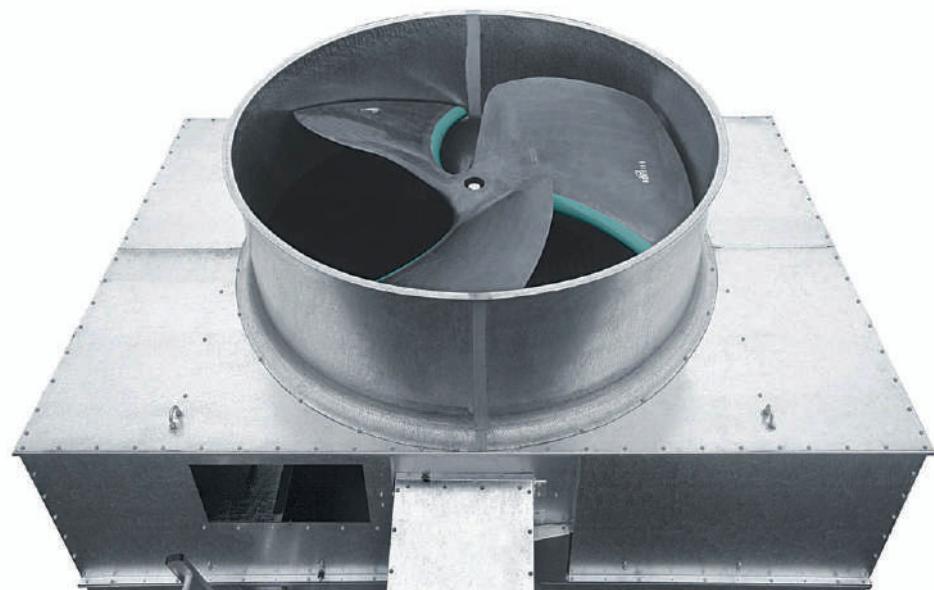


Service Manual



Installation and Maintenance

Axial Flow Cooling Fans FPX Series – 63" through 156"

Warning

Failure to comply with these instructions could cause serious bodily harm or property damage and will void the warranty.

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I. GENERAL INFORMATION

Introduction

This manual provides information necessary to install, operate and maintain E-series axial flow cooling fans. Maintenance guidelines and procedures are given so that your equipment will operate efficiently, with a minimum of repair or replacement requirements.

Description

Howden FPX-series fans have an integral fibreglass reinforced polyester (FRP) construction with fixed pitch blades. The impeller is one-piece molded for true blade alignment and accurate aerodynamic shape of the blade cross sections. The specially shaped aerofoil construction is designed for ultra low noise applications.

Howden FPX-series impellers are in compliance with EC directive 94/9EC (ATEX 100) for the equipment of level group II, Category 2, potentially explosive environment class 01. Also respect the instructions in paragraph IV commissioning.

Note: The nomenclature is 'cooling fans', however Howden supplies impellers only. Impellers are components in the sense of European Machinery Directive 98/37/EC.

Allowable operating temperature		
	Min.	Max.
All diameters	- 20°C - 5°F	+ 65 °C + 150°F

Allowable incidental upset temp. (<12h)		
	Max.	Max.
All diameters	+ 80°C	+ 175°F

Table 1

Options / Accessories (at extra cost)

- Tapered bushing for the drive shaft connection.
- Polyurethane leading edge protection for wet applications.
- Torque wrench.

Field Service

Howden Service maintains a staff of experienced field service personnel. Their expert knowledge may be of great assistance at inspection, installation or to get your fan unit back in service with a minimum of delay.

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II. RECEIVING / HANDLING / STORAGE

Receiving and unloading

Upon unloading the equipment, inspect it for damage. If damage occurred, file a claim immediately against the carrier and mark the bill of lading accordingly.

Superficial transport damages like scratches or small holes may be repaired with touch-up material (PU filler, e.g. Sikaflex 252).

All consignments are accompanied by a packing list with the following data:

- Order number of the Customer and of Howden.
- Impeller type.
- Parts supplied by Howden.

The delivered goods shall be checked upon arrival for full compliance with the order and/or the parts count and description stated on the packing list.

Shortages should be reported to your Howden Contract Engineer within 2 weeks from receipt of shipment at destination.

Handling

We recommend the use of a sling around the fan centre part or multiple slings around the fan blades. When handled with a single hoist, use a spreader bar to keep slings from sliding. If chain or wire slings are used, they should be well padded where they contact the fan hub or blades, especially where special coatings and paints are involved, as they are easily damaged. Always repair scratches with touch-up material (PU filler, e.g. Sikaflex 252) before installation. Severe impacts could distort the fan hubs and damage the blades.

