

ECP-3 Shotcrete Machine User's Manual

Thank You For Selecting Eurocrete



Read this manual carefully before operating or servicing the equipment

1. Application

ECP-3A Shotcrete/concrete spraying Machine is mainly used for dry-mix shotcreting and damp-mix shotcreting. It has some obvious advantages such as advanced technology, Perfect structure, stable performance, convenient operation and longevity of service etc. It is widely employed in mining, tunnel, culvert, subway, hydropower engineering, underground excavation engineering etc.

2. Main Technical Data

Output Capacity	3m ³ /h
Max. Horizontal Conveying Distance	200m
Suitable Mix Ratio(Cement/Sand)	≤1:3~5
Max. Aggregate Size	Φ15 mm
Conveying Hose Inner Diameter	Φ50mm
Conveying Pressure	0.2-0.4MPa
Air Consumption for conveying material	5~6m ³ /min
Air Motor Air Pressure	0.5MPa
Material Charging Height	0.9m
Rotor Speed	14r/min
Air Motor Type	TMH3.2
Air Motor Air Consumption	4.8m ³ /min
Overall Dimension(length×width×height)	1.13×0.54×1.02m
Net Weight	430kg

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3.Machine Structure and Working Theory

The structure and working theory of ECP-3A shotcrete Machine is shown as figure 1. The premixed materials are filled into vibrating hopper 1, and then passing through vibrating sieve to hopper 3. From there it flows into the through-going chambers of rotor 7 by the action of agitator 2 and moves to the discharge outlet with rotor running, where it is blown to Vortex Stream Implement 10 by compressed air leaded by air pipe 14. Here it is blown by scattering, accelerating, whirling, and floating vortex stream and through conveying hose to the nozzle, where a little adjustable amount water (for damp-mix shotcreting) is added.

ECP-3A Shotcrete Machine mainly includes drive device, rotor assy., air conveying system, spraying system and electric control casing etc.

3.1 Drive Device

Full sealing, Oil-immersed gear box 11 is mounted on the machine bottom and is transferred by three pairs gears. Its overall reduction ratio is 72 and efficiency is about 92%. A 3.2kw air Motor provides power supply.

Air Motor 13 is vertically installed on the gearbox, Paralleling with rotor axle.

Motor type: THM3.2

3.2 Rotor Assy.

This shotcrete machine adopts non-adhesive, through-going rotor with lining plastic chamber in its each hole. With this special rotor, it can improve the capacity to handle wet mixture and reduce clearing and maintenance work.

Rotor Plate 8: There are two rotor plates on the opposite sides of rotor, it is made of high-qualified alloy steel and can handle concrete more than 4000m³ during its working period.

Rubber Sealing Plate 5: There are two plates (upper and lower). Both of the upper and lower plates are made of anti-abrasive special rubber and can handle concrete 300-400m³ during its working period.

Clamping Device 16: By this device, the force is acted through the screws and cylindrical springs, which works as elastic auto-clamping device. Tight clamping by the turnover frame floating can provide a constantly uniform pressure at the sealing surfaces with a high tightening effect and low dust emission, and can avoid rubber plate over-worn, too.

3.3 Air Conveying System

There are three ball valves separately to control main air pipe, upper air pipe leading to rotor and lower air pipe leading to Vortex Stream Implement. There is another small air pipe leading to hopper vibrator. A pressure gauge is mounted on the lower air pipe to monitor the operating pressure of conveying hose.

3.4 Spraying System

It consists of conveying hose and nozzle unit. Conveying hose is made of anti-abrasive rubber, nozzle unit is made of high polymer. Water pipe, water valve and water ring are fixed on the nozzle unit.

4.Operation Manual

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Operators must be trained and be familiar with this manual and the machine structure before operating the machine.

4.1 Preparation

A. Connect the machine to air supply.

B. Check the oil indicator of Reducer, Air motor and oil-fog lubricator (please referring to **TMH3.2 Cylindrical Air Motor User's Guide**) to see lubricating oil enough or not.

C. Check all parts being fastened or not.

D. If there is no problem, start the machine and make it working for a short time checking its working condition. (Note: machine running should be the same with the arrow marked on the machine. Do not race the machine for a long time)

E. Check the clamping degree on rubber sealing plate. Tighten the clamping nut until there is no air leakage from rubber sealing plate. Check the tightness in two ways as follow:

(1) Bend up Conveying Hose and open the air valve with a pressure of about 0.3MPa .If there is no air leakage, it will be OK.

(2) Start the machine with running about 1/2 circle and stop it, if rotor stop instantly and run reversibly a bit, the tightness can be considered ok.



