OPERATION AND MAINTENANCE MANUAL
[OMM]
FOR DIRECT DRIVEN CENTRIFUGAL FANS

Type of fan: _____

Year of production: 20_____

Serial number: _____

Functional test performed: _____

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INTRODUCTION

This Operation and Maintenance Manual (OMM) with annexes is intended for the installation, supervision and operation of a fan. The annexes which constitute an integral part of the Operation and Maintenance Manual, and, among other things, determine the rights and obligations of the buyer and future user, are in particular:

1. Complaint Notification Form – CNF/PZR (template).
2. Fan Commissioning Protocol – FCP/PRW (template).
3. Warranty.

The document is intended for the buyer and future user of centrifugal fans. Before starting the operation, please read the contents carefully. The purpose of this documentation is to provide the user with guidelines concerning the construction, commissioning and operation of the devices. The design of the fans complies with the state-of-the-art requirements and with the ensuring of safety and health, as provided by pertinent regulations, directives and standards. The use of the fan inconsistently with its intended use, modifications (changes to the product) and non-compliance with the requirements and guidelines contained herein by the assembly team or the fan user will release OWENT from any warranty obligations and authorizes the manufacturer to withdraw from the warranty.

In the warranty period, Copy no. 1 of this Operation Manual as the basic one will oblige the fan user to:

- make records of repairs and inspections;
- allow the OWENT assembly supervision inspector to gain an insight into each complaint.

OWENT RESERVES THE RIGHT TO DESIGN CHANGES RESULTING FROM IMPROVING THE QUALITY OF THE FAN DURING THE WARRANTY PERIOD.

1. GENERAL CONDITIONS

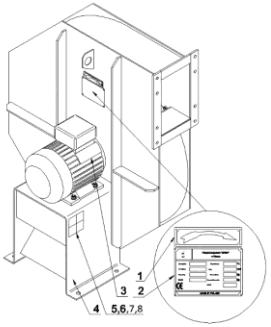
This manual and appendices must be read and observed by the personnel responsible for transport, assembly, operation, maintenance and repair of the fan and applied in the field of safety and health protection..

1.1. Without prior consent of OWENT, this manual may not be reproduced, unlawfully used in competitive activities and made available to third parties.

1.2. The installation supervision must be performed by OWENT. It is a prerequisite for obtaining a guarantee and warranty for the fan, with prior agreement with OWENT.

2. INSCRIPTIONS AND GRAPHIC MARKINGS

Serial plate



Direct drive

Markings used on fans			
Directional sign Fan serial plate Engine serial plate			Hearing protection required
	Ground		High voltage
	Hot surface		Rotating parts

The symbols below provide basic information and warn about possible dangers as described in detail later in this Operation and Maintenance Manual.

Marking used in the text			
	Warning; DANGER!		Hot surface
	Electric shock possible – high voltage		Danger of crushing your limbs
	Do not walk under a suspended load		Important

3. SAFETY PREREQUISITES

1.1. Persons who install the fans should read this manual thoroughly and follow the rules and guidelines concerning safety and health protection during transport, assembly, operation, maintenance and repairs.

2.1. The fan may only be used when it is in good technical condition after installation. The technical condition must be confirmed with an assembly correctness acceptance protocol.

3.1. Any procedures that entail entering the fan housing shall require appropriate equipment and protection, as well as the assistance of other person from outside.

4.1. Installation, use, operation, maintenance, repairs etc. must be performed by specialized, qualified and trained personnel.

Rotating and moving elements (heat diffusers, etc.) must be protected with appropriate permanent shields painted in yellow, and the device must have a sticker "Attention! rotating parts" put in a visible place.

5.1. If it is necessary to apply additional protective measures or procedures outside the scope of the contract and delivery, they must be made, installed and followed by the user before allowing the fan to operate.

6.1. The manufacturer is not responsible for various types of damage and accidents resulting from incorrect installation and operation of the fan.

7.1. Hot surfaces of fan elements which may burn, and which due to natural cooling cannot be covered and insulated, should be marked with a permanent warning sign - see opposite.

8.1. Workers engaged in assembly and operations should use personal protective equipment and use appropriate and safe tools.

9.1. The fan user should protect workplaces and provided them with appropriate fire-fighting equipment.

10.1. Use devices and electrical equipment in accordance with the safety rules and regulations for electrical devices.

OWENT is not responsible for any dangers and threats resulting from incorrect installation of the automatic control systems for the drive motor and other electric devices of the fan if performed by unqualified personnel.

THE USER OF THE INSTALLATION OR MACHINE IS OBLIGED TO USE IT IN ACCORDANCE WITH PN-N-18002: 2011P AND RELEVANT NATIONAL REGULATIONS.

Standards harmonized with directives constitute the basis for all safety aspects:

- 2006/42/CE – Machinery Directive MD;
- 2006/95/CE – Low Voltage Directive LVD.

Fans should not be installed near workplaces or in public places. Fans must always be installed so that rotating parts should not be touched.
A fan may be started up and operated only if the personnel are familiar with this manual and the regulations in force in the place of work of the device.

For fans designed for operation at elevated temperatures (>70°C), some precautions must be taken to prevent contact with hot surfaces (eg protective covers, warning signs). Note that some fan parts exceed 70°C but should not be insulated as an excessive temperature rise could damage the bearings.

While using the fan, there may be a risk of injury for the service team or other bystanders, especially when the machine is running and no shields are used to prevent foreign objects from getting into or out of the fan housing. Therefore, it is necessary to install protective covers and protective nets when the fan has a free inlet or outlet. If the fan is not connected to the ducts, they must have protective covers (nets) at the inlet and outlet. This also applies to sight glasses and hatches that must be secured on site. At the same time, it is forbidden to stay within the range of the stream of medium flowing through the fan.

During the fan operation, there may be a risk of damaging the working part of the machine (rotor), resulting from personnel‘s negligence (missed inspections) or for other reasons. Therefore, staying in the vicinity of the working machine is allowed only for maintenance or control and measurement operations. The fan should also be separated from the surroundings in a way that prevents any accidental approach.

