ball bearing with grease sealing plates is packed with grease during manufacture, and should not require addition of grease during operation, unlike the conventional open type bearing.

The ball bearing requires replacement if it produces badly abnormal during operation. The procedure for bearing replacement is as given below.

After disassembling the motor by the procedure given later, remove the defective bearing from the rotor shaft by use of a bearing puller.

Anti-rust grease on the surface of the replacement bearing should be removed with a cloth. Mount the new bearing on by the shock.

During this procedure, be careful not to give shocks to the sealing plate, as the sealing plate may be deformed or dropped by the shock.

However desirably the bearings may be in use, it is unavoidable for them to be damaged by fatigue. Nevertheless, an adequate operating method can reduce the fatigue or can prevent failures due to other causes. Besides, should a damage to be taken, the cause should be examined in view of the appearance and character of the damaged part. and care must be taken not to allow the same trouble to be repeated.

It is very difficult to locate the cause of a trouble, which is usually attributable to a combination of several causes.

No.	Trouble	Characteristic	Probable cause
1	Noise	Low noise (rustle or rumble)	Dents formed on the race face owing to careless installation.
			Dents formed on the race face by external vibration while the fan is at rest
		High - pitched noise	Too small clearance
		Intermittent noise	Foreign matter included
			Resonance due to careless assembly about the housing
2	Abnormal temperature		Insufficient clearance during operation
			Overload
3	Crack	Axial crack on the or outer ring	Too tight fitting
			Uneven installing surface
			Housing deformation
		Circumferential crack on the inner or outer ring	Uneven installing surface
			Extreme overload
Irregular crack	Crack on the retainer or ball due to grease aging		
4	Indentation on the race face	Indentation of the same pitch as the ball	Knock during installation
			Great blow struck on the bearing while the fan is at rest
5	Retainer damaged		Grease aging
			Ball damaged
			Rivet damaged by vibration
6	Rust	local spots on the race face	Corrosion by acid or moisture while the fan is at rest for a long time
		Surface rust	Incomplete contact (Faulty fitting)

3. DISASSEMBLY AND REASSEMBLY IF THE MOTOR]

To disassemble the motor, proceed as follows.

- (1) Disconnect the motor from the power supply.
- (2) Remove the direct coupling, and place the motor in a area suitable for disassembling.
- (3) Remove the bearing cover and the oil thrower on the direct coupled side.
- (4) Remove the bearing bracket.
- (5) Pull out the rotor as a whole in the direction toward the fan.
- (6) Place the rotor on a clean stand, and pull out the ball bearing with a tool.

Be careful not to contaminate disassembled bearing part, etc. with dust or dirt. Also, take care not to damage the insulation when pulling out the rotor.

The reassembly should be done by reversing the disassembling procedure, taking care to insure positive assembling of bearing part or other fits.

4. DRYING

Before starting the motor which has been at rest long or is suspected of moisture absorption, measure the insulation resistance of the winding and if the measurement is below the limit given below, it is necessary to dry the winding by the procedure given in the following paragraphs.

Circuit rated above 100V:1 Mohn or greater

Circuit rated below 100V:1/3 Mohn or greater

- (1) Hot air or external heating method :

Place a well ventilated sheet over the motor.

The insulation should not be heated about 90. C

- (2) Current method:

With the rotor locked, apply a low voltage to allow a short circuit current to flow in the winding. The winding is then dried by its own heat generation. Start at low current, increasing the current gradually until the temperature approaches 90. C, then keep the current

so that the insulation resistance reaches a constant value safely.

5. TRIAL RUNNING OF THE MOTOR

The motor which has been dried or disassembled and reassembled should be cleaned thoroughly, checked for loosened screw, etc. and then placed in trial running.

If the trial running is satisfactory, the motor may be directly coupled with the load.

6. REFERENCE

(1) Insulation resistance test for stator winding

Remove the cables from terminals and measure resistance between earth and stator winding by D. C. 500V megger.