Strictly prohibit starting the air motor without lubricating oil in oil-fog lubricator.

4.2. Shotcreting Operation

After the above mentioned preparation completed, fill the mixture to vibrating hopper, open the main valve completely and open upper air valve with 1/3 circle, then adjust lower air pressure (to Vortex Stream Implement) to about 0.05-0.1MPa (proportional to conveying distance). In the meantime, open the water valve of Nozzle Assy. to pre-damp the spraying surface, and then the operator can start the machine to shotcrete. The conveying pressure is about 0.2-0.4Mpa. Subject to the conveying distance and water/cement ratio, adjust the air pressure of Vortex Stream Implement till a spraying speed is suitable (spraying distance is about 0.6-1m), then adjust upper air pressure till there is no much material goes out from the air overflow

The rated air pressure of motor is 0.5Mpa(73psi), and the rated speed of rotor is 14 RPM.

opening.

4.3. Stop Shotcreting

- A. Stop the machine and blow the remaining material out.
- B. After the hose being cleared, close the water valve on Nozzle Assy.
- C. At last, close the main air valve.

If shotcreting will be stopped for a long time, at first, stop filling material, and then keep the machine working till the material in the hopper and chambers is sprayed out thoroughly. Add a bit of wet aggregate to clean the hopper and chambers.

4.4. Notes

- A. Attention must be paid to prevent large article entering rotor chambers to damage the machine.
- B. Air motor running at a high speed with out charge is not allowed.

5.Troubleshooting

Phenomena	Possible Reasons	Solutions
Motor is running, rotor will not turn	Gear is damaged	Check up one by one
	Square rod in rotor defective	Replace rotor
Power or speed runs down drastically	Piston travels reversibly or piston ring worn out	Change components
	Air pressure is too low	Adjust pressure
Air consumption much	Cylinder or piston ring worn out	Chang components
	Air line leakage	Check and repair airline
Air motor stop abruptly while running	Bad lubrication	Fill oil
	Air valve is blocked	Change parts
	Crank connecting rod or bearing is damaged	Change parts
	The screws on cylinder are loose	Tighten up the screws
	Air distributing failure	Weld it one more them
	Muffler blockage	Clean it
Air leaks between Rotor and Sealing Plate	Clamping Device is too loose	Check Champing Device. Clear the material between Rotor and sealing plate, then tighten.
	Rotor Plate is in bad conditions	Check Rotor Plate, if it is carved, Polish it or change a new one
	Sealing plates is in bad conditions	Check Sealing plates, if it is grooves, Polish it or change a new one
Rotor, vortex stream Implement or conveying hose blockage	Ratio of w/c is too high	Stop the machine and close the air valves. If Vortex Stream Implement is blocked, dismount Conveying Hose, clean Vortex Stream Implement and Rotor, and then lower W/C ratio
	The cross section area of air inlet pipe is too small or Air supply is	Chang a new pipe with a larger cross section or change a larger air compressor

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Eurocrete Concrete spraying machine ECP-3A Air Motor User's manual

	insufficient.	
	Oversized aggregate	If conveying hose is blocked, stops the machine, close air valve, dismount conveying hose from Vortex Stream Implement, open air valve to blow the remaining material in Rotor out, then check the conveying hose. Strike the blocked position to make the blocked material loose or draw it out. (Note: reduce the conveying pressure to zero before dismounting Vortex Stream Implement). Now re-connected conveying hose to Vertex Stream Implement and blow the material out .If the conveying distance is over 40m,resolve the problem every 20m separately.
	Air conveying pressure is too low	Stop machine and air supply. If Rotor chambers Implement is blocked, open the turnover frame, open Rotor, and then clean Rotor Chambers with brush, raise air pressure.
Output Capacity declines	Rotor chambers or Vortex Stream Implement is blocked.	Refers to blocking solution item
	Air valve is mis-mounted (too high pressure loss)	Reduce pressure loss. Re-install air valve
	Hopper is not fully filled up	Make Hopper filled up thoroughly and strength vibrating
Conveying Hose vibrates too strongly	Blocking begins	Handle blocked hose if necessary
	Conveying pressure is too low	Check air supply
	Air pressure is too high	Adjust air pressure
Material stream and water are not mixed thoroughly	Water pressure is too low	Check water pressure ($\geq 0.3\text{Mpa}$)
	Water inlet hole is blocked	Clean it, install a water filter if necessary
Too much dust at the nozzle	Too little water adding	Add more water at the nozzle
Mortar is dropped down at nozzle outlet	Too much water added	Add less water at the nozzle
Rebound rate too high (>15% for spraying wall, >20~30% for spraying ceiling)	The sieve curve is not suitable	Adjust sieve ratio when necessary
	The distance between nozzle and the surface being sprayed is too close	Enlarge the spraying distance to 0.8m
	The distance between nozzle and the surface being sprayed is too far	Reduce the spraying distance to about 1m

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	Spraying direction is not perpendicular to the surface being sprayed	Adjust spraying angle
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6. Maintenance

ECP-3A Shotcrete Machine is suitable for arduous environment and little trouble occurrence. However, maintenance and care should be taken to stable its function and prolong its working duration.

