



## **PROCEDURE FOR INSTALLATION, MAINTENANCE AND OPERATION OF NYBORG AXIAL FANS, DIRECT DRIVEN.**

### **Limitation:**

This manual encompasses the fan models:

MPV – A1K, MPV – A1E, MPV – A1B, MPV – A1M, MPV - D1K, MPV - D1M

Direct driven, non EX and non EX fans.

Do not encompass belt driven fans or fans with coupling drive.

### **Receipt of goods:**

Check first the goods for transport damage. In case of damage, notify the forwarder / transporter immediately.

Check the delivery towards the packing list to verify that all components are delivered.

### **Lifting:**

Fans are normally packed on wooden pallets. Fans should be transported by fork lift or similar. Pallet must be lifted and handled carefully and sudden impacts avoided.

It must be ensured that water (e.g. rain) will not enter the motor or bearings during lifting / handling

During installation, fan must be lifted by holes in fan flange or by lifting lugs on fan casing. The lifting lugs on motor should not be used. For fans MPV A1E and A1B lifting holes in motor pedestal might be used for lifting. Ensure that chain will not conflict or touch motor or other components. Also ensure that the crane wire is not turned in a way that can disengage eyebolts.

### **Storage:**

The fans can be stored outdoor for a short period, of 3-4 weeks. For longer storage periods the fans should be stored indoor, in a well ventilated room. Storage temperature should not fall below 5deg C and relative humidity not below 65-70%.

The fan must be always be drained and secured against water. - All surfaces should be cleaned of possible foreign materials and dirt. Ensure that thoroughly drying is done.

In case of damage in surface coating occur during storage, these must be repaired

For storage above 4-6 months it is recommended to turn the fan impeller manually 1-2 times every month. Storage time should not exceed one year.

For fans with stand still heating element: if stored for a longer period and in environment/temperatures where condensing can occur, the heating element of motor should be electrically connected.



## **Installation**

The fan must be installed on a level and proper foundation or horizontal surface. A foundation that is not sufficient stiff might be a source of vibration problems. The foundation must be sufficient stiff to give a resonant frequency of the foundation minimum 25% higher than the (highest) fan rotational frequency. It is important that the fan is not tightened up awry by foundation bolts. Adjust with shims if necessary.

If the fans is supplied with *adjustable* vibration dampers, they have to be adjusted to the fan is level.

Before installing the fan:

- Rotate the impeller by hand to check that it runs freely. Listen for unusual “grinding” noises from the bearings.
- Check the impeller clearance to the casing/inlet cone is more or less evenly distributed throughout the circumference.

Refer to section for lifting on previous page.

Install the fan so that the air flow will be in accordance with the air flow indication of the arrow on fan casing.

For the duct connected fan, there should be used gasket between fan flange and connection flange to avoid leakage. E.g. 4-5mm thick gasket is usually sufficient.

In order to assure proper ventilation for the motor the air stream from the cover of motor should not be blocked. Recommended minimum distance from the end of motor fan cover to obstacles are

Motor size	Minimum distance [mm] to blocking obstacle.
Up to 160	40
180 to 225	80
$\geq 250$	125

Check that fan is centered (not off set) with regard to the duct.

If the fan is connected to the flexible connection the connections should be centered / aligned with the fan inlet and/or outlet. Also it must be assured on the inlet that the collar/flex connection is firmly tight. A loose collar will reduce the effective inlet diameter and can reduce the fan performance. Gasket should be used to seal the flange connections.

### **Safety – protection – wire guards**

The protection for the impeller must be considered when installing the fan. If the fan is not delivered with touch protection grid, protection screens or similar must be installed to avoid contact to rotating impeller from fan inlet or outlets. This is especially important when the fan has either free inlet or free outlet.

For EX fans for hazardous area: wire guards must be installed at duct inlet and duct outlet with max dimensions 12x12 to prevent objects to enter air flow.

Proper touch protection is the responsibility of the customer.



### Electrical connection.

The electrical connection must be made by qualified persons. For EX motors with EX class EXD, the electric connection must only be made with certified persons.

Check the electric cable is for free from damage and cracks.

Measure the impedance of the insulation. If values are smaller than 1kohm per volt of rated voltage the windings must be dried out.

For a 3 phase motor the cables must be connected according to the connection diagram (usually on the inside of motor terminal box).

Check that the terminals are properly fastened.

Tightening torques for terminal board connections:

Thread Ø	M4	M5	M6	M8	M10	M12	M16
Tightening torque [Nm]	0,8..1,2	0,8..2,5	2,7..4	5,5..8	9..13	16..20	36..40

The terminal box must be free of dust, foreign bodies, humidity. Openings/cable entries not used must be closed with blinding plugs to prevent ingress of water and dust.

Take care that water (e.g. rainwater) will not enter the terminal when opened and during installation.

Check that the motor terminal box cover is properly closed not to allow water into the box.

The electric motor must always be protected with motor protection

For fans with frequency inverter and voltage 690V, it must be ensured that the motor is protected from voltage peaks either by a filter between inverter and motor or that a motor with special insulation is used.

For EX fans for hazardous area all conductive parts must be earthed to prevent build up of electrostatic charges.

D/Y starter – the relay time must be set to the correct value.

Check that earthing studs on motor, fan, and frame are connected if present.



## **START UP**

### Before start up

- Check that the duct is clean and free of foreign objects as bolts, tools, cloths (these can be sucked into the fan and damage the impeller) – pay especially attention to the suction side of the fan.
- Check that the fan dampers for supply and exhaust are open or will open when fan starts.

### **Warning**

- Never touch impeller while it rotates.
- Do not work on impeller while electricity is connected.
- During all maintenance work, the fan must be electrically isolated so it is not unintentionally started. A clear note / poster should be made at the starter panel (and possible remote start locations)
- Be careful with loose clothes that can be sucked into the impeller. E.g. loose ropes, loose clothes, scarf etc.
- Check that no person is standing in front of the fan inlet at fan start up.

After the fan has been duct connected start the fan for 2-3 seconds and check the rotation direction of the impeller corresponds to the indicating arrow on the fan casing.

If the rotation is wrong, two phases has to be interchanged on the wiring.

For two speeds fans: check the rotation direction for both speeds.

Start the fan again and let in run for 15-20 minutes.

If any abnormal noise, vibration or other condition occurs, stop the fan immediately and find the causes. Recommended vibration should in all cases be below 7 mm/s rms,

Measure the load current and check that it does not exceed rated current on motor tag plate. The dampers (both supply and exhaust) must be open.

### **Fans for frequency control:**

Fans must not be operated for speeds higher than indicated on fan tag plate without consent of Nyborg AS. It must also be ensured that fan is not operated in a resonant frequency of the fan, which may damage the fan. (this can be checked by measuring the vibration level as the fan accelerates slowly) If this is the case the frequency inverter must be programmed to quickly bypass possible resonant frequencies during acceleration/retardation, and these frequencies must be blocked in the inverter's operation. For EX fans, PTC thermistors must be connected.



## Maintenance

During all maintenance work, the fan must be electrically insulated/disconnected so it is not unintentionally started. A clear note / poster must be made at the starter panel (and possible remote start locations) that maintenance work is ongoing.

In case of malfunction contact Nyborg AS

### **Inspection, every 2. weeks**

To check	Method	Look for	Action if not satisfactory
Current	Ammeter	No level change more than $\pm 7\%$ 1)	Find causes
Vibration	By finger or vibration measurement	No change in vibration level	Find causes
Noise	Ear	No change in noise level, no unusual or new type of noise.	Fault search and find causes
Smell – fume	Nose	No fume/smell, e.g. from motor, etc.	Check motor windings, check leakage in duct system.

- 1) In winter or period with cold temperature of the conveyed air, the higher air density will cause the fan to consume more power, and increase the rated current.



### Maintenance every 3- 6months

To check	Method	Look for	Action if not satisfactory
Fan casing, painting, galvanizing.	Visual	Check no corrosion, scratches, and no damage	Repair
Bolts, nuts	Visual + wrench	Properly tightened	Tighten up
Leakage in duct	Finger, hand	Leakage	Seal, repair
Insulation resistance	Ohmmeter/multi meter	Within expected values (> 1kohm per V)	Dry windings, if still too low, find cause.
Motor terminal box, el connections *)	Visual, (wrench)	No damage to leads, no loose connections No water – moisture, dust inside box.	Repair, tighten, remove moisture
Bearing checked	Ear (noise), turning resistance, vibration monitoring (SPM/SKF), other	No “bearing noise”, no extra resistance when turning impeller, no unnormal values	Change bearings
Vibration dampers	Visual	Check no damage	Replace
Collars/flexible connections	Visual / hand (leakage)	Check no damage	Replace

\*) If motor terminal box is EXD, insulation resistance measurement should not be done on motor terminal box.