Storage

If not installed immediately, it is recommended to store the impeller in a dry and shaded area.

For long-term storage (in excess of 6 months) it is necessary to check the condition of the corrosion protection agent of the metal insert shaft bore.

Reapply or repair where necessary, using an acid-free corrosion protection agent (e.g. Esso Rust ban 397 or equivalent).

Do not allow any material of any kind to be stored on top of the impeller.

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III. INSTALLATION

Required Tools

- Torque wrench (check tightening torques for the correct model).
- Socket and wrench.
- Tape measure.

Rotation and flow direction

Standard rotation is clockwise when viewed into the air-stream. See figure 1.

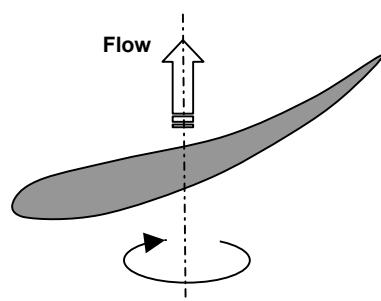


Figure 1

Preparation

Clean all mating surfaces between shaft, tapered bushing and fan hub. All corrosion preventive coatings should be removed.

Check the following before parts shall be assembled:

- Drainage holes at the blade tips shall be open (3 holes in each blade).
- Make sure the drive shaft is properly centred with respect to the fan casing. Also check if the shaft is vertical within the prescribed tolerance.
- Check the concentricity of the driver shaft end before mounting the impeller. The impeller should not be mounted if the concentricity error exceeds 0.02 mm (0.0008") see figure 2.

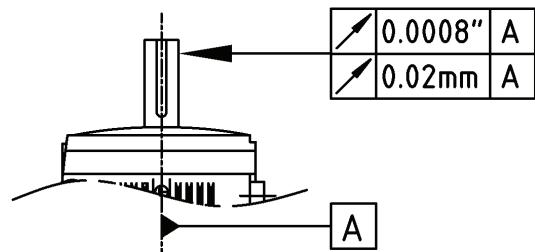


Figure 2

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Impeller Installation

(Supply of tapered bushing is optional).

- a) Do not lubricate bushing, coupling flange bore or hardware. Use of lubricants can cause impeller damage.
- b) Slip the bushing onto the drive shaft and check the key (5) for proper fit (figure 3). Be sure the shaft is completely through the bushing. Keep a bolt length as minimum distance x between bolts (4) and flange of the drive (figure 4).
- c) Lock the bushing on the shaft by tightening the setscrew in the flange. Support the bushing with a sleeve to prevent it from sliding down during assembly.
- d) Install the impeller onto the bushing. Start bolts (4) by hand turning just enough to engage threads.
- e) Keep tightening them as equally as possible, in several steps, while drawing the hub onto the bushing until the bushing tightly grips the shaft.
- f) Tighten the bolts to the torque shown in table 2. Do not over-torque. Excessive torque can cause impeller or bushing damage. Some gap must remain between the flange of the bushing and coupling flange in properly tightened assembly.

Torque value bolts
taper bushing to impeller

Class 8.8 (A3B)		
Bolt size (bushing type)	Torque (Nm)	Torque (lb·ft)
1/2 - 13 UNC (QD-E)	80	60
5/8 - 11 UNC (QD-J)	185	135

Table 2

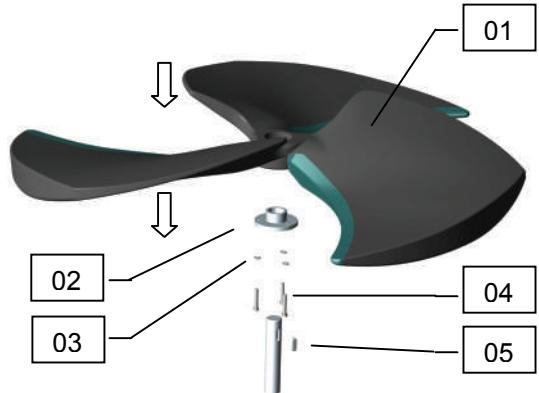


Figure 3

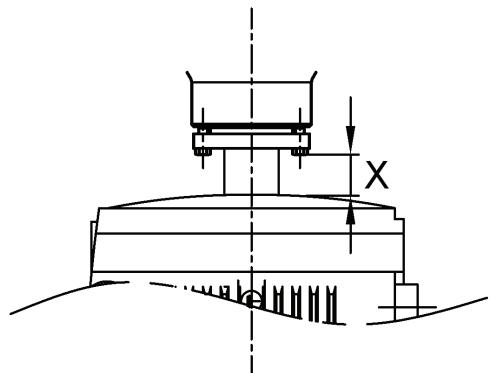


Figure 4

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Minimum tip-clearance

Tip clearance "s" is the distance between the blade tip and the impeller casing (figure 5). Due to normal impeller casing tolerances the tip clearance is not constant around the impeller casing.