6.1 Sealing Plate and Rotor Plate are key parts and must pay more attention to ensure no failure occurs during working.

Clamping force on sealing plate does not distribute evenly. The most differential force exists between the material discharge opening and the air overflow hole. Further, Max. Clamping force position floats back and forth while Rotor running. This problem can be solved by four-point floating clamping device, which ensures very little air leakage between the friction surfaces. So proper clamping is very important to prevent machine wear and tear.

If clamping is not fit, compressed air will leak from the friction surface with little granular which will lead dust emission around the machine. These little granular can damage sealing plate and make sealing degrade in a short time.

Too high-tension force in Sealing Plate is not allowed, otherwise over heat and over wear will be occurred by friction. Sealing plate's temperature limit is 110°C. In working , its suitable temperature is below 80°C.

Each shift should clear sealing plate and check it tear condition. If its rubber surface is worn to the same height as the end of reinforce bar inside it, it must be changed (Fig.2) for its sealing capacity will be reduced.

Check Rotor Plate once a week. If Rotor Plate is deeply carved (/1mm), it should be re-polished.

The hole of edges in Rotor Plate should be checked frequently. It should be kept sharp all the time. If the hole of edges are blunt; small particles will enter the friction faces and lead more wearing.

Polish Rotor Plate in time will decrease much trouble and save cost.

6.2. Chambers and Vortex Stream Implement are made of non-adhesive material and are not clogged in normal condition. However, they should be checked and cleared after every shift.

6.3. Pay attention to speed reducer frequently.

A. Its lubrication oil should be of No.50 Gear Oil (SY1172-77S) or No.30 Machinery Oil.

B. Reducer temperature rising should not exceed 40°C.

C. After every shift, the clogged material on Reduce surface should be cleared off.

D. Monitor Oil level indicator regularly, fills it up when lubrication oil is not enough.

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- E. Change new lubrication oil after 250 working hours (about 3 months).
- F. Check it regularly if there is any oil leakage of Reducer and handles it in time.
- G. Add lubrication grease to the bearing on the square shaft of Rotor every week.
- H. Clear the air vent shield on Reducer to ensure it unblocked.

6.4 Check Agitating plate and Agitating Paddle to see if there is any distortion or welding failure frequently and adjust the clearance (about 4mm) between Agitating Plate and Hopper Bottom to ensure it not friction Hopper Bottom directly.

6.5 Air Motor should be driven by dry clean compressed air, and oil sprayer should be mounded on the pipe system. Moist oil enters Air Motor with compressed air. Lubrication oil should be of No.20 or No.30 machinery oil.

6.6 Filter Water Trap and Pressure Reduction Valve on the air driven system should be checked frequently to ensure air system unblocked.

6.7 Heavy striking should be avoided when repairing Air Motor. After Air Motor completely assembled, its crank can be moved freely and evenly.

7 Sealing plate and Rotor Plate Repair

7.1 Surface turning and grinding of Sealing Plate

To avoid Sealing Plate deformation while being restored. A magnetic clamping plate or a rigidly fixing device should be used to clamp Sealing Plate on the lathe, then lathe its surface about 2-3mm till the deepest carves disappear, then grind its surface by a grinding machine or an emery wheel 2-3 times.

The reinforce bar inside Sealing Plate must be about 2mm lower than the plate surface (Fig.2).

Work piece speed——200r/min

Grinding wheel speed——about 1600r/min

Feeding speed——0.2-0.3mm/r

7.2 Rotor Plate Restoration

Separate Rotor Plate and Rotor with a delicate chisel. Heavy hammers must not be used so as not to damage brittle Rotor Plate.

Clear the friction surfaces of Rotor and Rotor Plate.

Grind Rotor Plate until all the nicks disappear.

When assembling Rotor Plate to Rotor. Insert the pin into the positioned pin hole first and make it 1-1.5mm lower than the surface of Rotor Plate. More attention should be paid that the pin must not be higher than the surface of Rotor Plate so as not to damage Rubble Sealing Plate.