For EX motors for hazardous area in general – please refer to the maintenance instruction in the ATEX certificate and motor operation and maintenance manual.



**Maintenance every 1-2 years.**

To check	Method	Look for	Action if not satisfactory
Impeller	Visual	No corrosion, no wearing, no dust build up, no dirt	Clean and rebalance if needed
Motor*	Visual	No excessive rust, corrosion, no damage to painting.	Repair or replace
Brass lining for EX fans (if present)	Visual	No corrosion, clearance even through circumference	Contact Nyborg
Bolts, nuts, fasteners,	Visual, wrench	No corrosion, no damage,	Replace
Vibration dampers	Visual	Rubber ok, not degradation due to aging.	Replace
Gasket	visual	Rubber ok, not degradation due to aging	Replace

\*) –EX motor for hazardous area – own requirements might apply. Please refer to ATEX certificate and motor operation and maintenance manual.

**Bearings**

A standard (non EX) el motor usually only need maintenance of the bearings. See motor maintenance instruction for details.

Smaller motors (frame size 132 and smaller) usually have closed bearings and are sealed for life. Motors from frame size 160 and bigger (non EX motors) usually have open bearings that need relubrication.

See documentation from motor supplier for grease intervals and grease amounts.

**Fitting and refitting of motor and impeller (for change of motor or bearings)**

Dismounting and mounting should only be done by qualified persons.

All parts should be marked with regard to position before dismounting so they can be put back to exact same location (e.g. the motor or inlet flange should be marked with orientation with regard to fan housing. )

When refitting, check that gap between impeller and casing are evenly distributed. Do this by turning impeller through its circumference.

Check also that sealing between motor flange and/or inlet cone towards fan housing is air tight. Apply gasket or sealing mass if needed.

**To replace the bearings:**

Motor with EX class EXD or EXDE – change of bearings must only be done by persons with authorization/certification for this.

After the impeller has been dismantled according to procedure above; Take out the shaft key. Loosen flange or shield on motor DE side and take out the rotor part of elmotor out from the fan casing. Then replace the bearings.



REVISION HISTORY			
REV. NO.	DESCRIPTION	DATE	APPROVED

**Procedure demounting of impeller with two demounting holes in impeller hub. Bigger axial fans > ø500, and all centrifugal fans, excepted models MSV 125, 160, 100, LSV 250, 315.**

Unscrew and remove bolt and washer that is fastened in motor shaft.

Put a washer, a nut (e.g. M8 or M10) or similar on top of motor shaft to prevent threads in motor shaft to be damaged by demounting tool.

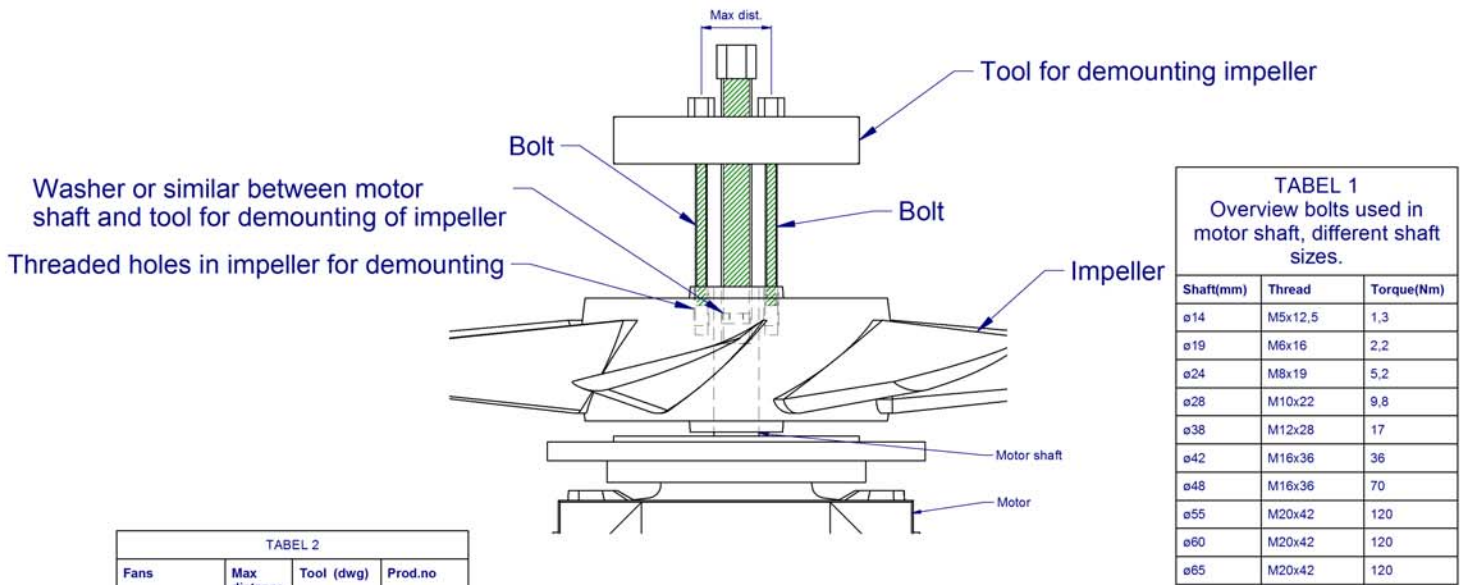
Use demounting tool (it might be you need to find two bolts with proper length and use for the demounting tool) as shown sketch below.

Screw these two bolts into 2 threaded holes on impeller on each side of motor shaft. Be careful to screw these the same distance so the demounting tool is not inclined with regard to motor shaft.

Demount impeller by turning the center bolt on demounting tool

If axial fan is equipped with hemisphere or other loose part in front of hub, the position of this with regard to impeller hub must be clearly marked with ink pen or similar before they are demounted so they are put back in exact same place later. If not balance of impeller will be rendered.

In general before demounting of any part, all parts should be marked, so things are put back in correct place.



**TABEL 1**  
Overview bolts used in motor shaft, different shaft sizes.

Shaft(mm)	Thread	Torque(Nm)
ø14	M5x12,5	1,3
ø19	M6x16	2,2
ø24	M8x19	5,2
ø28	M10x22	9,8
ø38	M12x28	17
ø42	M16x36	36
ø48	M16x36	70
ø55	M20x42	120
ø60	M20x42	120
ø65	M20x42	120

**TABEL 2**

Fans	Max distance (mm)	Tool (dwg)	Prod.no
PUV > 500	160		
MPV	100		
Centrifugal fans	90		
MPV A7L, A7T, A9T	160		

Date: 28.05.14	Drawn/Drawn: N.Skotheim	Scale: 1:2	 N-6230 SYKKYLVEN
Checked:	Checked:	Approved:	
Mass: 0 kg			
<b>Procedure Demounting of impeller with two threaded holes.</b>			Replacement for: Replaced by:
Reference:			<b>2-10040</b>
Project:		Sheet size: A2	Sheet no: 1/2



**Mounting of impeller:**

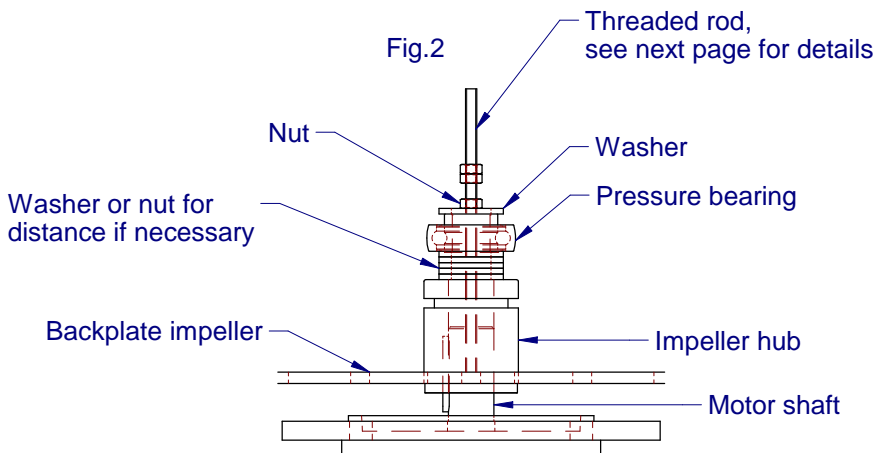
Use a threaded rod which is fitted to threads in motor shaft (see table 1 for correct size) and screw this into motor shaft

Put impeller onto shaft

Add a washer and a pressure bearing to get sufficient distance if necessary.

Add a nut and turn the nut downwards till impeller hub is resting on the edge/recess on motor shaft.

Put on washer and bolt that was originally in impeller. Use threadlock on bolt to prevent unscrewing, e.g. locktite. Turn this well back on. See fastening torques tabell 1.