Do not touch the leads or and do not work on the energized motor. There is a risk of electric shock which may result from the lack of appropriate electrical protection which should be installed by the fitter in the place where the fan works. Protection against electric shock should additionally

comprise the grounding of the machine, made in accordance with the applicable regulations. Service or inspection procedures are allowed only after removing all electrical connections. The switching device must be marked and secured so that inadvertent actuation cannot occur. The rotor must be locked mechanically.

Engine service and safety conditions according to the engine specifications manual.

11.1. Manufacturer's reservations.

This manual and annexes must be read and followed by the personnel responsible for transport, assembly, operation, maintenance and repair of the fan and applied in the field of safety and health protection.

- The manufacturer is not responsible for any consequences of using the device contrary to its intended purpose.
- It is unacceptable to install any additional elements on the device that are not its accessories.
- Unauthorized changes or modifications to the device are not allowed.
- Protect the device against mechanical damage.
- The fan is not suitable for forcing the medium contaminated with a mixture of flammable substances in the form of gases, vapors, mists and dusts which, in combination with air, ,can create an explosive atmosphere.
- The fan cannot be used for forcing the medium containing sticky impurities that may settle on the device, especially on the rotor.

- The fan is not adapted to forcing the medium containing caustic contaminants which may have an adverse effect on the device.
- During use, the maximum rotor speed should not be higher than the nominal speed.
- It is unacceptable to install the fan on a base of inadequate load-bearing capacity and quality.
- The fan cannot be used for the dusty medium above 0,1 [g/m^3].
  In the case of ordering a fan with a direct drive or a clutch drive for the motor - in a situation where the motor for assembly is delivered by the buyer - and if the delivered motor turns out to be defective, OWENT has the right to charge the buyer with the costs of additional works, i.e. assembly/disassembly and test runs of the defective motor, in accordance with the valid OWENT price list. The warranty provided by OWENT for the fan does not cover the motor provided by the buyer.
- In the case of ordering a fan with a direct drive for the engine or with a clutch drive for the engine - in a situation where the engine and its assembly are outside the scope of the order, OWENT will deliver the fan in parts for self-assembly, in accordance with the attached written instructions. OWENT is not responsible for the correct alignment and assembly of the fan, as well as for the safe running of the fan. The warranty provided by OWENT for the fan covers only the parts delivered as fan subassemblies.

4. TRANSPORT

The delivery of the fan or spare parts is carried out with OWENT means of transport, courier or through collection directly from the warehouse by the customer. In particular, the method of delivery may be specified in the quotation. In the case of personal collection, the buyer is obliged to collect goods from the OWENT warehouse within seven days of the date of receipt of information about the completion of the order. After this date, storage costs will be charged in an amount of 0,5% of the net order value for each day of storage, increased by the VAT due. In the event of failure to collect the subject of the order or refusal to accept the subject of the order, the buyer is obliged to pay the entire price and to cover the costs incurred in connection with the delay in receipt, including storage costs.
The risk of accidental loss, destruction or damage to the subject matter of the contract passes to the buyer upon its receipt or delivery.

4.1. Safety conditions during transport.

DANGER TO LIFE! DO NOT APPROACH AN OVERHEAD LOAD!

4.1.1 When transporting the fan and its components, take all precautionary measures so as not to cause an accident to persons or damage the transported components. The regulations concerning internal and external transport must be observed and the transport personnel must be trained accordingly.

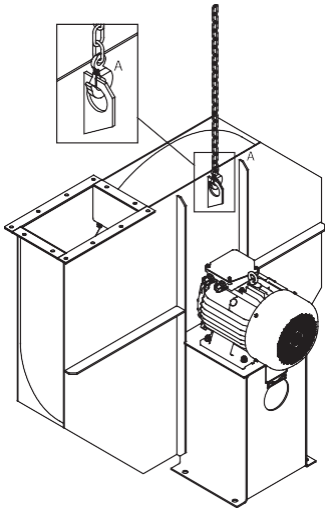
4.1.2 Keep in mind the following assumptions:

– The fan and its elements should be lifted or moved with a lifting device adapted to the size and weight of the transported element.

- Fit all hooks, catches, crossbeams, etc. on the appropriate grips and openings provided on the parts in transport.
- When transporting by rail, in trucks, on platforms, etc., the relevant external transport regulations must be observed.
- Transported elements should be properly secured against shifting on the floor aboard the means of transport.
- It is recommended that the rotating assembly be prevented from turning and that the bearings are relieved for transport.
- The fan should be transported in parts or units, properly protected against possible damage and preserved during the storage. It is recommended to store the fan only in dry and closed rooms, in a place with a temperature controlled in the range of + 5°C to + 45°C. In the case of temporary storage in the open air, the fan should be protected against the influence of weather conditions.
- During transport, expansion joints can be secured against free movements with a steel strip screwed to the holes. During assembly to the system it is necessary to remove the compensators' protection in order to screw them to the system. It is necessary to remove the transport supports of the expansion joints.

4.2. Examples of how to transport the fan.

Fans with direct drive can be transported, among others ,with a shackle attached to the transport holes on the fan/base.



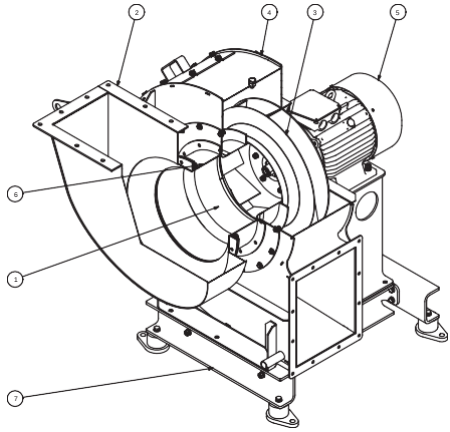
Direct-driven fan, made in a version with insulation instead of a lug, may have a threaded hole oriented at the top of the housing for screwing in an eye bolt (DIN 580).

5. CONSTRUCTION AND TECHNICAL DESCRIPTION

The OWENT centrifugal fan with a direct drive is used to pump the medium with a temperature from -20 ° C to 80 ° C and dustiness under 0,1g/m^3.

Direct drive:

1. Inlet funnel.
2. Elbow inlet.
3. Rotor wheel.
4. Spiral housing.
5. Engine.
6. Connector.
7. Frame with vibro-isolators.