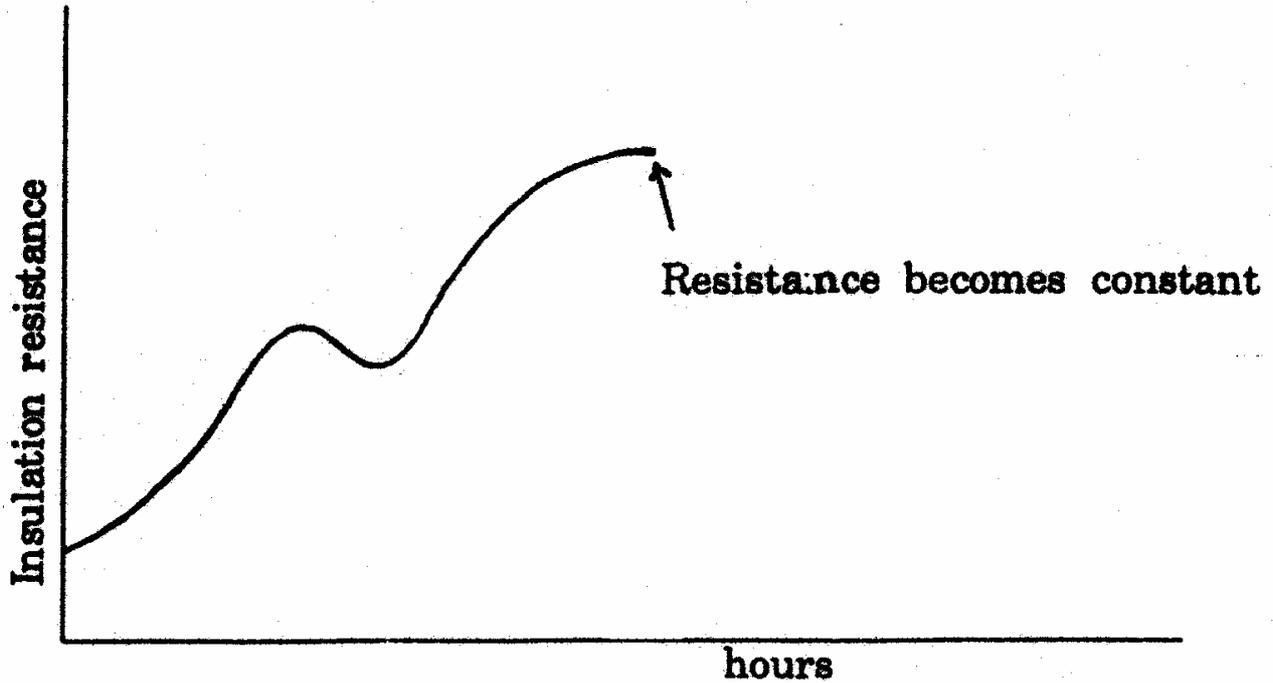
The resistance should be more than follows.

$$R = \frac{\text{Machine rated voltage} \times 3}{\text{Machine rated output(kw)} + 1000}$$

Note : R : Insulation resistance for stator winding.

If the resistance is too low (less than 1 M) it should be dried by the procedure of item 4.

Typical trend of insulation resistance.



Caution

1. During drying, carefully heat up to exceed 90. C at any points of winding.
2. It should be continued to dry that the resistance measured are saturate.

(2) Re - greasing

Following grease should be used. Refer to the attached Table 2.
Recommended Grease.