**TABEL 1**  
Overview bolts used in motor shaft, different shaft sizes.

Shaft(mm)	Thread	Torque(Nm)
ø14	M5x12,5	1,3
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ø38	M12x28	17
ø42	M16x36	36
ø48	M16x36	70
ø55	M20x42	120
ø60	M20x42	120
ø65	M20x42	120

Example pressure bearing:  
 Type 51305A (motors <N160) (25x52x18)  
 Type 51308A (motors ≥N160) (40x78x26)

Date: 20.05.14	Const / Drawn: N.Skotheim	Scale:	 N-6230 SYKKYLVEN
Checked:	Checked:	Approved:	
Mass:			Matl:
Project:			Projection:
Reference:			Replacement for:
Project:			Replaced by:
Sheet size: A2			2-10037
Sheet no: 2/3			



## Trouble shooting guide

<b>Problem</b>	<b>Component</b>	<b>Possible reason</b>	<b>Only for</b>	<b>Action</b>
Fan does not start	Fan/motor	Damage to electric motor		Replace el motor
	El connection	Incorrect power supply connection		Correct the connection
	El connection	Incorrect power supply voltage		Check if motor is multivoltage, if not change motor or power supply
	Fan/motor	Impeller is touching the casing/inlet cone		Repair or replace fan
	El connection	Damage to electric switch/blown fuses/no electricity/emergency stop pressed.		Repair
Air flow is too low	Fan	Rotating direction is wrong		Change el connection
	Duct/system	Damper is closed or partly closed		Open damper
	Duct/system	Something is blocking the duct (either on supply and / or exhaust side)		Find and remove
	Fan	Inlet collar is loosely fitted, and is reducing the air flow.		Refit
	Filter	Filter is dirty or clogged		Change the filter
	Duct / system	System resistance/pressure is higher than anticipated / calculated		Replace fan, modify duct or change impeller (angle)
	Fan	Impeller is wrong (e.g. RD impeller for LG fan)		Change impeller
	Duct / system	Elbows or obstacle right in front of inlet or outlet of fan.	Axial fan	Modify, insert guides
	Fan	Wrong speed (too low) of motor		Change the motor / fan
	Duct/system	System poorly designed with high air speed through bends, orifices, openings, outlets etc.		Modify duct or change fan
	Duct/system	Leakage in the duct or fan		Repair, seal
Current too high / Fan might be tripping	Fan	Wrong rotating direction		Modify electric connection



<b>Problem</b>	<b>Component</b>	<b>Possible reason</b>	<b>Only for</b>	<b>Action</b>
Current too high / Fan might be tripping	Fan	Motor is wrongly wired and thus running in over or under voltage.		Correct the wiring.
	Fan	Condensing damage in motor / moist or water in motor windings.		Dry out the windings, and replace motor if needed
	Fan	Wrong speed (too high) on motor		Replace motor
	Duct /system	Fan is operating far away from its working point.		Use a regulating damper if too high air flow
	System	Density of flow medium is too high (e.g. due to very cold conveyed air)		Change motor protection settings if cold air. (non EX fans)
	Fan	too small motor selected for the fan		Change the motor (impeller) or fan (check with Nyborg)
Unnormal noise, frequency driven fan		Switching frequency of inverter causes noise in motor		Change the switching/carrier frequency of inverter up (not the output frequency)
Unnormal noise		Loose bolts, parts, etc.		Tighten
		Bearing(s) defect on fan		Change bearings
		Motor cooling fan touching cover (dump in cover)		Replace motor cover
		Mechanical, resonance, etc,		Insulate the fan mechanically, use vibration dampers and flex connections
		Insufficient stiffening, etc		Stiffen fundamentals, ducts etc.
		Impeller touching stationary part		Identify parts, repair or replace parts.
Excessive vibration		impeller imbalance due dust or other deposits.		Clean the impeller for build ups, if still problem, rebalance impeller.
		Bearings defect on fan		Change the bearing
		Impeller imbalance due to damage or tear / corrosion on impeller		Replace or rebalance impeller



## Restriction in guarantee

The warranty is void in case of:

- Improper installation and operation of the equipment, inconsistently with intended use and instructions/operations and maintenance manual.
- Repairs or constructional modifications without the producer's permit.
- Damages resulting from external sources (mechanical, chemical damage, flooding etc)
- Lack of legible producer's nameplate

The warranty do not cover

- Damage caused by improper transport or storage of fans.
- Normal wear and tear of parts.

## Restriction in use

If not otherwise stated:

Fan can be used in ambient temperatures from -20 C to +45 C

Dust content of conveyed air should not be higher than 0,3g pr m<sup>3</sup>



## **PROCEDURE FOR INSTALLATION, MAINTENANCE AND OPERATION OF NYBORG CENTRIFUGAL FANS, DIRECT DRIVEN.**

### **1.1 Limitation:**

This manual encompasses the fan models:

LSV – B, MSV – B, HSV – B, HRV – B, HZV - B

Direct driven, belt driven, non EX and EX fans (for hazardous area), and fans with gas tight motor flange.

Do not encompass fans with coupling drive.

### **2.1 Receipt of goods:**

Check first the goods for transport damage. In case of damage, notify the forwarder / transporter immediately.

Check the delivery towards the packing list to verify that all components are delivered.

### **2.2 Lifting:**

Fans are normally packed on wooden pallets. Fans should be transported by fork lift or similar. Pallet must be lifted and handled carefully and sudden impacts avoided.

It must be ensured that water (e.g. rain) will not enter the motor or bearings during lifting / handling

During installation, fan must be lifted by

1. Existing lifting holes on fan casing,
2. Lifting eyes inserted into and fastened to fan flange.

The lifting lugs on motor should not be used. Also ensure that chain will not conflict or touch motor or other components. Also ensure that the crane wire is not turned in a way that can disengage eyebolts.

### **2.3 Storage:**

The fans can be stored outdoor for a short period, of 3-4 weeks. For longer storage periods the fans should be stored indoor, in a well ventilated room. Storage temperature should not fall below 5deg C and relative humidity not below 65-70%.

The fan must be always be drained and secured against water. - All surfaces should be cleaned of possible foreign materials and dirt. Ensure that thoroughly drying is done.

In case of damage in surface coating occur during storage, these must be repaired

For storage above 4-6 months it is recommended to turn the fan impeller manually 1-2 times every month. Storage time should not exceed one year.

For fans with stand still heating element: if stored for a longer period and in environment/temperatures where condensing can occur, the heating element of motor should be electrically connected.



### **3.1 Installation**

The fan must be installed on a level and proper foundation or horizontal surface. A foundation that is not sufficient stiff might be a source of vibration problems. The foundation must be sufficient stiff to give a resonant frequency of the foundation minimum 25% higher than the (highest) fan rotational frequency. It is important that the fan is not tightened up awry by foundation bolts. Adjust with shims if necessary.

If the fans is supplied with *adjustable* vibration dampers, they have to be adjusted to the fan is level.

Before installing the fan:

- Rotate the impeller by hand to check that it runs freely. Listen for unusual “grinding” noises from the bearings.
- Check the impeller clearance to the inlet cone is evenly distributed throughout the circumference.

Refer to section for lifting (2.2) on previous page.

Install the fan so that the air flow will be in accordance with the air flow indication of the arrow on fan casing.

For the duct connected fan, there should be used gasket between fan flange and connection flange to avoid leakage. E.g. 4-5mm thick gasket is usually sufficient.

In order to assure proper ventilation for the motor the air stream from the cover of motor should not be blocked. Recommended minimum distance from the end of motor fan cover to obstacles are

Motor size	Minimum distance [mm] to blocking obstacle.
Up to 160	40
180 to 225	80
$\geq 250$	125

Check that fan is centered (not off set) with regard to the duct.