8 Appendixes

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1. Bearings and Gears List of Reducer

No.	Code	Name	Specifications	Pieces	Being parts of
1	CP1017-09	Ball Bearing	309(45×110×25)	1	Reducer
2	CP1017-11	Ball Bearing	214(70×125×24)	1	Reducer
3	CP1017-12	Ball Bearing	314(70×150×35)	1	Reducer
4	CP1017-10	Ball Bearing	310(50×110×27)	1	Reducer
5	CP1017-08	Ball Bearing	308(40×90×23)	2	Reducer
6	CP1017-06	Gear	m=4 z=69	1	Reducer
7	CP1017-05	Gear	m=4 z=15	1	Reducer
8	CP1017-04F	Gear	m=3.5 z=67	1	Reducer
9	CP1017-03F	Gear	m=3.5 z=19	1	Reducer
10	CP1017-02F	Gear	m=2.5 z=92	1	Reducer
11	CP1017-01F	Gear	m=2.5 z=21	1	Reducer
12	CP1017-07	Push Bearing	8104(20×35×10)	4	Clamping Device

2. Standard parts and easy-worn parts

Code	Name	Specifications	Being parts of	Pieces
CP1017-16	O ring	φ69×5.3	Reducer	1
CP2029-03	O ring	φ75×3.55	Nozzle Assay (Hose System)	1
CP1021-06	O ring	φ20×2.65	Clamping Device	4
CP1021-02	Rubber Spring		Clamping Device	4
CP1024	Upper Sealing Plate		Rotor Assay	1
CP1023	Lower Sealing Plate		Rotor Assay	1
CP1027	Plastic chamber		Rotor Assay	10
CP1025	Rotor plate		Rotor Assay	2
CP1008	O ring	φ67×3.55	Hopper Bottom	1
CP1002	O ring	φ67×3.55	Panel	1