5.1. Names and definitions of the basic units and parts of the fan.

(*- if applicable)

5.1.1 **Fan** - a rotating machine which receives mechanical energy and utilizes it by means of one or more rotors provided with blades to maintain the flow of the medium; the value of the work transferred per unit mass does not exceed the value of 25 [kJ/kg].

5.1.2 **Spiral housing** – a fan assembly forming a duct with a spiral contour and rectangular cross-section, with the rotor inside it and used to collect and direct the flowing medium.

5.1.3 **Rotor wheel (rotor)** – a rotating assembly mounted on the motor shaft, provided with a blade ring, transmitting the mechanical energy obtained from the drive motor.to the flowing medium

5.1.4 **Inlet funnel** - an inlet element that directs the pumped medium to the rotor blades, with an axial-symmetric profile and aerodynamically shaped walls so that the cross-section decreases in the direction of the flow of the pumped medium.

5.1.5 **Maid** – a fan housing element that allows the rotor to be removed from inside, containing the inlet funnel.

5.1.6 **Frame with vibro-isolators*** - a steel structure welded or bolted which allows to minimize the effects of vibration exerted on the environment.

5.1.7 **Heat diffuser*** - a smooth or ribbed disc integrated with the shaft or mounted on the shaft to dissipate heat energy from the shaft to the environment.

5.1.8 **Inlet/outlet compensator*** - flexible connections of the fan with the installation ducts.

5.1.9 **Sealing** – a sealing element for the passage of the rotor hub through the housing on the motor side.

Optional accessories*: inlet cover, outlet cover, inlet connector, elbow inlet, flexible compensators, shock-absorbing frame with vibro-shock absorbers, noise silencers, thermal and acoustic insulation.

6. STORAGE AND MAINTENANCE

a. Depending on the size, the fans are shipped assembled or in parts.
b. The fan and its parts must be stored in a closed, roofed, dry room free, from aggressive factors.
c. All parts of the fan and its assemblies must be preserved with appropriate anti-corrosion coatings. Maintenance should be carried out every six months. In order to preserve the elements, they must be properly disassembled or taken into parts; remove the old protective grease, clean, rinse and preserve again..
d. Fan components, such as: electric motors, actuators, control and measurement devices as well as other elements and devices not manufactured by OWENT, should be stored and maintained according to the manufacturer's instructions.
e. Compensators must be stored only under tension. For longer periods of storage, flexible couplings must be placed in a safe place without installation. Compensators must be protected against damage caused by welding, stepping, sharp objects, chemicals, etc..

7. ASSEMBLY AND DISASSEMBLY

7.1. Pre-assembly requirements.

a. Check the technical condition and completeness of the fan delivery according to the shipping specification.

b. Maintain and clean all stored fan elements.

c. The foundation or supporting structure must provide, among other things:

- adequate durability resulting from the static and dynamic load on the fan;
- adequate damping of vibrations -both natural and from neighboring machines;
- preventing resonance in the fan-foundation-base system.

OWENT CANNOT BE HELD RESPONSIBLE FOR THE CONSTRUCTION AND QUALITY OF THE FOUNDATION FOR THE FAN .

d. The foundation for the fan should be made in accordance with applicable construction standards in terms of quality of workmanship, including surface flatness.

e. The installation of the fan should be performed under the supervision of an OWENT inspector and by persons trained in this field.

f. Appropriate assembly and service platforms, which are not included in the scope of OWENT's delivery, must be made and installed for the assembly and operation of fans. These platforms must be ready for use before the fan is allowed to have run tests.

g. All welding works should be carried out so that the welding current does not flow through the motor bearings, mating elements, control and measurement equipment, etc..

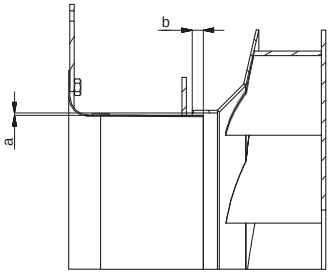
h. Fasteners' threads, exposed to high temperatures, are recommended to be lubricated with a suitable graphite or copper grease.

i. Before assembling the rotor on the shaft, it is necessary to check the compliance of its direction of rotation with the casing system according to the assembly drawing (in case of delivery of different structural systems). Also check that the direction of concurrent opening of the blades (if applicable) corresponds to the direction of rotation of the rotor.
j. The rotor should be mounted and dismantled by using appropriate mechanical devices (hoists and pullers) or hydraulic devices.

HYDRAULIC DEVICES AND EQUIPMENT ARE DELIVERED BY OWENT ON A SEPARATE ORDER.

IT IS FORBIDDEN TO DRIVE AND PUNCH REPLACED ELEMENTS WITH A HAMMER, BECAUSE THIS MAY DAMAGE THE BEARINGS AND PUNCHED ELEMENTS.

k. Provision should be made for the installation of the inlet and outlet expansion joints.
l. It is recommended to use ropes and slings during transport, assembly and disassembly of the rotor with or without the motor.
m. OWENT supplies the rotor mounted on a shaft and statically and dynamically balanced.



During all works performed on the fan - such as assembly, operation, maintenance, repair - it must be ensured that the gap "a" and the overlap of funnel "b" between the rotor and the inlet funnel are the same. The distance "a" and the overlap "b" should not differ from the values from before disassembly.

Before commencing the proper installation, the fan's technical condition should be checked. Before installing the fan at the workplace, make sure that the structural elements to which it is to be attached have sufficient strength. The fan should be fixed to the ground in a permanent manner, while the choice of the fixing procedure is left to the user. If the fan has been transported in parts, its assembly at the place of installation should be performed only by OWENT's service team or, in justified cases, by experienced persons authorized by the OWENT service, using auxiliary installation equipment.

The installation site must be level and have an adequate load-bearing capacity. There should be sufficient space left around it for installation and maintenance. Easy access to the inspection hatch should be provided.

When installing the fans, the guidelines included in the standard: PN-EN 1997-1: 2008/NA: 2011P must be followed. Eurocode 7 - Geotechnical design - Part 1: General rules.