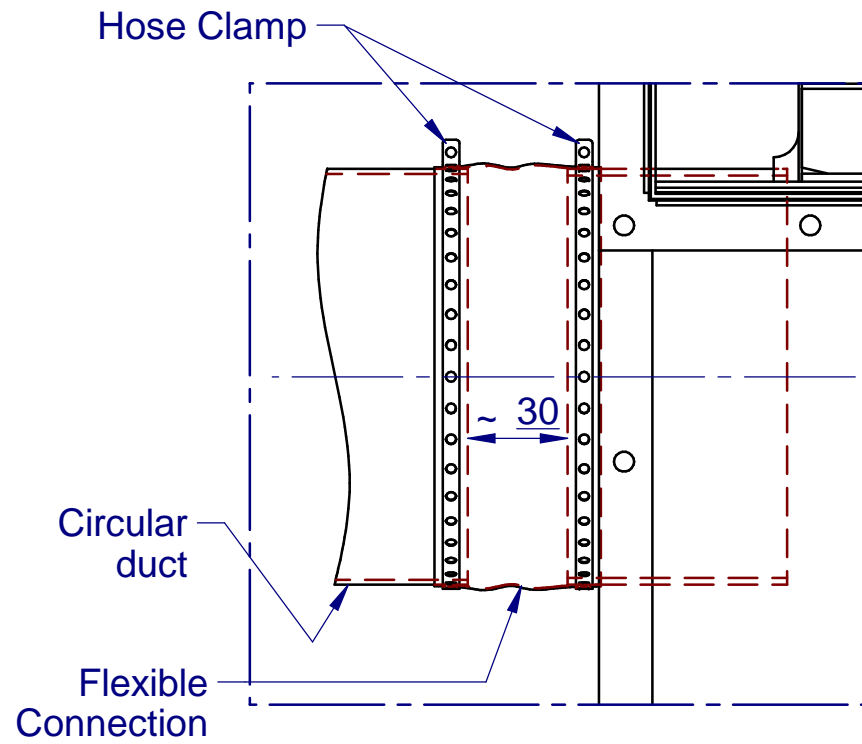
If the fan is connected to the flexible connection the connections should be centered / aligned with the fan inlet and/or outlet. Also it must be assured on the inlet that the collar/flex connection is firmly tight. A loose collar will reduce the effective inlet diameter and can reduce the fan performance. Gasket should be used to seal the flange connections.

Collars are delivered with straight or flanged end. Collars should be fastened like next page (drawing 3-51149.)