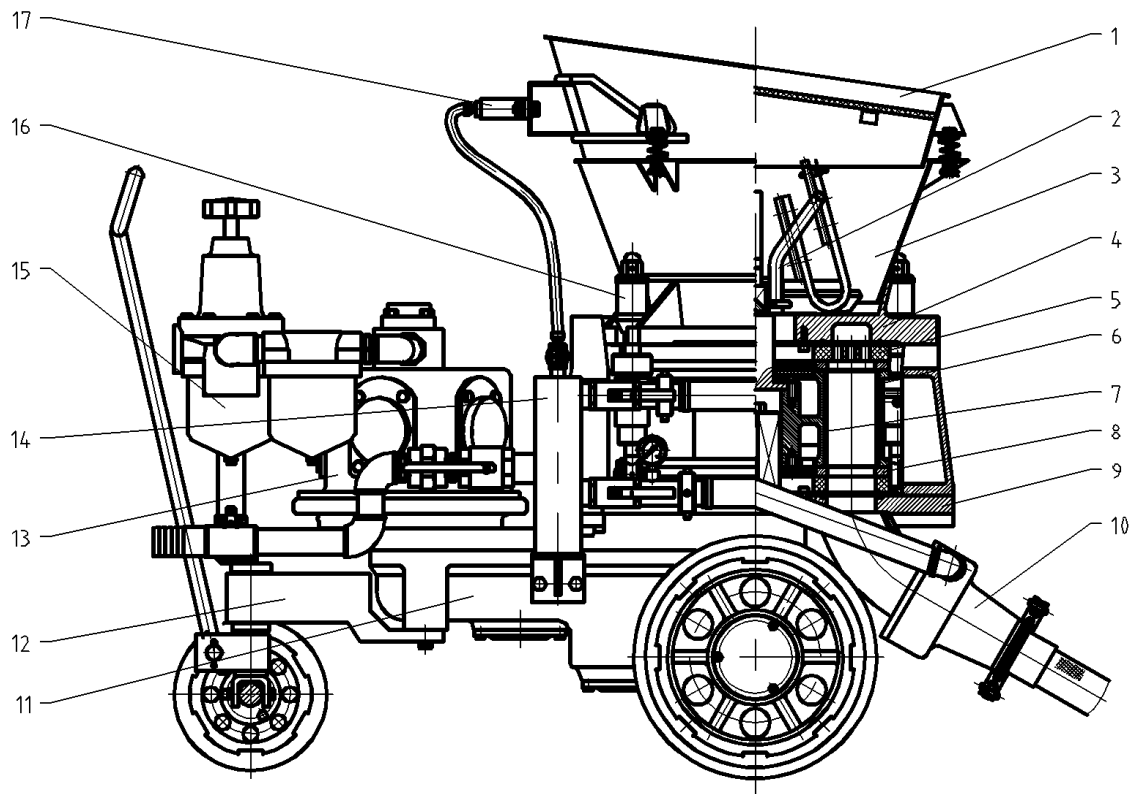
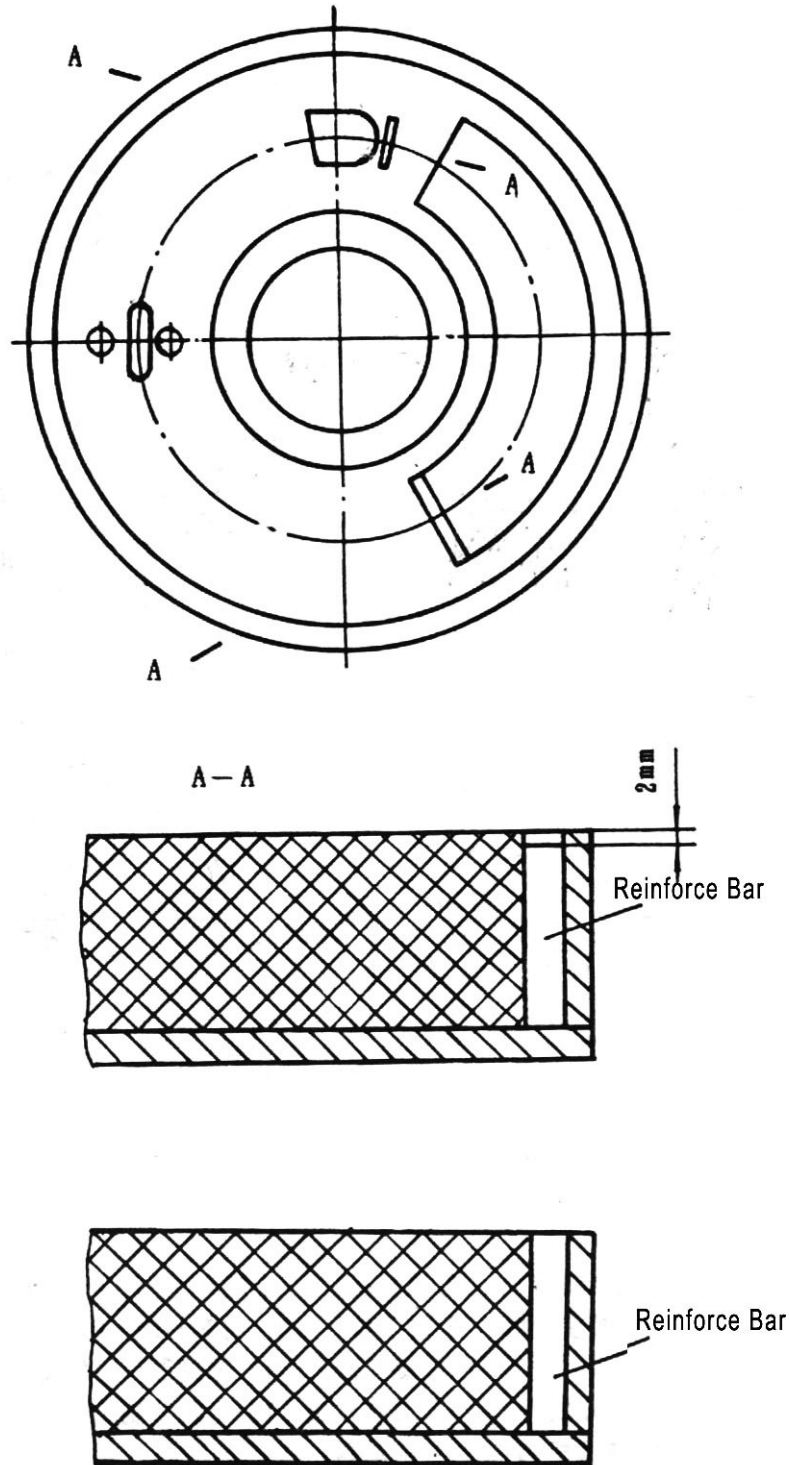


Fig.1 ECP-3A Pneumatic Shotcrete System

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|---------------------|-----------------------------|---|------------------|
| 1. Vibrating Hopper | 2. Agitator Paddle | 3. Hopper | 4. Hopper Bottom |
| 5. Sealing Plate | 6. Rotor Body | 7. Rubber Chamber | 8. Rotor Plate |
| 9. Face Plate | 10. Vortex Stream Implement | 11. Gear-box | 12. bottom Frame |
| 13. Motor | 14. Air Pipe System | 15. Filter, Regulator, Lubricator, FRL unit | |
| 16. Clamping Device | 17. Vibrator | | |