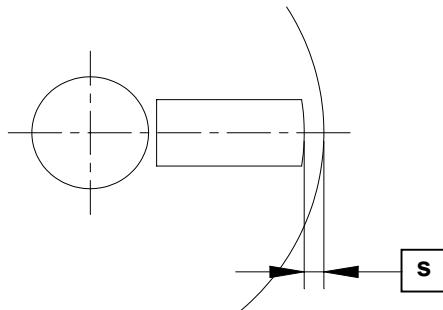


Figure 5

Howden recommends a tip clearance of 0.5 % of the impeller diameter. Fan selections using Howden CF-P20 software are standard based this. In any case the tip clearance shall be no less than 0.33 % of the impeller diameter.

Impeller size	Tip clearance			
	Minimum		Recommended	
mm	inch	mm	inch	
63"	5	1/5	8	5/16
1700 mm	5	1/5	8	5/16
1800 mm	5	1/5	8	5/16
74"	6	1/4	9	3/8
2000 mm	6	1/4	9	3/8
84"	7	9/32	11	7/16
92"	8	3/10	12	15/32
2400 mm	8	3/10	12	15/32
108"	9	1/3	14	17/32
3048 mm	9	1/3	14	17/32
132"	11	7/16	17	2/3
144"	12	1/2	18	11/16
156"	13	1/2	20	3/4

Table 3

Retaining plate

(Supply of retaining plate is optional).

Install retaining plate with gasket, washers and bolts after the tapered bushing and the impeller have been installed. For torque values of galvanised retaining plate bolts see table 4.

Retaining plate shall be flush against the metal insert of the impeller, and covers the polyester material.

Bolts size	Class 8.8 / AISI 316 (A4)	
	Nm	lb·ft
M12x1.75	85	63
M16x2	200	148
M20x2.5	245	181
M24x3	300	221

Table 4

Important

Howden strongly recommends the installation of a retaining plate for all vertical shaft applications with impeller hanging below the driver or whenever the airflow is directed towards the driver.

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IV. COMMISSIONING

- a. Check all bolts and nuts for proper tightening (including the fan casing hardware).
- b. Make sure that the metal bearing support structure is electrically earthed in order to avoid sparkling by electrical static discharge.
- c. Turn the impeller by hand to check that it runs freely and does not rub or strike the impeller casing.
- d. Impellers driven by a two-speed e-motor: Only switch from "high speed" to "low speed" after the impeller speed has slowed down to less than the "low speed". To be sure you may choose to switch the e-motor only after the impeller has come to a complete standstill. Neglecting this rule may lead to irreparable impeller damage!
- e. Make sure that all tools and assembly aids like beams, supports, ladders...etc. have been removed. All the required protections, mechanical and electrical, must be installed before starting the fan. Make sure that all applicable local safety requirements have been met to ensure safe operating conditions.
- f. 'Bump' the motor to check for clockwise rotation of the impeller, when viewed into the air stream (also see figure 1).
- g. Immediately after first start up check for smooth operation of the fan assembly. Listen for irregular noise / vibrations. For allowable vibration levels of the complete installation refer to the system manufacturer.

Please refer to international standards that may apply for the specific application, such as, ISO-10816-1, AMCA and CTI Manual Chapter 10.

The impeller shall never be exposed to a vibration level of more than 7.1 mm/sec (0.28 in/sec) V_{r.m.s.} measured at the drive shaft bearings.

Important

Following measures must be emphatically respected for potentially explosive environments and to comply with Directive 94/9/EC (ATEX 100):

- *Electrically earthed metal bearing support to avoid sparkling by electrical static discharge*
- *Minimum prescribed tip clearance to avoid rubbing along the impeller casing.*
- *Directions for design of the impeller support structure according to Howden document 03-07.341*

WARNING

A strong fan-speed reduction may lead to irreparable impeller damage. Never use a forced impeller deceleration like a brake or an e-motor switching to a lower drive-speed; instead let the impeller run out.

WARNING

Contact with rotating fan blades can cause severe injury or death. Never insert items into the fan to determine movement or direction of rotation. Install fan guards or screens on arrangements with exposed fans. Always use lockout and tag out procedures before performing fan adjustments, maintenance, service or inspection.