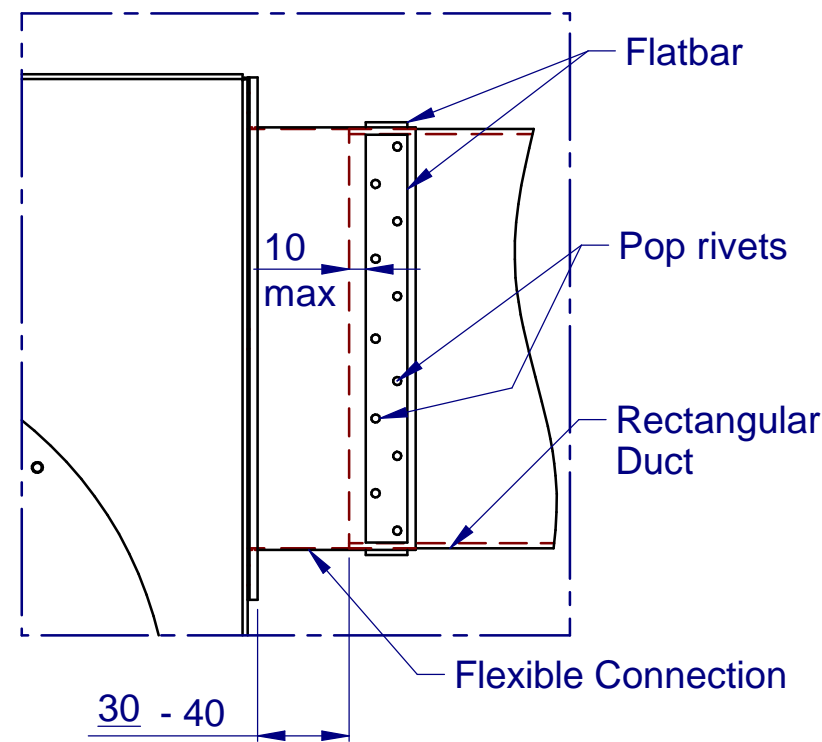
REVISION HISTORY

REV. NO.	DESCRIPTION	DATE	APPROVED

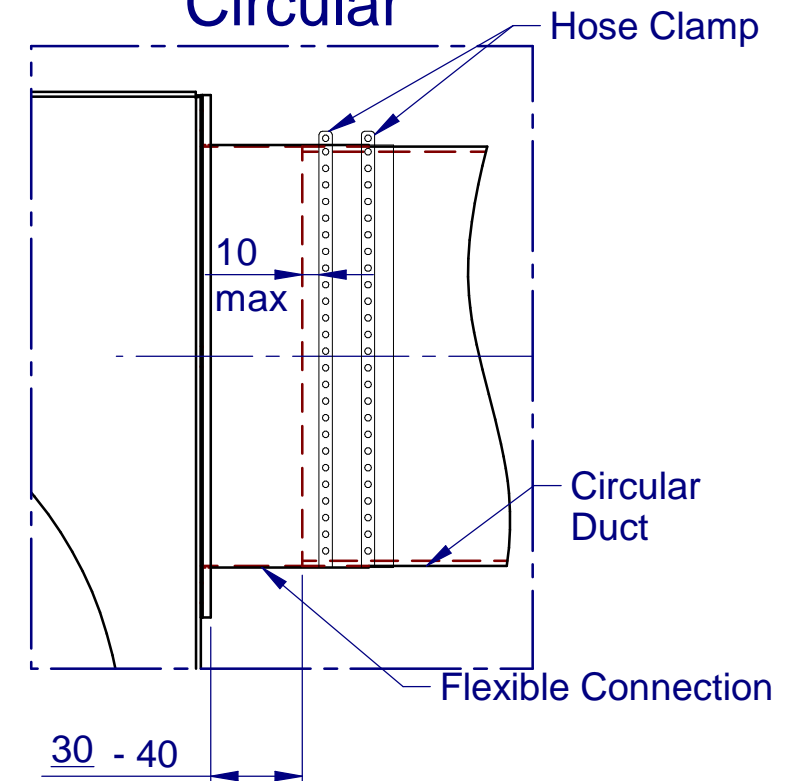
Fan Inlet



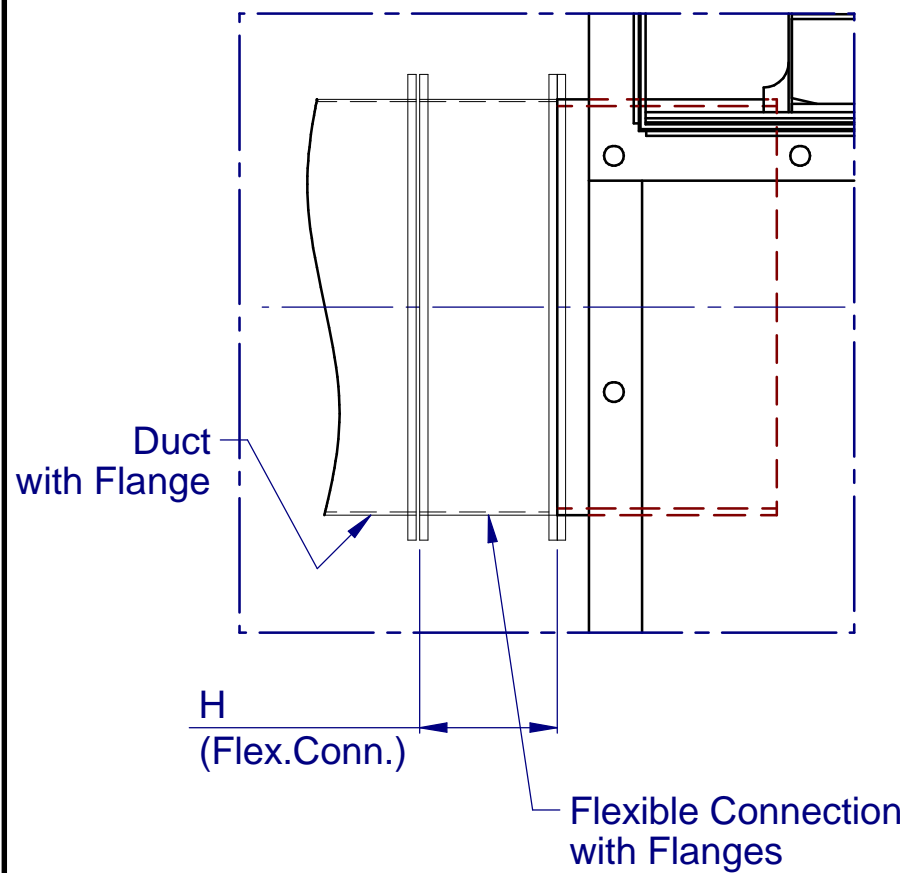
Fan Outlet Rectangular



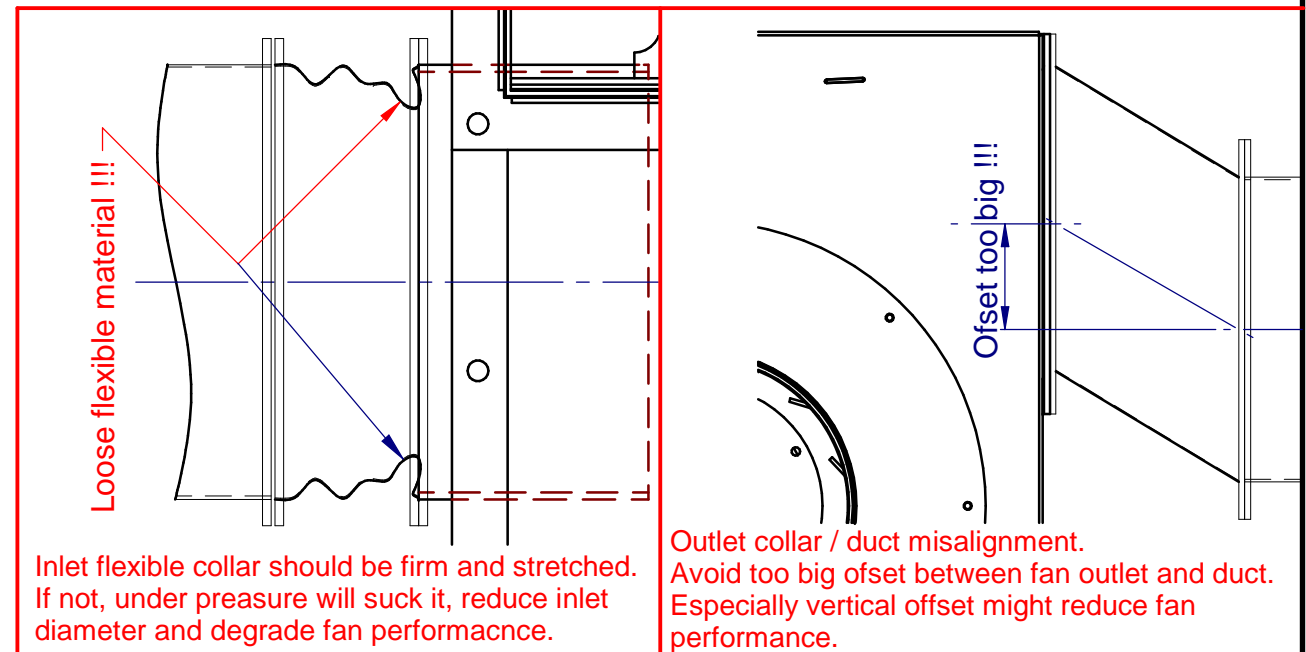
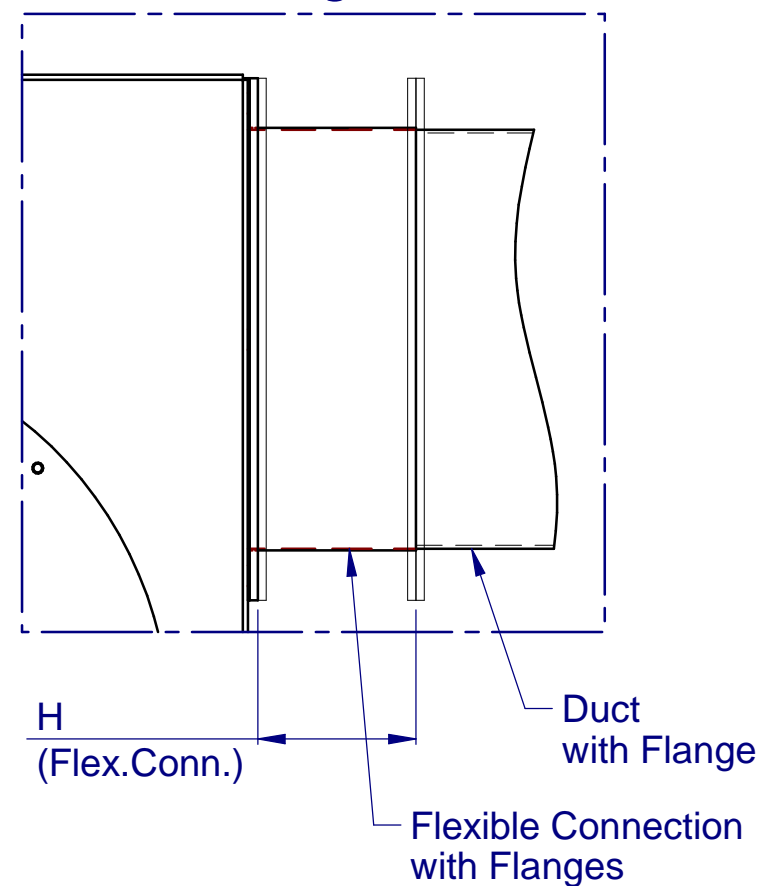
Fan Outlet Circular



Fan Inlet Flanged



Fan Outlet Flanged



Date: 04.05.16	Constr./Drawn: R.Hensler	Scale: 1:5	<p><b>NYBORG AS</b> N-6230 SYKKYLVEN</p>
Checked:	Checked:	Approved:	
<p><b>Instalation Drawing</b> <b>MSV / LSV Flex. Connection</b></p>			<p>Projection: </p> <p>Replacement for:</p> <p>Replaced by:</p> <p>Rev:</p>
Reference:	Project:	Sheet size: A3	Sheet no: 1/1





### 3.1.1 Safety – protection – wire guards

The protection for the impeller must be considered when installing the fan. If the fan is not delivered with touch protection grid, protection screens or grid must be installed to avoid contact to rotating impeller from fan inlet or outlets. This is especially important when the fan has either free inlet or free outlet.

For EX fans for hazardous area: wire guards must be installed at duct inlet and duct outlet with max opening dimensions 12x12 mm to prevent objects to enter air flow.

Proper touch protection is the responsibility of the customer.

### 3.1.2 Electrical connection.

The electrical connection must be made by qualified persons. For EX motors with EX class EXD, the electric connection must only be made with certified persons.

Check the electric cable is for free from damage and cracks.

Measure the impedance of the insulation of motor windings. If values are smaller than 1kohm per volt of rated voltage the windings must be dried out.

For a 3 phase motor the cables must be connected according to the connection diagram (usually on the inside of motor terminal box).

Check that the terminals are properly fastened.

Tightening torques for terminal board connections:

Thread Ø	M4	M5	M6	M8	M10	M12	M16
Tightening torque [Nm]	0,8..1,2	0,8..2,5	2,7..4	5,5..8	9..13	16..20	36..40

The terminal box must be free of dust, foreign bodies, humidity. Openings/cable entries not used must be closed with blinding plugs to prevent ingress of water and dust.

Take care that water (e.g. rainwater) will not enter the terminal when opened and during installation.

Check that the motor terminal box cover is properly closed not to allow water into the box.

The electric motor must always be protected with motor protection

For fans with frequency inverter and voltage 690V, it must be ensured that the motor is protected from high voltage peaks from inverter either by a filter between inverter and motor or that a motor with special insulation is used.

For EX fans for hazardous area all conductive parts must be earthed to prevent build up of electrostatic charges.

If fan is started by D/Y starter – the relay time must be set to the correct value.

Check that earthing studs on motor, fan, and frame are connected if present.

### 3.1.3. Fans with belt drive:

When turning impeller, check that belts or other parts are not touching the protection cover.

Warning : Never run the fan without the belt cover protection in place.



## **4.1 START UP**

### Before start up

- Check that the duct is clean and free of foreign objects as bolts, tools, cloths (these can be sucked into the fan and damage the impeller) – pay especially attention to the suction side of the fan.
- Check that the fan dampers for supply and exhaust are open or will open when fan starts.

### **Warning**

- Never touch impeller while it rotates.
- Do not work on impeller while electricity is connected.
- During all maintenance work, the fan must be electrically isolated so it is not unintentionally started. A clear note / poster should be made at the starter panel (and possible remote start locations)
- Be careful with loose clothes that can be sucked into the impeller. E.g. loose ropes, loose clothes, scarf etc.
- Check that no person is standing in front of the fan inlet at fan start up.

After the fan has been duct connected start the fan for 2-3 seconds and check the rotation direction of the impeller corresponds to the indicating arrow on the fan casing.

If the rotation is wrong, two phases has to be interchanged on the wiring.

For two speeds fans: check the rotation direction for both speeds.

Start the fan again and let in run for 15-20 minutes.

If any abnormal noise, vibration or other condition occurs, stop the fan immediately and find the causes. Recommended vibration should in all cases be below 7 mm/s rms,

Measure the load current and check that it does not exceed rated current on motor tag plate. The dampers (or louvers) both on supply and exhaust side must be open.

#### **4.1.1 Fans for frequency control:**

Fans must not be operated for speeds higher than indicated on fan tag plate without consent of Nyborg AS. It must also be ensured that fan is not operated in a resonant frequency of the fan, which may damage the fan. (this can be checked by measuring the vibration level as the fan accelerates slowly) If this is the case the frequency inverter must be programmed to quickly bypass possible resonant frequencies during acceleration/retardation, and these frequencies must be blocked in the inverter's operation. For EX fans, PTC thermistors must be connected.