The fans must be installed in the mounting position for which they were ordered and delivered. The installation must be made on an even, horizontal foundation; it is recommended to make a leveling grout of low-shrinkage concrete. In order to avoid jamming or chafing of the rotor, particular care should be taken that the fan is not mechanically deformed or subject to undesirable stresses. After installing the fan, connect it to the ducts. It is recommended to use compensators to connect the device with the rigid ducts of the system. The ventilation ducts must not burden the fan in any way. The entire installation must have a properly made earthing installation. When using vibro-isolators, it may be necessary to insert leveling washers. The fan with mounted vibro-shock absorbers must not be moved across the floor or subjected to stress. This action damages the vibro-isolators. The dimensions of the spacing of openings, their number and anchor diameters for standard fans are included in the catalogs of a given series

of types. Otherwise, they should be determined on the basis of measurements or the attached sketch (drawing). In order to allow a fan equipped with vibration isolators to make certain movements, especially during the start-up, flexible compensators must be installed on the suction and discharge connections. Particular attention should be paid to maintaining their coaxiality when connecting the ducts (in the case of using flexible compensators, a slight misalignment is allowed). In the case of connecting the ventilation network directly to the fan flanges, the compliance with the condition of assembly alignment is a prerequisite for the correct installation of the machine to the network

7.2. Disassembly and assembly of the engine.

WHILE LIFTING THE DISASSEMBLED MOTOR FROM THE FAN, DO NOT APPROACH THE SUSPENDED LOAD.

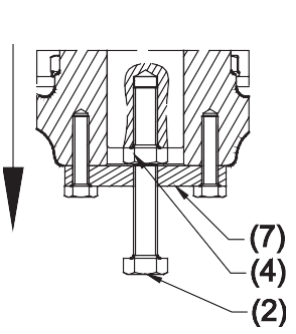
Before proceeding to disassembly the motor, first disconnect the electric supply and remove permanently the cables from the terminals of the motor terminal box. You have to protect the terminals, and the wires must be secured and grounded. Then loosen the motor mounting bolts, remove the ground connection. The engine should be removed with the installed transport bolts by using the available lifting devices or manually in accordance with the guidelines contained in the OHS regulations.

Before lifting, tighten the provided shipping bolts, designed to bear the weight of the motor..

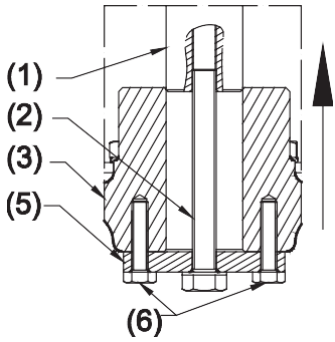
Each prolonged storage of the motor requires it to be placed in a dry, dust-free place. The engine manufacturer specifies special requirements for transport and storage. Motor assembly is a procedure similar to the disassembly.

7.3. Disassembly and reassembly of rotors using a puller.

IN THE COURSE OF PULLING OUT AND FITTING PROCEDURES, PROTECT THE ROTOR AGAINST FALLING BY USING SUPPORTS, SUSPENDING THE ELEMENT UNTIL SETTING IT ON THE SHAFT OR PLACING ON A STABLE BASE.



Rotor disassembly



Rotor assembly

First, remove the accessories such as the elbow inlet, adjustment device (if any). Then you need to disassemble the extractor with the inlet funnel screwed to the side of the housing. In the case of a split housing, the upper part can be lifted off after removing the flange bolts. Support the rotor with wooden beams or with a crane, but not lift it. Remove the protection from the drive shaft. To remove the rotor from the drive shaft **(1)**, stop the hole in the shaft with the locking screw **(4)**, then mount the puller discs **(7)** with the clamping screws **(6)** on the rotor hub **(3)**. Then, screw the bolt **(2)** into the disc thread and turn until the rotor is loosened. In the next step, remove the rotor and remove the locking screw **(4)**.

To mount the rotor on the drive shaft, fit the retractor discs **(5)** with the mounting bolts **(6)** to the rotor hub. Clean and lubricate the shaft and the hub bore. Place the rotor on the drive shaft **(1)** and press it lightly. Insert the bolt **(2)** with washer into the hole in the hoist disc **(5)** and screw - as far as possible - into the drive shaft.
When the assembly is complete, the rotor should be turned by hand and check whether it turns freely without rubbing or knocking.

7.4. Instructions for force fitting on a TAPER-LOCK sleeve.

- Clean thoroughly and degrease all ground surfaces, like the collet holes and flank face as well as the conical hub bore.
- Then insert the bushing into the bore of the hub so that all tapped hole halves fit exactly into the non-tapped hole halves.
- Lubricate a little the custom-made studs or cylindrical screws with oil and screw them in, but do not tighten them home.
- Clean the motor shaft and lubricate it with oil, then place the rotor with the collet in desired location.
- If a key is used, it must first be placed in a groove on the shaft. The key should have a slight play.
- Then, using a DIN 911 Allen key, evenly tighten the bolts (double-sided or cylindrical) to the torque values given in the table.
- After a short start-up (approx. 0.5 to 1 hour) check the tightening torques of the bolts and correct them if necessary.

Detailed assembly and disassembly instructions are available on the manufacturer's website.

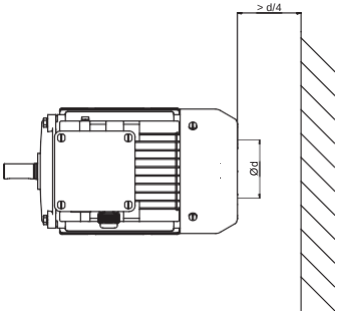
NOTE: All bolted connections must be tightened to the torque shown in Table 1.

Thread acc. PN/M-02013	Permissible moment for threaded connections at k=1,43				
Nominal diameter [d]	Thread pitch [p]	Mechanical strength class of bolts and screws PN/M-82054.			
		5.8	8.8	10.9	12.9
		Minimum yield point			
mm	mm	400	640	900	1080
3	0,5	0,896	-	-	-
3,5	0,6	1,44	-	-	-
4	0,7	2,18	3,48	4,9	5,88
5	0,8	4,11	6,48	9,11	10,9
6	1	7,16	11,4	16,1	19,3
8	1,25	16,3	26,1	36,8	44,2
	1	14,1	22,6	31,9	38,2
10	1,5	31,1	49,9	70,1	84,2
	1	23,5	37,7	53	63,6
12	1,75	52,9	84,7	119	143
	1,25	42	67,2	94,5	113
16	2	113	181	255	306
	1,5	91,9	147	206	249
20	2,5	221	354	498	598
	1,5	150	240	337	405
24	3	383	612	861	1034
	2	282	452	636	763
30	3,5	712	1140	1604	1924
	2	459	735	1033	1240
36	4	1189	1903	2676	3211
	3	954	1526	2146	2576
Values of permissible tightening torques for dynamically loaded connections are taken by multiplying the torques acc. to tabl. by 0.85					

NOTE: In case of any problems with the assembly, please call the OWENT service.