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V. PREVENTIVE MAINTENANCE

Though the impeller requires little maintenance, it is recommended to conduct inspections at regular intervals, to check damage due to vibrations, fouling or wear and tear.

Actual recommended maintenance intervals will depend on the use and application of the complete system installed and shall be determined by the operator.

Important

De-energize the fan and use lock out and tag out procedures prior to performing adjustments, service, inspections or lubrication.

- Check for smooth operation of the fan and listen for irregular noise / vibrations.
- De-energize the fan and make a visual inspection for deposits, and or damages.
- Visually inspect the blades surface and blade stems for cracks. Hairline cracks could appear in resin rich areas around the edges of the fan blade and will normally stop progressing. Hairline cracks in itself are harmless, however we advise you to fill these cracks with a touch-up material (PU filler, e.g. Sikaflex 252) to prevent moisture penetration affecting the blades. Howden Cooling Fans can provide you a repair kit complete with instructions.

For all other cracks we suggest to send photographs to Howden Cooling Fans for evaluation.

- Visually inspect the blades for wear and tear. Exposed fibreglass should be re-coated. We recommend shipping the worn impeller to Howden for refurbishment.
- Replace corroded bolts and nuts.
- Deposits should be removed from impeller and fan housing using brushes and/or a water jet with a maximum water pressure of 3 Bar or 45 Psi.
- Check if the drainage holes at the blade tip and blade shoulder are still open.

Repairs of the FRP blades shall be carried out strictly in accordance with Howden procedures.

We suggest that any damage shall be photographed and forwarded to Howden Cooling Fans for evaluation.

VI. CONTACT HOWDEN

Howden Cooling Fans

Lansinkesweg 4
P.O. Box 975
7550 AZ Hengelo
The Netherlands

Tel. +31 74 255 6000
Fax +31 74 255 6060
Email: cooling.fans@howden.nl
Web: www.howdenpower.com

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VII. TROUBLE SHOOTING

In case of any failure, please contact Howden stating the impeller serial number as mentioned on the nameplate located at the hub of the impeller.

Problem	Possible cause	Possible solution
Air volume low.	Fouling of system.	Clean system air-cooler bundles or cooling tower fill.
	Obstacles in housing/air stream.	Check actual total area of obstacles and impeller housing inlet shape against original selection.
		In dry-coolers the minimum required free height of the air inlet area is 1.0 times the fan diameter. This shall be higher in case of multiple row units.
Power absorption (too) high.	Fouling of system.	Clean system air-cooler bundles or cooling tower fill.
	Obstacles in housing/air stream.	Check actual total area of obstacles and impeller housing inlet shape against original selection.
		In dry-coolers the minimum required free height of the air inlet area is 1.0 times the fan diameter. This shall be higher in case of multiple row units.
Air temperature lower than design air temperature.	Air temperature lower than design air temperature.	Check performance against current air temperature.
	Transmission out of order.	Check transmission.
Impeller is rubbing against fan casing.	Bolting of drive-train connection, support structure or fan housing is not tight.	Tighten all bolts.
	Impeller not centred.	Centre the impeller.
	Tip clearance too small.	Increase diameter of fan casing.
	Fan casing too weak.	Stiffen fan casing.

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Problem	Possible cause	Possible solution
Vibration level high.	Imbalance of impeller.	Contact Howden for advise.
	Lack of stiffness in support structure.	Reinforce support structure.
	Bolting of drive-train connection or fan housing is not tight.	Tighten all bolts.
	Drive alignment incorrect.	Realign.
	Driver bearing damage.	Repair or replace.
	Drainage holes are blocked.	Open the drainage holes.
Hairline cracks on blade surface.	Could appear in resin rich areas around the edges of the fan blades and will normally stop progressing.	Hairline cracks are harmless in itself, however we advise to fill these cracks with a touch-up material e.g. Sikaflex 252 to prevent moisture penetration affecting the blades (Contact Howden for a repair kit).
Scratches or small damages.	Transport and handling.	We advise to fill these cracks with a touch-up material e.g. Sikaflex 252 to prevent moisture penetration affecting the blades (Contact Howden for a repair kit).
Noise higher than predicted.	Fan too close to obstacles.	Contact Howden for advise.
	Influence of mechanical noise caused by drive-train.	Contact drive-train supplier.
	Resonance of fan-drive and/or support structure.	Contact Howden for advise.

Table 5

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VIII. DOCUMENT VERSION CONTROL

Version 03

12 April 2007

Adjustment of preventive maintenance

Adjustment of tip clearance table

Adjustment of instructions impeller installation

Replacement of the word cap screws into bolts