### 4.1.3 Fans with belt drive: LSV B2, B3, MSV - B2 and B3, HSV B2, B3

Warning – keep in mind safety precautions. Disconnect the fan electrically before start working on it.

Check that belt tension is correct (see table 4.1 and fig 4.1) and that pulleys are parallel and aligned (figure 4.2).

Deviation from alignment should not be bigger than 1mm/m of distance between center of pulleys. Use ruler or similar to check.

Correct belt tension is important to avoid too fast wearing or belt slip. See also specific data sheets / documentation for belts and belt tension if present.

- Start the fan and let it run for one hour, check the belt tension again and adjust if needed.
- Then check the belt tension again after one week (and adjust if needed)

The belt tension should always be checked as described above after start up after prolong downtime period of fan. When installing new belts, the initial tension should be 20% higher than in table below (That is deflection should be only 80% of table value) when set for first time.

When adjusting the belt tension, parallelity of the pulleys must be ensured.

Remember to put the belt protection on before starting the fan.

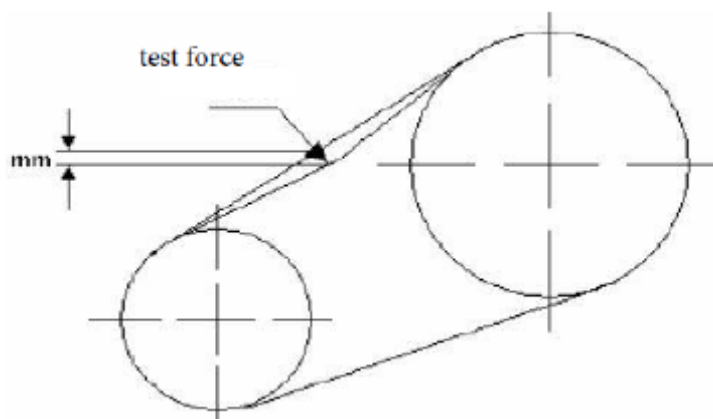


Figure 4.1 Checking belt tension. Deflection and test force

Profile	Test force per V-belt [N]	Diameter of the smallest pulley (mm)	Deflection depth [mm] Per 100mm pulley distance (center – center)
SPZ	25	56 ≤ 71	3,19
		> 71 ≤ 90	2,86
		> 90 ≤ 125	2,67
		> 125	2,47
SPA	50	71 ≤ 100	4,16
		> 100 ≤ 140	3,58
		> 140 ≤ 200	3,33
		> 200	3,19
SPB	75	112 ≤ 160	3,90
		> 160 ≤ 224	3,32
		> 224 ≤ 355	2,89
		> 355	2,73

Table 4.1 - belt tension. deflection and test force

We recommend (especially for bigger fans) to use a tension gauge tool to ensure correct tension and prolong lifetime of belts.

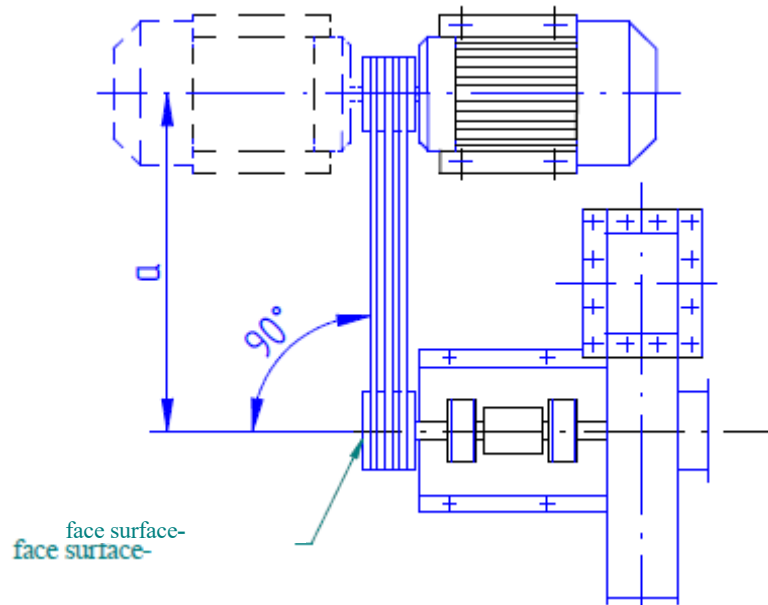


Figure 4.2 Assembly of a motor with belt drive

#### 4.1.4 Fans with gas tight coupling

Check that grease is filled. It can in some cases be, that sealing rings are tight and will give smoke etc during start up. Observe this in 5 min and see if dissapaires. Let fan run for 30 minutes, turn off fan and check that temperature of rings are normal. Warning - don't touch the motor.



## 5.1 Maintenance

During all maintenance work, the fan must be electrically insulated/disconnected so it is not unintentionally started. A clear note / poster must be made at the starter panel (and possible remote start locations) that maintenance work is ongoing.

In case of malfunction contact Nyborg AS

### **5.1.1 Inspection, every 2-3. weeks**

To check	Method	Look for	Action if not satisfactory
Current	Ammeter	No level change more than +7% 1)	Find causes
Vibration	By finger or vibration measurement	No change in vibration level	Find causes
Noise	Ear	No change in noise level, no unusual or new type of noise.	Fault search and find causes
Smell – fume	Nose	No fume/smell, e.g. from motor, etc.	Check motor windings, check leakage in duct system.

- 1) In winter or period with cold temperature of the conveyed air, the higher air density will cause the fan to consume more power, and increase the rated current.

### **5.1.2 Inspection/maintenance every 3- 6months**

To check	Method	Look for	Action if not satisfactory
Fan casing, painting, galvanizing.	Visual	Check no corrosion, scratches, and no damage	Repair
Bolts, nuts	Visual + wrench	Properly tightened	Tighten up
Leakage in duct	Finger, hand	Leakage	Seal, repair
Insulation resistance	Ohmmeter/multi meter	Within expected values (> 1kohm per V)	Dry windings, if still too low, find cause.
Motor terminal box, el connections *)	Visual, (wrench)	No damage to leads, no loose connections No water – moisture, dust inside box.	Repair, tighten, remove moisture
Bearing checked	Ear (noise), turning resistance, vibration monitoring (SPM/SKF), other	No “bearing noise”, no extra resistance when turning impeller, no unnormal values	Change bearings
Vibration dampers	Visual	Check no damage	Replace
Collars/flexible connections	Visual / hand (leakage)	Check no damage	Replace
Belts (belt driven fans only)	Visual	Surface condition ok	Replace



### 5.1.3 Inspection/maintenance every 1-2 years.

To check	Method	Look for	Action if not satisfactory
Impeller	Visual	No corrosion, no wearing, no dust build up, no dirt	Clean and rebalance if needed
Motor*	Visual	No excessive rust, corrosion, no damage to painting.	Repair or replace
Brass lining for EX fans (if present)	Visual	No corrosion, clearance even through circumference	Contact Nyborg
Bolts, nuts, fasteners,	Visual, wrench	No corrosion, no damage,	Replace
Vibration dampers	Visual	Rubber ok, not degradation due to aging.	Replace
Gasket	Visual	Rubber ok, not degradation due to aging	Replace

### 5.1.4. Maintenance at other intervals

What to maintain	Maintenance operation	Interval.	Comment
Motor	Regreasing of bearings for motor with open bearings (grease nipple)	Acc to interval on motor documentation (and possible tag plate on motor). Grease should be changed every 3 <sup>rd</sup> year	Should be done when motor is running. If practically difficult rotate the impeller by hand.
Fans with gas tight sealing	Regrease coupling,	If nothing other stated on tag plate/documentation, every 800-1000 running hours, min 1 time a year.	12-15 gram (take care to avoid overfilling)
Fans with gas tight sealing	Replace simmer rings	Should be changed every 10.000-12.000 running hours, minimum every 3 <sup>rd</sup> year.	
Belt driven fans	Tension of belts	Check correct tension (2 times a year)	Adjust tension (see 4.1.3)
Belt driven fans, with spherical roller bearings	Bearings	Refill lubricant every 6000 running hour, min every 3 <sup>rd</sup> year. This is a very rough guide. See figure 5.1 for calculated interval	
Belt driven fans, bearings with grease nipple	Bearings	Regrease bearings approx. every 2000 operation hour as rough guide. See figure 5.1 for calculated interval.	



## 5.2 Bearings (belt driven fans):

Bearings with permanent lubrication (no grease nipples) : do not need relubrication.