Before used

After used

Fig.2 Rubber Sealing Plate

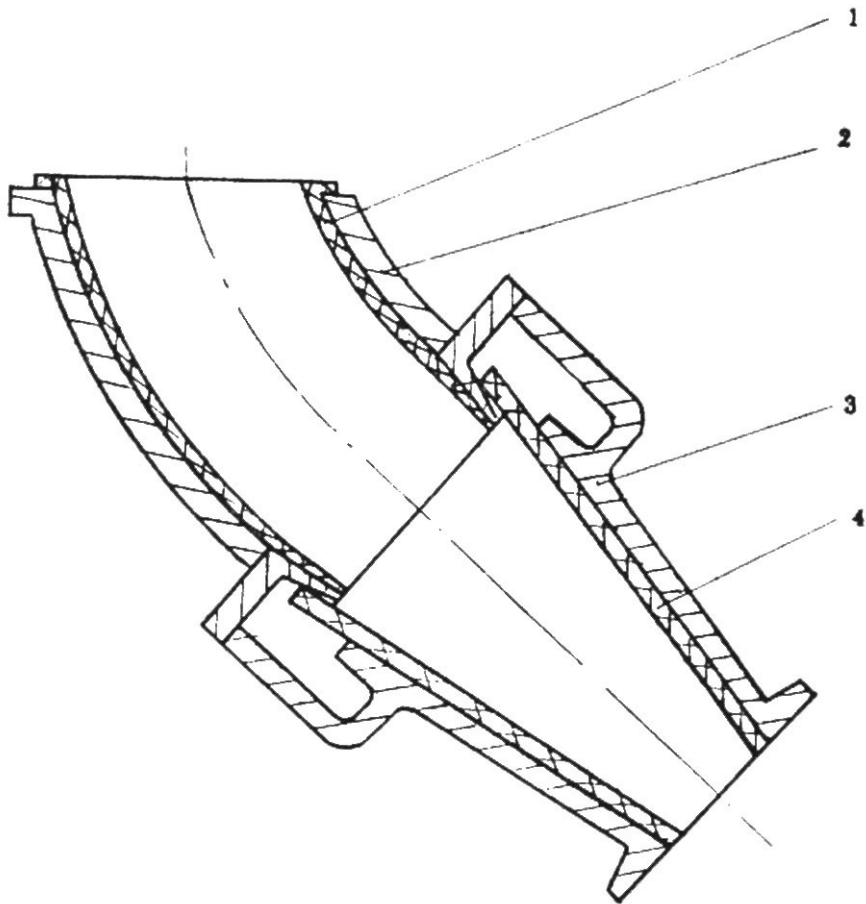


Fig.3 Vortex Stream Implement

1.Bend Plastic Hose
3.Taper Pipe Frame

2.Vortex Stream Elbow Frame
4.Taper Pipe Cover