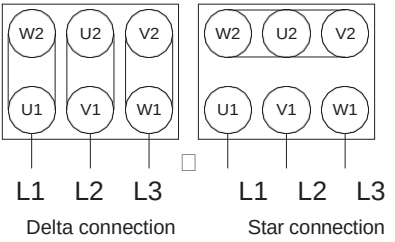
7.5. Electrical connection.

ELECTRICAL CONNECTIONS CAN BE CARRIED OUT ONLY BY TRAINED PERSONNEL IN ACCORDANCE WITH APPLICABLE LAWS!



The connection of the fan to the electrical network must be made in accordance with the connection diagram in the terminal box and in line with the instructions of the motor manufacturer. In order to connect the device to the electrical installation, lead the supply wires or cables through the appropriate cable entries in the motor connection box. The fan must be earthed,

and the motor is to be protected by fuses in the electricity network. The connection must be made by authorized specialists, taking into account the protection and safety instructions. The electrical connection must be permanently secured (no hanging wires allowed), the terminal box must be free from foreign bodies such as dirt, moisture, etc. The air flow cooling the motor must not be impeded. Provide a minimum space for free cooling of the motor. The wiring diagram for connections to the three-phase power supply is presented in the figure below. It should be performed by authorized and qualified personnel. The fan is not equipped with power cables. The recipient should provide cables that must meet the requirements of the relevant directives and standards harmonized with the given directives. The cables should be connected in accordance with the attached installation diagram (3 x 400 V, 50 Hz). The diagram is also on the cover of the electric motor junction box. Recommended boost Y/Δ.



UNUSED CABLE CHOKE HOLES AND TERMINAL BOX MUST BE CLOSED TO PREVENT ACCESS OF DUST AND MOISTURE. THE ELECTRICAL CONNECTION OF THE POWER CABLES IS BEST IF MADE WITH BUSBARS.

8. START-UP AND COMMISSIONING

COMMISSIONING MUST BE CARRIED OUT BY TRAINED PERSONNEL IN ACCORDANCE WITH APPLICABLE LAWS.

Connect the drive motor correctly to the electrical system in accordance with the regulations for electrical devices and the instructions of the motor manufacturer. Other electrical devices and automatic control systems (if any) must also be connected properly.

8.1. It is recommended to check the strength and patency of the ducts.

8.2. First launch.

Check that the direction of rotation of the rotor is compatible with the rotation of the motor. The operation of the drive motor must be checked according to the manufacturer's instructions.

In case of excessive vibrations and excessive noise, the fan must be stopped immediately, the cause is to be identified and removed.

8.3. Second launch.

Run the fan for four hours.
You need to check the tightness of the bearings, elbow inlets, housing, seals between the shaft and the housing and the elbow inlet.
Remove any defects after stopping the fan.

8.4. Third launch.
Run the fan for 72 hours. In the event of non-compliance, the device can be put into continuous operation. Other arrangements and decisions in the field of fan assembly and test runs are made by the representative of OWENT's assembly supervisors.

9. USE AND MAINTENANCE

The parts subject to lubrication and relubrication are seals and bearings. Lubricate and re-lubricate the bearings in the motor according to the manufacturer's recommendations.

THE USER PERFORMS MAINTENANCE AND INSPECTIONS OF THE FAN IN ACCORDANCE WITH THE DEVELOPED MAINTENANCE SCHEDULE. IMMEDIATE MAINTENANCE IS REQUIRED IN THE EVENT OF VIBRATIONS, OR ANY DECREASE IN PERFORMANCE.

Before commencing maintenance work, the electric power supply of the motor must be switched off, and then secured against any accidental start-up. Check that the fan rotor has stopped and immobilize it. Then proceed to disassembling the fan parts.
Before disassembly, all contacting parts must be marked so that when reassembled, they assume the same position in relation to each other. Particular attention should be paid when installing the rotor on the motor shaft, especially at the entry gap between the rotor and the inlet funnel. Differences in values after assembly will lead to a reduction in

the fan's operating parameters. After assembly, the pre-disassembly values should be maintained.

The fan should be cleaned at least once a year in order to maintain high efficiency and operational reliability. Ad hoc cleaning can be done through manholes and sight glasses located on the housing and the elbow inlet. **The fan rotor should be cleaned more often if the rotor is stuck to the dust contained in the pumped medium.**

During maintenance, all impurities from the fan housing, which may change the balancing parameters of the fan rotor, should be removed. Only suitable detergents and cleaning agents must be used. Do not use high-pressure devices or strong solvents for cleaning, protect the fan from scratching.

The respective components of the fan should be stored in dry rooms, away from the influence of weather conditions. Machined parts should be protected against corrosion by covering them with a layer of protective grease. The remaining parts should be covered with a protective varnish. During a longer downtime of the fan, close all manholes and inspection openings in the ventilation system.

9.1. Relubrication.

- Lubricate the motor bearing in accordance with the motor manufacturer's manual.
- If there is a relubricated shaft seal, apply 20 g of grease every 700 hours of continuous operation.

9.2. Overview of common faults and possible causes.

9.2.1. The fan at the designed number of rotor revolutions has a flow curve that differs from the catalog curve.

Possible causes:

- *a wrong fan is being considered.*
- *a wrong curve at one's disposal .*
- *a wrong rotor wheel installed.*
- *The rotor rotates in the wrong direction.*
- *There is too much gap between the inlet funnel and the rotor.*
- *Others.*

9.2.2. The fan, at a constant speed and with a curve compliant (within a tolerance) with the catalog, operates at a different operating point than assumed.