### Bearings with grease nipple or grease filled roller bearings.

Regreasing interval of bearing will depend on factors as operation speed of bearing, load, and size of bearing + surrounding factors as temperature, moisture and dust/contaminants. High temperature, contaminants in air will make greasing intervals shorter.

If no other information given grease used is high quality lithium grease (e.g. SKF LGMT-2)

Fans for high temperature will normally have special greasing. See own documentation or tag plate on fan.

### 5.2.1 Grease filled spherical roller bearings

Grease-filled Spherical Roller- and Ball Bearings. Grease filled bearings have to be cleaned up and refilled with grease (lubrication) at regular intervals fill the free space in the Grease-filled bearings only to half the free space. Filling more grease than this may cause heat generation. See also bearing manufacturer's own lubrication instructions if present.

Take utmost care to avoid contaminants or dusts into bearings when regreasing.

## 5.3 Changing the bearings (belt driven fans)

Bearings should be inspected and checked regularly.

Tools like SPM instruments can be used to see when bearing is close to failure.

The interval of bearing change will depend on the importance of the fan.

To change bearings, or refill the complete bearings.

Remember safety precautions. Cut off power supply to fan.

Measure distance from bearing to end of shaft.

Take off the belt guard, V-belt and fan belt pulley.

Mount the new bearing with same distance as old bearing to shaft end.

Make sure to center the impeller with regard to the inlet cone when bearing is fastened.

## 5.4 Replacing the V-belts:

Remember safety precautions. Cut off power supply to fan.

If one belt on the fan needs to change, all the belts for the fans should be changed. Motor must be adjusted so belts can be taken off. When installing new belts, check and ensure parallelism (fig 4) and correct tension acc to 4.1.3. Belts should be carefully put on pulleys, do not force belts over pulleys (as it can shorten life time).

When installing new belts, the initial tension (first time set) should be 20% higher than in table 4.1 (that is, deflection should only be 80% of the value in table 4.1 and figure 4.1)

Changing pulles (to change fan speed). It must be consulted with Nyborg, that this change is allowable (not exceeding max speed of fan, and not overloading motor).

Check tension (as per table 4.1 and figure 4.1)





## 5.5 Motor Bearings

A standard (non EX) el motor usually only need maintenance of the bearings. See motor maintenance instruction for details.

Smaller motors (frame size 132 and smaller) usually have closed bearings and are sealed for life. Motors from frame size 160 and bigger (non EX motors) usually have open bearings that need relubrication.

See documentation from motor supplier for grease intervals and grease amounts.

## 5.6 Fitting and refitting of motor and impeller (for change of motor or bearings)

Dismounting and mounting should only be done by qualified persons.

All parts should be marked with regard to position before dismounting so they can be put back to exact same location (e.g. the motor or inlet flange should be marked with orientation with regard to fan housing. )

When refitting, check that gap between impeller and casing are evenly distributed. Do this by turning impeller through its circumference.

Check also that sealing between motor flange and/or inlet cone towards fan housing is air tight. Apply gasket or sealing mass if needed.

### To replace the motor bearings:

Motor with EX class EXD or EXDE – change of bearings must only be done by persons with authorization/certification for this.

After the impeller has been dismantled according to procedure above; Take out the shaft key. Loosen flange or shield on motor drive end (DE) side and take out the rotor part of el.motor out from the fan casing. Then replace the bearings.

REVISION HISTORY			
REV. NO.	DESCRIPTION	DATE	APPROVED

**Procedure demounting of impeller with two demounting holes in impeller hub. Bigger axial fans > ø500, and all centrifugal fans, excepted models MSV 125, 160, 100, LSV 250, 315.**

Unscrew and remove bolt and washer that is fastened in motor shaft.

Put a washer, a nut (e.g. M8 or M10) or similar on top of motor shaft to prevent threads in motor shaft to be damaged by demounting tool.

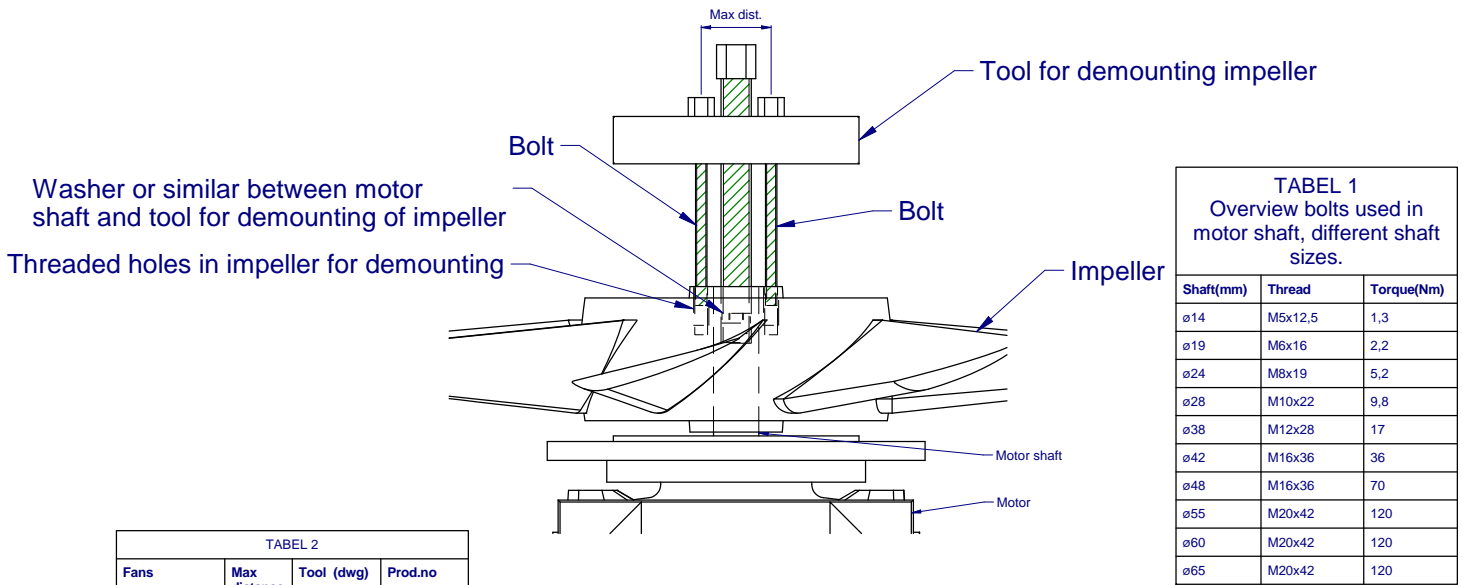
Use demounting tool (it might be you need to find two bolts with proper length and use for the demounting tool) as shown sketch below.

Screw these two bolts into 2 threaded holes on impeller on each side of motor shaft. Be careful to screw these the same distance so the demounting tool is not inclined with regard to motor shaft.

Demount impeller by turning the center bolt on demounting tool

If axial fan is equipped with hemisphere or other loose part in front of hub, the position of this with regard to impeller hub must be clearly marked with ink pen or similar before they are demounted so they are put back in exact same place later. If not balance of impeller will be rendered.

In general before demounting of any part, all parts should be marked, so things are put back in correct place.



Fans	Max distance (mm)	Tool (dwg)	Prod.no
PUV > 500	160		
MPV	100		
Centrifugal fans	90		
MPV A7L, A7T, A9T	160		

Date: 28.05.14	Const / Drawn: N.Skotheim	Scale: 1:2	 N-6230 SYKKYLVEN
Checked:	Checked:	Approved:	
Mass: 0 kg			Material:
<b>Procedure Demounting of impeller with two threaded holes.</b>			Replacement for: <b>2-10040</b>
Reference:	Project:	Sheet size: A2	Sheet no: 1/2

REVISION HISTORY			
REV. NO.	DESCRIPTION	DATE	APPROVED

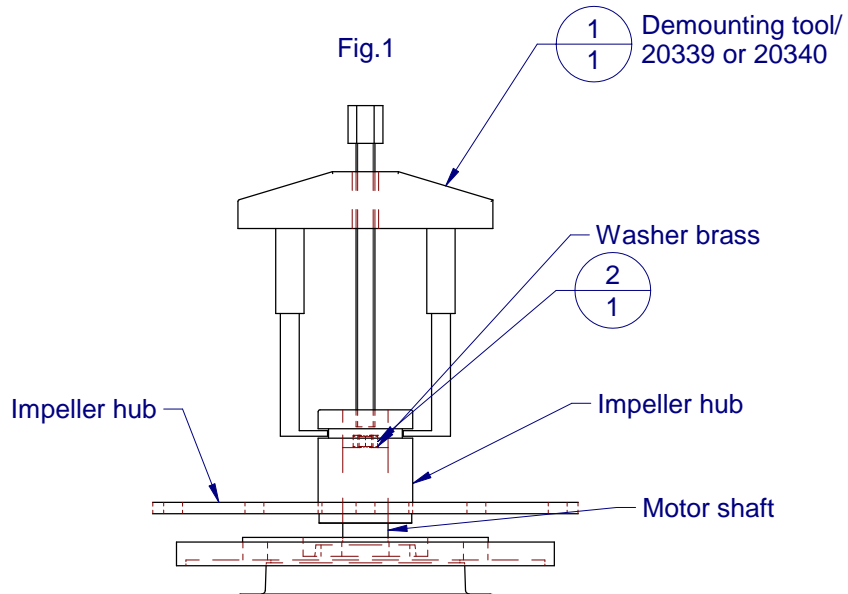
**Procedure demounting of impeller, centrifugal fans, models MSV125, 160, 200 LSV 250, 315:**

Unscrew bolt and washer from motor shaft (or impeller shaft)  
 Use the brass washer (alternatively a washer, nut (e.g. M8 or M10) or similar) on top of motor shaft, so that threads in motor shaft are not damaged by demounting tool.