(3) Period of re - greasing

Operate frequently	Every 3 month
Operate intermittently	Every 6 month

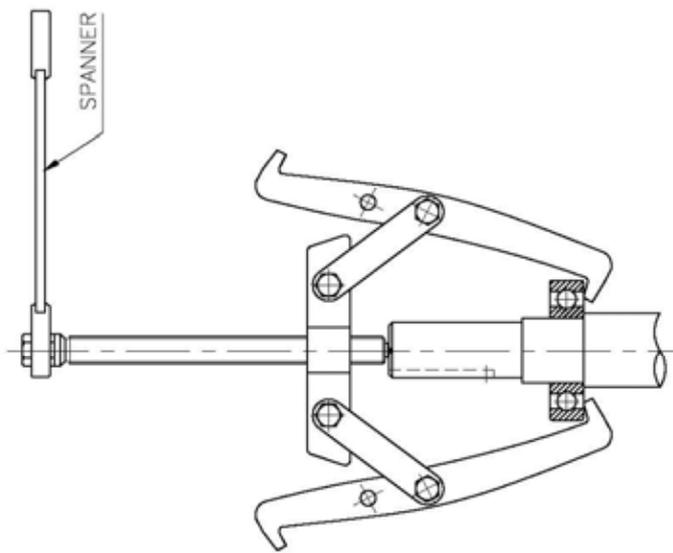
Table 2.

RECOMMENDED GREASE

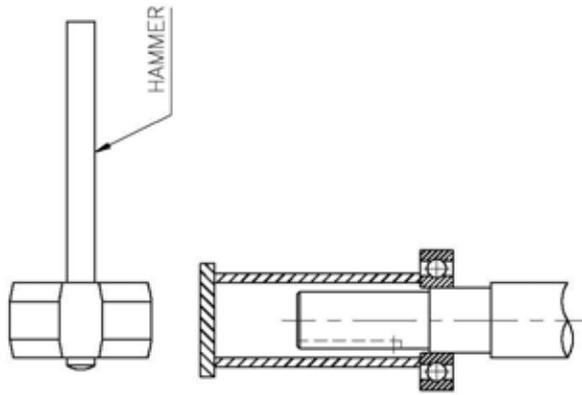
Manufacturer	Insulation Class E. B.		Insulation Class F	
	Grease	Soap	Grease	Soap
NIPPON OIL	MULTINOC NO.2	NITUM	MULTINOC WIDE 2	LITUM
MARUXXEN OIL	WR - 3	NATRIUM	WR - 3	NATRIUM
IDEMISHUKOSAN	DAPHNR CORONEK GREASE NO.2	LITUM	DAPHNE GERASE	BENTON
ESSO	REACON NO. 325	LITUM	TEMPREX N2	LITUM
SHELL	ALVANIA NO. 2	LITUM	DOLIUM GREASE 2	PORIYUA
MOBIL	MOBILUX NO. 2	LITUM	MOBIL GREASE 28	CARBURETTING HYDROCARBON
DAIKYO OIL	DAINAMIC GREASE MP - 2	LITUM	DAINMIC GREASE MP - 2	LITUM
ANTER	MULTISERVICE	LITUM		
BP	BP ENEREASE LS - 2	LITUM	BP ENERGREASE HTB 2	BENTNITE
CALTEX	REGAL STARFAL PREMIUM NO. 2			
CASTROL	CASTROL SPHEEROL AP2			
CHEVRON	DURA - LITH GREASE 2	LITUM		
TEXACO	TEXACO REGAL AFB2			
GULF	GULF CROWN GREASE N2	LITUM		
TOTAL	TOTAL MULTIS EP22			
MISHUBISHI OIL	DIAMOND MULTIPUROPOSE GREASE NO.2	LITUM	DIAMOND MULTIPUROPOSE GREASE NO. 2	