Possible causes:

- *The network is miscalculated.*
- *During assembly, contrary to the design assumptions, the diameter of the wires and the number of local resistances were changed.*
- *The network is not tight.*
- *The network is dirty.*

9.2.3. The fan vibrates strongly.

Possible causes?

- *the rotor is out of balance*
- *Foreign body/bodies stuck to the rotor blade.*
- *Uneven adherence or drying of the sediment on the blades.*
- *Uneven erosion or corrosion of the blades.*
- *Careless assembly of the hub on the shaft, loss of fit between the hub and the drive shaft journal.*
- *Defect in the motor or bearing arrangement.*
- *Loose motor bolts, bearings, or foundation bolts.*
- *Resonance.*
- *Work on the unstable part of the flow curve.*

- *Others.*

9.2.4. Fan and network are noisy.

Possible causes?

- *Too high rotational speed of the rotor in relation to the noise permissible in the given conditions.*
- *The fan runs at a low efficiency.*
- *No expansion joints between the inlet funnel and the pipeline.*
- *Fan base resonance.*
- *No sound insulation.*

9.2.5. The electric motor becomes excessively hot during operation.

Possible causes?

- *Insufficient cooling of the engine (dust accumulation in the engine, ambient temperature higher than 40°C).*
- *No current in one phase (wrong wire contact in the terminal box, in the distribution box, the switch, or a blown fuse.*
- *Voltage drop in the network (caused by the energy supplier or by the too small a cross-section of the motor power cables), incorrectly selected motor (the actual fan operation point is different from the assumed one, fluid density change).*

In the event of lodging a complaint, the fan must be cleaned, and the complaint form attached to this Operation Manual should be completed and returned..

9.3. Natural frequencies of the fan.

The fan parts, and in particular the rotor, exhibit natural frequencies excited at a certain rotational speed, which may be the cause of the resonance phenomenon.

The fans are designed in such a way that the phenomenon of resonance does not occur during the operation at a constant nominal speed.

Fan operation with speed control by means of an inverter allows the excitation to occur whenever the rotational speed changes. If the natural frequencies of the parts lie within the fan rotational speed

range, they should be suppressed ("cut out") by appropriate parameterization of the inverter.

10. OPERATING AND OHS MANUAL

10.1. Fan instruction manual.

Periodical checks:

a. Proper operation of the fan and of the control and measurement equipment,
b. The condition of the seals on the housing segment divisions and the elbow outlet (if any).
c. The condition of the seals in the transition zone of the motor shaft from the fan housing and the tightness of the fan components.
d. Tightening of fasteners.

In the event of operational disruptions, the fan must be immediately stopped, the cause should be determined and removed.

10.2. Health and safety instructions.

Observe the applicable occupational health and safety (OHS) regulations for transport, tools, assembly, repairs, operation, etc..

- Repairs and overhauls of the fan should be performed with the mains voltage disconnected.
- You need to pay attention to the correct fitting of the covers.
- Check the technical condition of the fan, electric motor, other electrical devices, electrical system, grounding or neutralization, in accordance with the regulations for electrical devices.
- Check the technical condition of the service platforms, tools and other auxiliary devices.

11. REPAIR MANUAL

The actual assessment of the technical condition of the fan, qualifying it for inspection or overhaul, is made by the user basing on observations of the degree of wear of individual parts and fan assemblies..
It is recommended that periodic inspections are performed every 4,300 hours, and repairs every 26,000 hours of operation.

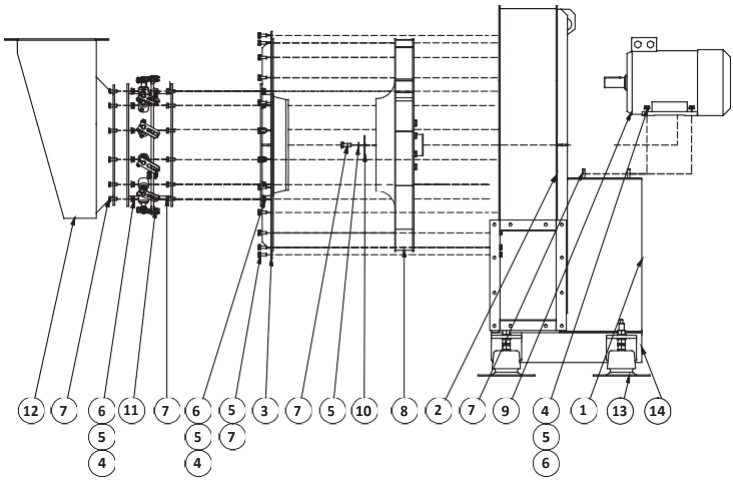
11.1. A periodic inspection includes:

- checking the technical condition of the rotor (erosion),
- checking the engine bearing clearances,
- checking fasteners, tightening bolts and nuts,
- checking all seals.

11.2. Fan repair:

- disassembly of the fan, its assemblies or parts,
- assessment of the technical condition of the rotor and shaft. Any mechanical damage, erosion and cracks must be repaired and then compensated,
- repair and inspection of the engine should be performed according to the engine manufacturer's instructions,
- assessment of the technical condition of the housing and elbow inlets. Sheets and other elements damaged by erosion and corrosion must be replaced, and any cracks should be welded over, checked and all seals should be replaced ,
- check the technical condition of the fasteners and replace if necessary,
- damaged elements can be ordered at OWENT.

12. LIST OF SPARE PARTS



Item	Name of part	Spare part
1.	Base	YES
2.	Spiral housing	YES
3.	Extractor	YES
4.	Round washer	Standard part
5.	Spring washer	Standard part
6.	Nut	Standard part
7.	Screw	Standard part
8.	Rotor wheel	YES
9.	Electric engine	YES - bearings
10.	Lock washer	YES
11.	Adjusting device*	YES
12.	Elbow inlet*	YES
13.	Vibroinsulating frame*	YES
14.	Vibro-isolator*	YES

(* - accessories - option) RISK ASSESSMENT

THE FAN USER IS OBLIGED TO INFORM THEIR EMPLOYEES ABOUT THE OCCUPATIONAL RISKS ASSOCIATED WITH THE WORK AND THE PRINCIPLES OF PROTECTION AGAINST THREATS.