Use demounting tool as shown fig1.  
 There should be a groove for the demounting tool on the impeller hub.  
 Demount impeller by turning center bolt.

**TABLE 1**  
 Overview bolts used in motor shaft, different shaft size

Shaft	Bolt	Torque (Nm)
ø14	M5x12,5	1,3
ø19	M6x16	2,2
ø24	M8x19	5,2
ø28	M10x22	9,8
ø38	M12x28	17
ø42	M16x36	36
ø48	M16x36	70
ø55	M20x42	120
ø60	M20x42	120
ø65	M20x42	120



Parts List			
1	20-339 / 20-340		
2	ø12 x 12 brass, ø22 x 12 brass		
Date:	20.05.14	Const / Drawn:	N.Skotheim
Checked:		Approved:	
Scale:	1:2	Mass:	0 kg
<b>Prosedyre avtersing av impeller/          procedure demounting of          impeller, centrifugal fan</b>		Material:	NYBORG AS N-6230 SYKKYLVEN
Reference:	Project:	Replacement for:	Replaced by:
		<b>2-10037</b>	
Sheet size:	A2	Sheet no.:	1/3

### Mounting of impeller:

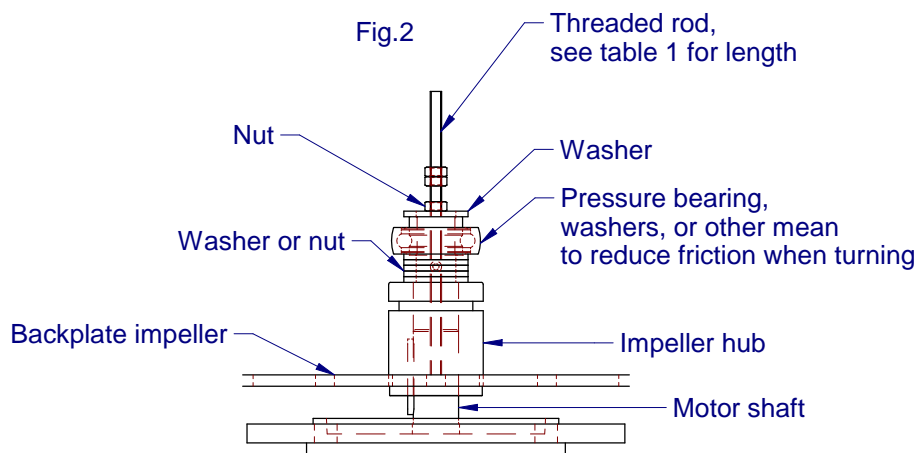
Use a threaded rod which is fitted to threads in motor shaft (see table 1 for correct size) and screw this into motor shaft

Put impeller onto shaft

Add a washer and preferably a pressure bearing to get sufficient distance if necessary.

Add a nut and turn the nut downwards till impeller hub is resting on the edge on motor shaft.

Put on washer and bolt that was originally in impeller. Use threadlock on bolt to prevent unscrewing, e.g. loctite. Turn this well back on. See torques tabel 1



**TABEL 1**  
Overview bolts used in motor shaft, different shaft sizes.

Shaft(mm)	Thread	Torque(Nm)
ø14	M5x12,5	1,3
ø19	M6x16	2,2
ø24	M8x19	5,2
ø28	M10x22	9,8
ø38	M12x28	17
ø42	M16x36	36
ø48	M16x36	70
ø55	M20x42	120
ø60	M20x42	120
ø65	M20x42	120

Example pressure bearing:  
 Type 51305A (motors <N160) (25x52x18)  
 Type 51308A (motors ≥N160) (40x78x26)

Date: 28.05.14	Const / Drawn: N.Skotheim	Scale:	 N-6230 SYKKYLVEN
Checked:	Checked:	Approved:	
Mass:			Matl:
Project:			Projection:
Reference:			Replacement for:
Project:			Replaced by:
Sheet size: A2			2-10040
Sheet no: 2/2			



## **5.7 Trouble shooting guide**

<b>Problem</b>	<b>Component</b>	<b>Possible reason</b>	<b>Only for</b>	<b>Action</b>
Fan does not start	Fan/motor	Damage to electric motor		Replace el motor
	El connection	Incorrect power supply connection		Correct the connection
	El connection	Incorrect power supply voltage		Check if motor is multivoltage, if not change motor or power supply
	Fan/motor	Impeller is touching the casing/inlet cone		Repair or replace fan
	El connection	Damage to electric switch/blown fuses/no electricity/emergency stop pressed.		Repair
Air flow is too low	Fan	Rotating direction is wrong		Change el connection
	Duct/system	Damper is closed or partly closed		Open damper
	Duct/system	Something is blocking the duct (either on supply and / or exhaust side)		Find and remove
	Fan	Inlet collar is loosely fitted, and is reducing the air flow.		Refit
	Filter	Filter is dirty or clogged		Change the filter
	Duct / system	System resistance/pressure is higher than anticipated / calculated		Replace fan, modify duct or change impeller (angle)
	Fan	Impeller is wrong (e.g. RD impeller for LG fan)		Change impeller
	Fan	Wrong speed (too low) of motor		Change the motor / fan
	Duct/system	System poorly designed with high air speed through bends, orifices, openings, outlets etc.		Modify duct or change fan
	Duct/system	Leakage in the duct or fan		Repair, seal
Current too high / Fan might be tripping	Fan	Wrong rotating direction		Modify electric connection



<b>Problem</b>	<b>Component</b>	<b>Possible reason</b>	<b>Only for</b>	<b>Action</b>
Current too high / Fan might be tripping	Fan	Motor is wrongly wired and thus running in over or under voltage.		Correct the wiring.
	Fan	Condensing damage in motor / moist or water in motor windings.		Dry out the windings, and replace motor if needed
	Fan	Wrong speed (too high) on motor (or motor running on freq.converter at too high frequency)		Replace motor
	Duct /system	Fan is operating far away from its working point.		Use a regulating damper if too high air flow
	System	Density of flow medium is too high (e.g. due to very cold conveyed air)		Change motor protection settings if cold air. (non EX fans)
	Fan	too small motor selected for the fan		Change the motor (impeller) or fan (check with Nyborg)
Unnormal noise, frequency driven fan		Switching frequency of inverter causes noise in motor		Change the switching/carrier frequency of inverter up (not the output frequency)
Unnormal noise		Loose bolts, parts, etc.		Tighten
		Bearing(s) defect on fan		Change bearings
		Motor cooling fan touching cover (dent /damage in cover)		Replace motor cover
		Mechanical, resonance, structure boren noise, etc,		Insulate the fan mechanically, use vibration dampers and flex connections
		Insufficient stiffening, etc		Stiffen fundaments, ducts etc.
		Impeller touching stationary part		Identify parts, repair or replace parts.
Excessive vibration		impeller imbalance due to dust or other deposits.		Clean the impeller for build ups, if still problem, rebalance impeller.
		Bearings defect on fan		Change the bearing
		Impeller imbalance due to damage or tear / corrosion on impeller		Replace or rebalance impeller
		Fundament too weak or resonsance		Strengthen/stiffen fundament



## 6.1 Restriction in guarantee

The warranty is void in case of:

- Improper installation and operation of the equipment, inconsistently with intended use and instructions/operations and maintenance manual.
- Repairs or constructional modifications without the producer's permit.
- Damages resulting from external sources (mechanical, chemical damage, flooding etc)
- Lack of legible producer's nameplate

The warranty do not cover

- Damage caused by improper transport or storage of fans.
- Normal wear and tear of parts.

## 6.2 Restriction in use

If not otherwise stated:

Fan can be used in ambient temperatures from -20 C to +45 C

Dust content of conveyed air should not be higher than 0,3g pr m<sup>3</sup>

In case of other conditions, this should be stated on data sheet / tag plate