4) Assembly and re-assembly of bearing

4-1) Re-Assembly

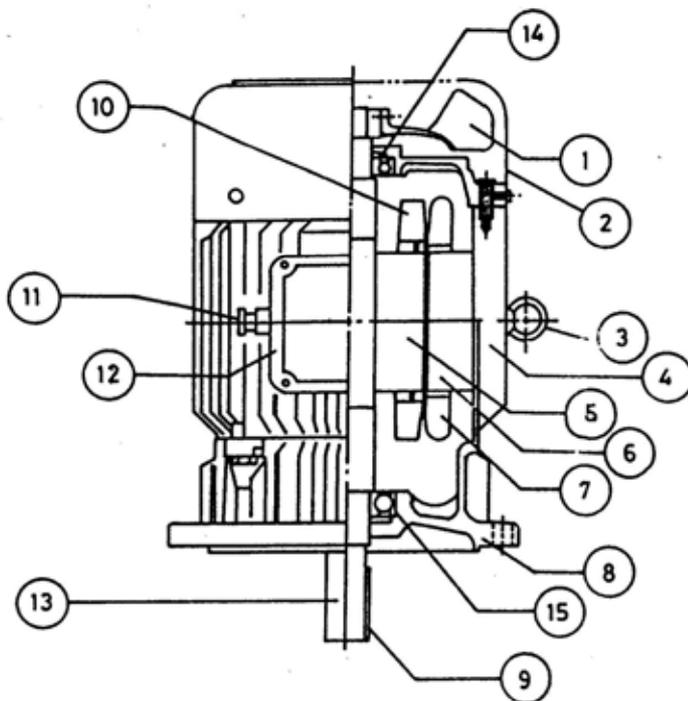


4-2) Assembly

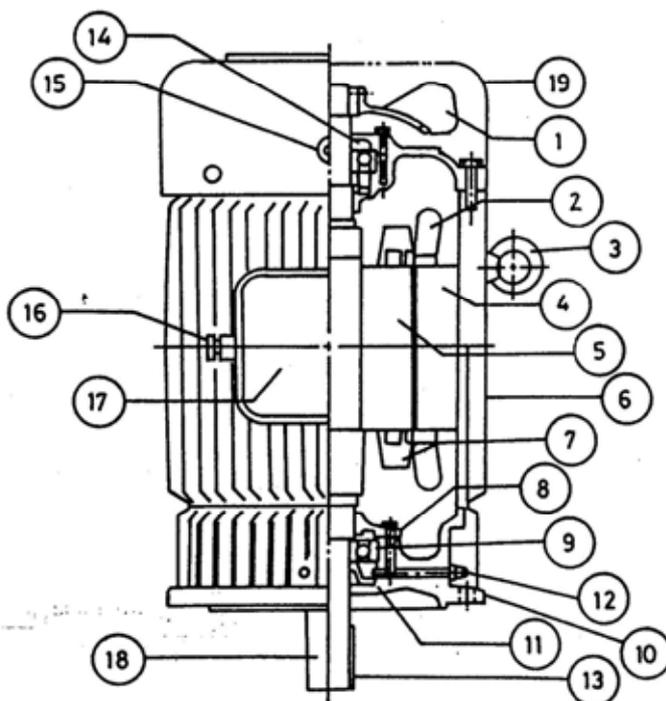


DATE	CODE	MEMO	SIGN
	△		
	△		
	△		

NO.	DESCRIPTION	MAT.L	QTY	SPECIFICATION	REMARKS
MFG. NO.	DATA	CUSTOMER			
QTY	SCALE	TITLE			
DWG. NO.					
H-TOOL-02				LAYOUT DWG OF BEARING TOOL	
3RD ANGLE PROJECTION 04.03.22 HMMCO Hyundai Machine Machinery Co., Ltd. Incheon Korea					



NO.	NAME OF PARTS
1	EXTERNAL FAN
2	EXTERNAL FAN COVER
3	EYE BOLT
4	FRAME
5	ROTOR CORE
6	STATOR CORE
7	STATOR COIL
8	BRACKET (FLANGE)
9	SHAFT END KEY
10	END-RING FAN
11	CABLE GLAND
12	TERMINAL BOX
13	SHAFT
14	PRELOADED SPRING
15	SEALED BALL BEARING



NO.	NAME OF PARTS
1	EXTERNAL FAN
2	STATOR COIL
3	EYE BOLT
4	STATOR CORE
5	ROTER CORE
6	FRAME
7	END-RING FAN
8	HOUSING COVER
9	OPEN BALL BEARING
10	BRACKET (FLANGE)
11	GREASE RING
12	GREASE NIPPLE
13	SHAFT
14	PRELOADED SPRING
15	GREASE NIPPLE
16	CABLE GLAND
17	TERMINAL BOX
18	SHAFT-END KEY
19	EXTERNAL FAN COVER