PROBLEM:

In various areas of human activity, occur certain events that generate threats affecting humans, technical facilities and their environments. Those dangers carry risks. The risk of threats may sometimes exceed the value of the accepted risk. For this reason, there is a need to carry out risk and threat assessments. An estimation of the risk of threats is most often the result of the risk analysis performed. One of the groups of risk analysis methods are those included in the class of qualitative methods. Below, an assessment of the risks associated with the operation and operation of fans is performed.

DATA:

- The area of human activity subject to analysis (in which threats are sought),
- maintenance - operation - of fans.

THREATS:

- electric shock due to cutting though the fan power cord,
- personal injury due to a broken rotor and its running out of the housing,
- hand injuries caused by touching the moving parts of the fan,
- burns when touching hot fan parts,
- a fire caused by an overloaded fan,
- the risk of hearing damage related to the noise emitted by the fan during its operation.

13. FINAL REMARKS

During the use, there may be special conditions regarding work safety, transport, assembly, operation, maintenance, etc., exceeding the scope of the compiled documentation..

In these cases, you should follow a reasonable, professional and carefully thought-out procedure, so as not to cause damage recklessly or destruction of the fan and lead to a life-threatening situation. The employee operating the device should be informed how to behave in the event of noticing typical damages or irregularities in work.

An employee may be allowed to independently operate the fan only after demonstrating full knowledge of the operating and safety regulations.

The theoretical and practical knowledge as well as the level of technical culture of service and supervision should be constantly improved.

The manual is supplemented by the catalog of radial fans. The fan made upon the terms conditions agreed with the ordering party, operated in accordance with this manual in the light of the PN-N-18002:2011P standard, is a safe machine.

13.1. Additional remarks regarding the storage of the fan before fitting it in its final place.

- The device should be stored in a place not exposed to weather conditions, where there is no risk of impact or any other mechanical damage.
- The floor surface should be dry, smooth and flat. Do not put heavy or sharp objects on top of packaged products.
- When the device is stored for more than a month, the registered shaft rotation should be performed at least once a month.

- Records should be made in the table below by sending the information together with the signature of the person performing the activity to the address serwis@owent.pl

14. RECORD OF INSPECTIONS, REPAIRS AND OVERHAULS

Schedule of periodic inspections and servicing operations on a direct drive fan _____

Fan serial number: _____

Item	Procedures for the running fan	Frequency	Comments
1.	Tightening the fasteners securing the fan	Every 3 months	
2.	Control of supply voltage and rated current	Continuously	
3.	Checking the fan for any noticeable damage and faults	Every 3 weeks	
4.	Checking the grounding condition of the motor and the switch	Once every 12 months	
5.	Overview of components that cannot be checked in the installed state	Every 12 months	

Item	Procedures for the running fan	Frequency	Comments
6.	Cleaning the fan	Every 12 months	
7.	Leveling the vibroinsulating frame	Every 12 months	
8.	Relubricate the engine bearings	According to the engine manual	
9.	Change the lubricant in the engine	According to the engine manual	
10.	Replacing the bearings in the engine	According to the engine manual	
11.	Checking the contacts on the motor terminals	According to the engine manual	
12.	Cleaning the air ducts in the engine (in dusty conditions)	Every 2 months	
13.	Measurement of the insulation resistance in the engine	At a dowtime every 12 months	
14.	Relubrication of the seals	Every 700 hours of operation	
15.	Rotate the rotor at least two revolutions	Every 30 days	
16.	Draining any residual water from the housing	Every 30 days	

Item	Procedures	Date	Signature

Control card number _____

Fan serial number _____

Previous card number _____

Date of submission of the previous card _____

The rigor of carrying out control procedures in accordance with the attached schedule must be strictly observed. Confirmation of the procedures performed should be sent to the following address: serwis@OWENT.pl or OWENT@OWENT.pl every six months within 10 calendar days of the end of each subsequent six-month period, counting from the date of the acceptance-commissioning protocol of the fan Failure to send the control card within the required confirmation period will result in the loss of the warranty. Note: each downtime lasting more than 30 days should be recorded in the card (downtime start date, start-up date)!

Previous control card number _____

Number of procedures entered on the previous control card _____

_____

Signature

Item	Procedures	Date	Signature

Item	Procedures	Date	Signature

Item	Procedures	Date	Signature

Item	Procedures	Date	Signature

Item	Procedures	Date	Signature

Item	Procedures	Date	Signature

15. ANNEXES

1. **WARRANTY**
2. **FAN START-UP FORM**
3. **COMPLAINT FORM**
4. **SERVICE APPLICATION FORM**

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1. Warranty

WARRANTY

1) The Seller provides a warranty for the operation of his product, with the proviso that the User will comply with the recommendations contained in the Operation and Maintenance Manual of the fan. The warranty does not cover the effects of external factors (in particular corrosion, erosion and sticking).

a. the warranty period ends 12 months after the date of commissioning, but no longer than 15 months of the date of delivery unless the parties agree otherwise,

b. any complaints should be sent to the e-mail address: serwis@owent.pl and report on the phone number 694 910 335,

c. complaints during the warranty period will be considered immediately after receiving the notification.

2) The warranty is valid only in Poland.

3) The warranty covers the check weighing of the fan for a period of 1 month of the date of commissioning, but not longer than 3 months after the date of sale.

4) The seller is not responsible for any damage caused in connection with transport and storage.

5) The warranty does not apply to:
   a. any use of the product inconsistently with its intended purpose or specified operating conditions,
   b. disassembly, alteration, repair or replacement of parts made without the consent of the Seller,
   c. wear of parts in normal operation.
6) The warranty is excluded if the User makes it impossible or difficult to determine objectively the cause of the complaint.
7) The costs arising from an unjustified complaint shall be borne by the Applicant according to the Seller's prices.
8) The warranty does not cover the engine provided by the Buyer.
9) If the motor and its assembly are beyond the scope of the order, the warranty covers only the parts delivered as fan subassemblies.
10) The buyer may claim to remove the defect or replace the item concerned. The Seller shall decide about the choice of the claim settling.
11) In the event of removing the defect or replacing the item with a new one, the warranty period is extended only by the time in which the Buyer could not benefit from the item under repair or replacement of the item, but not longer than by 3 months.