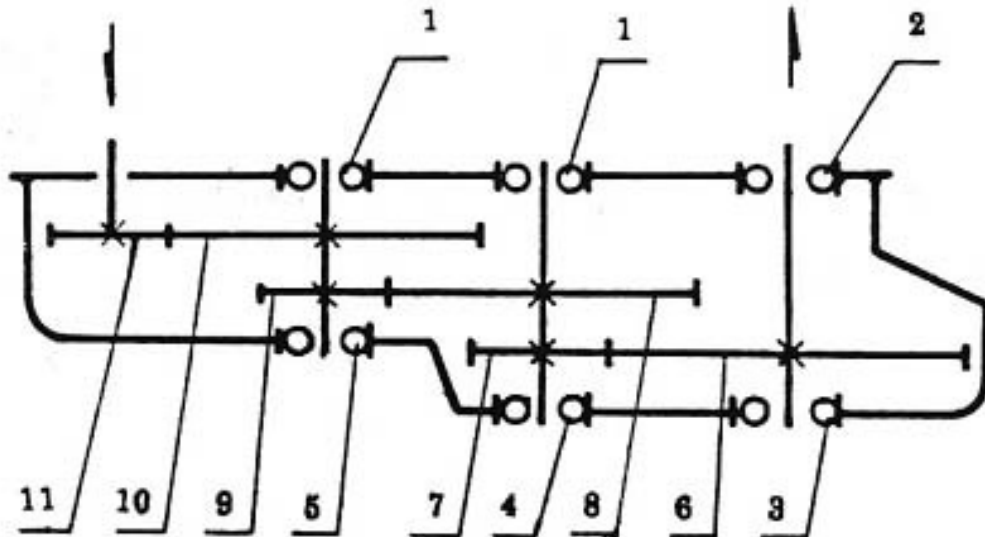


Fig.4 Reducer Driving System

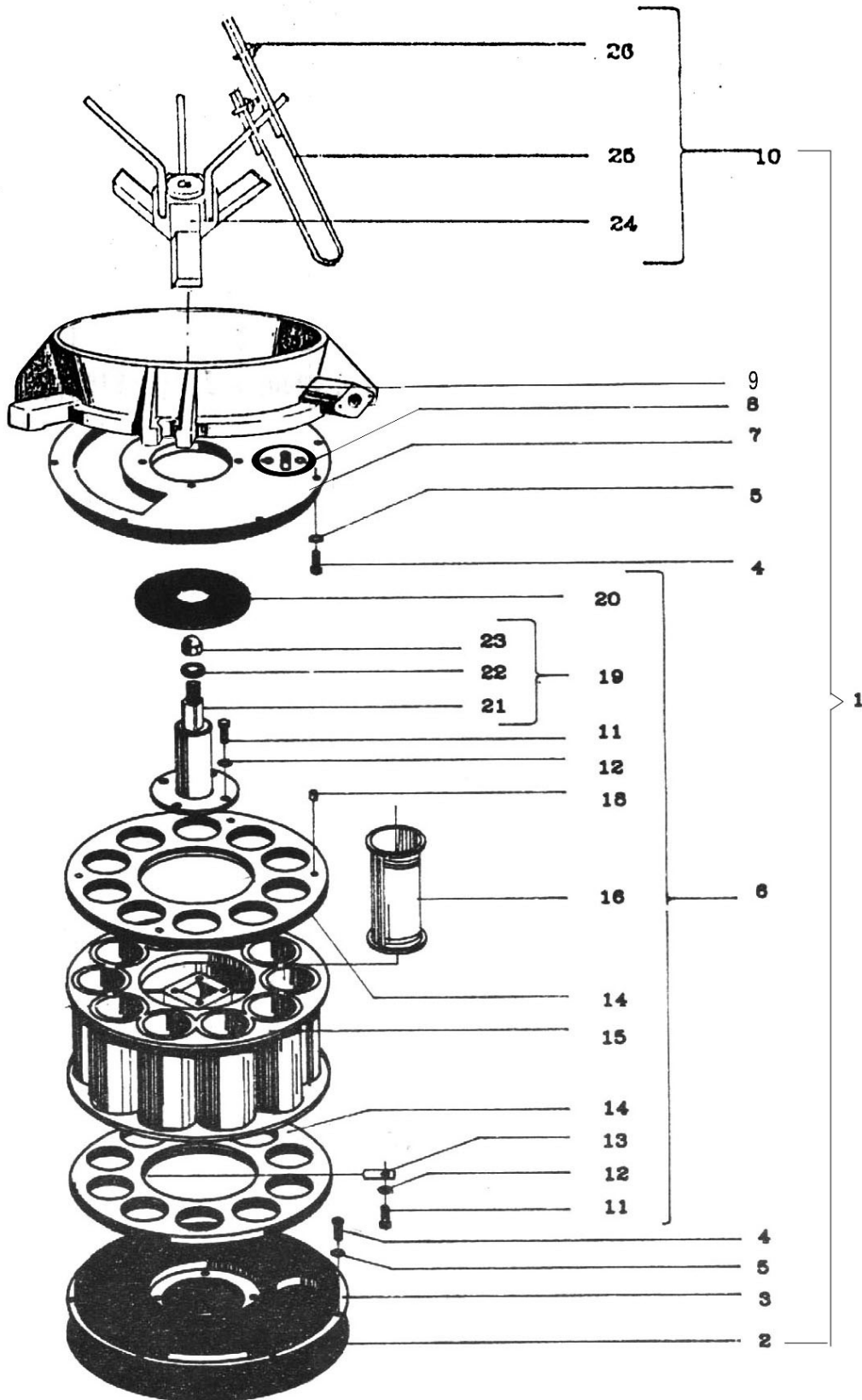


Fig.5 Assembly View of Rotor Assay

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Parts List of Rotor Assay (Fig. 6)