Additional warranty terms:

2. Fan start-up form

Purchase document number:	**Date:**

1. Applicant's data:	**2. User/workplace data:**
Name of company:	Name of company:
Street and number:	Street and number:
Postal code:	Postal code:
Town:	Town:

3. Reporting Person

Name:	Surname:	Phone:	E-mail:

4. Equipment:

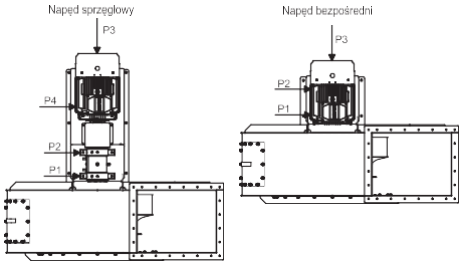
Type:	Serial number:	Installation delivery Date:

4.1. Is the device complete and does not lack any elements necessary for its proper operation?	YES	NO
4.2. Does the device work in correct operating conditions?	YES	NO
4.3. The device is connected properly to the mains?	YES	NO
4.4. Is the vibration measurement carried out continuously?	YES	NO
4.5. Is the temperature is measured continuously?	YES	NO
4.6. Did OWENT supervise the assembly?	YES	NO
4.7. Did OWENT supervise the commissioning?	YES	NO

5. Detailed description of the fan start-up:

Vibration measurement, temperature measurement, description of fan operation, etc.

Table with the results of vibration measurements				
Direction of measure ment	Measurement points according to the sketch			
	P1	P2	P3	P4
Horizontal (H)				
Vertical (V)				
Axial (A)				



3. Complaint form

Purchase document number:			**Date:**
1. **Applicant's data:**		**2. User/workplace data:**	
Name of company:		Name of company:	
Street and number:		Street and number:	
Postal code:		Postal code:	
Town:		Town:	
3. Reporting Person			
Name:	Surname:	Phone:	E-mail:
4. Equipment:			
Type:	Serial number:		Installation elivery Date:

4.1. Is the device complete and does not lack any elements necessary for its proper operation?	YES	NO
4.2. Does the device work in correct operating conditions?	TAK	NIE
4.3. The device is connected properly to the mains?	TAK	NIE
4.4. Is the vibration measurement carried out continuously?	TAK	NIE
4.5. Is the temperature is measured continuously?	TAK	NIE
4.6. Did OWENT supervise the assembly?	TAK	NIE
4.7. Did OWENT supervise the commissioning?	TAK	NIE

5. Detailed description of the complaint:

circumstances of occurrence, date of occurrence, date of noticing, what work was carried out on the installation or in the vicinity of the equipment? e.t.c.

In order to **verify the application efficiently, photos and a video should be sent**
6. COMMENTS:
1. The applicant declares that he is familiar with the General Terms and Conditions of OWENT Agreements (available at www.owent.pl).
2. In the event that the OWENT service has not received the Commissioning Protocol of the Reported Device according to the template contained in the Operation and Maintenance Manual, this application will not be considered a warranty.
3. During the visit of the OWENT service team, the applicant undertakes to ensure collision-free and safe access to the devices and to operate the device enabling the efficient execution of the works..
4. In case the application - as a result of the OWENT servicing procedure - is qualified as not subject to the guarantee and/or warranty or the application is qualified as subject to the guarantee and/or warranty, but access to the device or devices is impossible or difficult - the applicant undertakes to cover the costs of the procedure (according to the seller's rates, in particular for: costs of spare parts, materials, transport and labor as well as administrative costs).
5. If, after qualifying the application as not subject to warranty and/or warranty, it is found that the service intervention is necessary, the applicant undertakes to pay an advance payment for the service on the basis of a proforma invoice issued by OWENT..
6. On the day of the service's arrival, the applicant undertakes to delegate an employee authorized to collect the work performed and to sign the Service Report. Otherwise, the Service Protocol will be drawn up unilaterally with binding effect for both parties.

4. Service application form

Scheduled date for the performance of the proecdure	**Service ordered on:**
1. **Applicant's data:**	**2. Place of service:**
Name of company:	Name of company:
Street and number:	Street and number:
Postal code:	Postal code:
Town:	Town:

3. Subject of the service:

3.1. Is the device complete and does not lack any elements necessary for its proper operation?	YES	NIE	N/A
3.2. Does the device work in correct operating conditions?	YES	NO	N/A
3.3. The device is connected properly to the mains?	YES	NO	N/A
3.4. Is safe access to the service/device provided?	YES	NO	N/A
3.5. Have the rotor and the inside of the housing been cleaned prior to the arrival of the service team?	YES	NO	N/A
3.6. Has the insulation been removed for gaining access for service team?	YES	NO	N/A
3.7. Were the hatches dismantled?	YES	NO	N/A
3.8. Will a service be provided to perform works not included in the subject of the service, but which will prove necessary for the proper performance of the service?	YES	NO	N/A
3.9. Will there be access to the power grid within a reasonable scope of the service performed (220 V/400 V)?	YES	NO	N/A
3.10. Will it be possible to weld with any method at the place of its performance/work during the service??	YES	NO	N/A
3.11. Will there be vertical and horizontal transport necessary to perform the service?	YES	NO	N/A
3.12. What are the procedures for entering the plant and the prevailing health and safety requirements. Send the guidelines by e-mail (tests, qualifications, clothing, necessary training, etc.)?			

4. Description of the subject of the service: (to be completed by the contractor / OWENT)

In order to provide the service, photos must be sent (ordering party)

5. COMMENTS:

1. The Ordering Party declares that they are familiar with the General Terms and Conditions of the OWENT Agreements (available at www.owent.pl).

2. During the visit of the OWENT service team, the Ordering Party undertakes to ensure collision-free and safe access to the devices and to ensure that the device is operated efficiently.

3. If, during the service performed by OWENT, employees of OWENT will have to perform work not covered by the subject of the service, the ordering party undertakes to pay a remuneration for additional work basing upon the agreed cost estimate with OWENT (orally and / or via e-mail confirmation)

4. On the day of arrival of the service team, the ordering party undertakes to delegate an employee authorized to hand over the work and to sign the Service Protocol. Otherwise, the Service Protocol will be drawn up unilaterally with the effect binding both the parties.