No.	Code	Name	Quantity	Notes
1		Rotor Assay	1	
2	CP1008	O Ring	1	φ67×3.55
3	CP1023	Lower Sealing Plate	1	M8×15
4		Socket Head Cap Screw	22	8
5		Spring Washer	22	
6		Rotor Unit	1	
7	CP1024	Upper Rubber Sealing Plate	1	
8	CP1002	O Ring	1	φ67×3.55
9	CP1009	Hopper Bottom	1	
10		Agitator	1	
11	CP1039	Hex Head Screw	8	M12×30(4 pcs) M12×15(4 pcs)
12		Spring Washer	8	
13	CP1040	Press Washer	4	
14	CP1025	Rotor Plate	2	
15	CP1026	Rotor Body	1	
16	CP1027	Rubber Chamber	10	
18	CP1029	Core Pin	8	
19		Flange Shaft Unit	1	
20	CP1042	Rubber Cushion	1	
21	CP1028	Flange Shaft	1	
22		Spring Washer	1	20
23	CP1041	Crown Nut	1	M20
24	CP1010	Agitator Paddle	1	
25	CP1011	Steel Cable	1	
26	CP1012	Cable Lock	2	

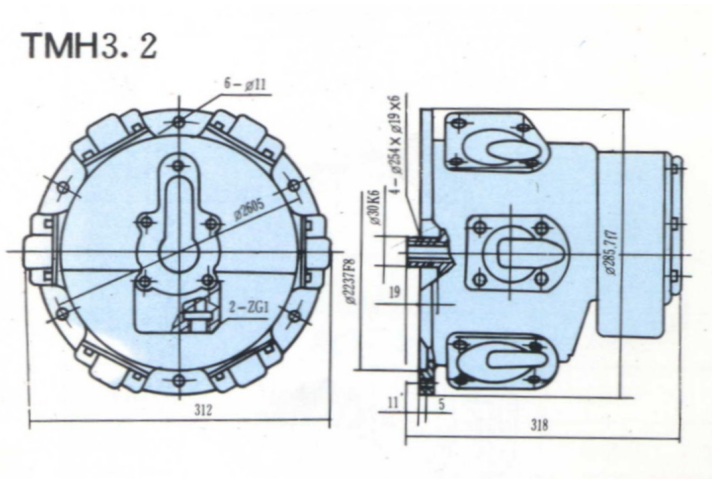
TMH3.2 Cylindrical Air Motor User's Guide

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1.Structures and Features

Cylindrical Pneumatic Motor is a power that is device driver by compressed Air and transfer Air pressure to mechanic power. After compressed Air enters Pneumatic Motor, the Air distributing system will distribute the Air to each cylinder in turn, relating to the set phase. The Air acts on the piston and makes it to travel forward and backward that drives the connecting rod and crank cyclically run.

2.Installation and Connecting Dimensions



3.Specifications

Rated Power		Rated Speed	Air Consumption	Rated Pressure	Net Weight
kW	hp	r/min	M3/min.kw	Mpa(psi)	kg
3.2	4.4	1000	1.5	0.5(73)	22

4.Operation and Maintenance

- 4.1 The compressed Air must be kept dry and clean. An oil-fog lubricator should be mounted on the pipe system. Vaporized lubrication oil enters Pneumatic Motor with compressed Air and the lubrication oil should be Mobil D.T.E.11M, Shell Tellus OI T15 or Esso UNIVIS J 13.
- 4.2 Should add Mobil D.T.E.11M, Shell Tellus OI T15 or Esso UNIVIS J 13 lubrication oil from filler hole on the case, and check oil surface every shift, dram dirt oil from the lower plug on the shield every week to ensure the connecting rod and crank well lubricated.
- 4.3 During maintenance, the heavy striking must be avoided. After assembly completion, the crank should move freely without any blockage.
- 4.4 During empty changing experiment should not exceed half minute.

4.5 Trouble Shooting

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Phenomena	Possible Causes	Solution
Power and speed goes down dramatically	Cylinder, or piston ring worn Too low pressure	Change components Adjust pressure
Air consumption rises abruptly	Cylinder, piston ring or valve Cover worn Air leakage	Change component Examine and repair the air system
Stop abruptly during running	Bad lubrication Air distributing valve blocked, or burn Crank connecting rod or bearing worn Cylinder screw loose Welded parts of distributing valve broken	Add oil Change component Change component Tighten it up Re-weld

5. Consumable items list

No.	Name	Drawing Code	Quantity
1	Crank shaft inner sleeve	11143006	1
2	Crank shaft outer sleeve	11153606	1
3	Connecting rod ring	20244606	2
4	Bearing	Z107	1
5	Oil ring	20915706	6
6	Connecting rod	30121006	6
7	Piston pin	08141506	6
8	Piston ring	20115706	6
9	Piston	13265706	6
10	Bearing	Z108	1

Remarks : The oil consumption of FRL is about one cup per work day, but must keep oil in oil-fog lubricator of FRL.



Oil Level for air motor