



**The Fan Manufacturers' Association**  
A group within the HEVAC Association

# Smoke Control Association & Fan Manufacturers' Association Guide

Smoke extract fan maintenance;  
Best practice guide ensuring that your life safety  
equipment is fit for purpose

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## Guide Purpose

Emergency use fans for heat and smoke control systems are specifically designed and manufactured for safety critical applications. Harmonized standards of these regulations define a list of critical components. **Repair and replacement of the defined critical components shall only be carried out by the manufacturer's authorized representative.** For fans certified by a notified body, the substitution of a critical component by an alternative version of this component, must be approved by the notified body.

A BSI working committee (FSH25), with its members drawn from manufacturers, installers, test establishments and motor manufacturers, was formed to examine the key issues associated with smoke extract fans.

The key objective of this guide is to raise awareness of the need to ensure that any powered smoke extract fans which are selected, manufactured and installed in accordance with EN 12101-3:2015, must then be correctly maintained to ensure that they continue to offer building occupants the highest degree of smoke protection and reassurance possible.

Although new equipment must be manufactured to comply with the latest standards, existing plant, which has been installed for many years, may not comply with the 2015 version of EN 12101-3 (which was introduced and enforced in 2017).

As amendments to the electrical and mechanical requirements have occurred and as the key fan component, the electric motor, will naturally deteriorate over time, then this guide is designed to provide advice on how best to maintain the equipment to the highest possible standard (by adhering to manufacturers maintenance procedures).

In addition, this guide also provides guidance on deciding if the main smoke extract or pressurisation fans should be replaced with new equipment which has been designed, tested, certified and manufactured to the very latest standard. This will offer building owners or operators a reduced level of risk and liability, whilst also, and more importantly, providing the highest level of smoke protection for building occupants.

The [Smoke Control Association](#) provide additional resources in the form of guidance references and design guides

## Fan Maintenance or Replacement Decision

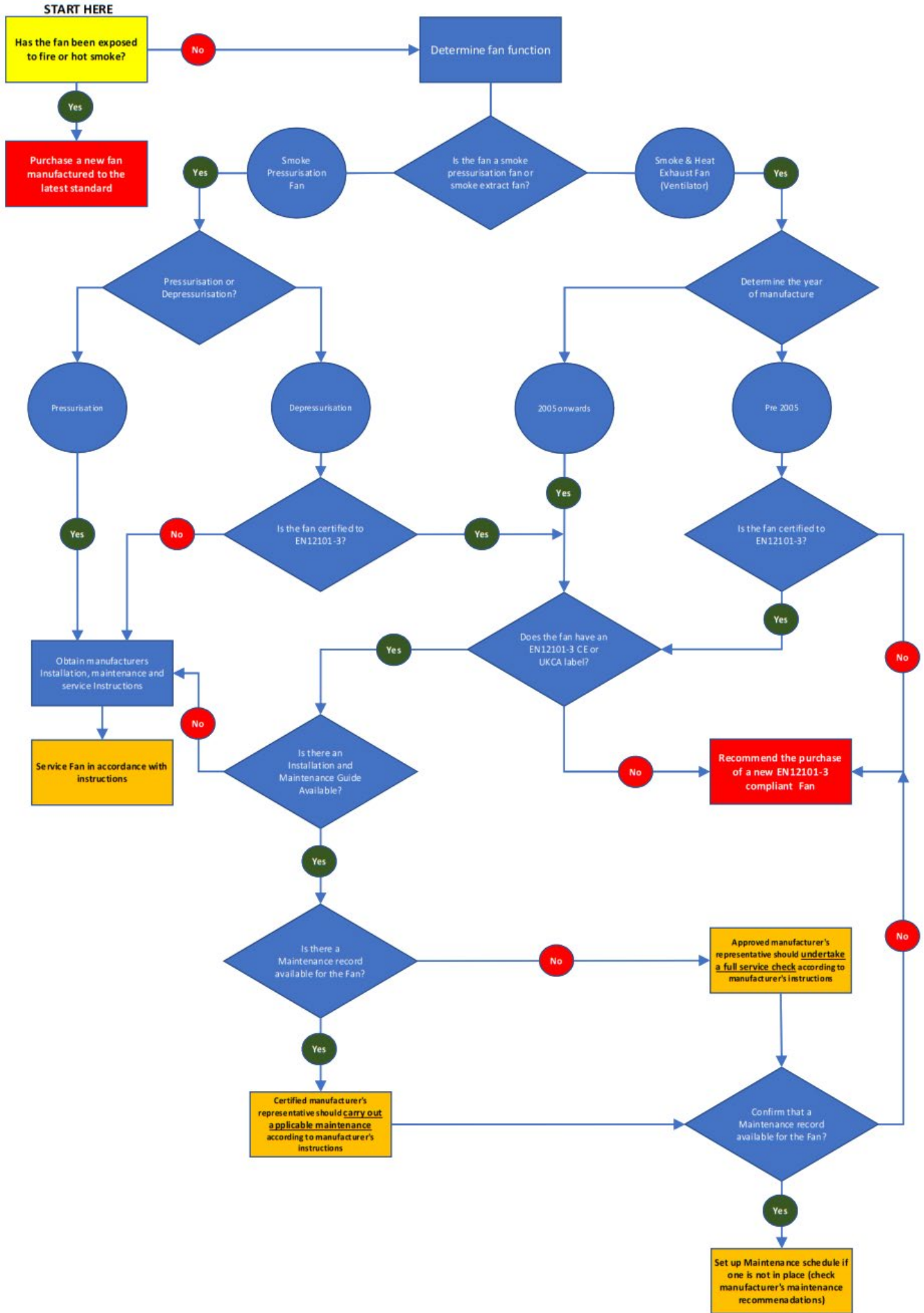
A simple decision-making flowchart has been included within this guide, to help building operators and maintenance engineers to determine the most appropriate course of action, to ensure that smoke extract fans are maintained to the highest and most appropriate standard. The key steps in this process are as follows:

- Identify the fan function - fire engineered ventilation designs will have fan requirements stated within the fire strategy.
- Determine the year of manufacture (pre-2005, or 2005 onwards).
- Confirm if the fan is certified to EN 12101-3 and that it has a CE or UKCA label attached.
- Determine if there is an appropriate set of installation, operating, maintenance and service instruction available
- Check that an up to date and valid maintenance record exists.

Possible resultant actions (dependent on the above factors) are:

- If the fan was manufactured before 2005, then this will mean that the fan and drive motor will not comply with an acceptable specification level as defined within the EN 12101-3 standard. The recommendation in this case is to purchase a replacement fan which fully complies with EN 12101-3:2015.
- If the fan was manufactured between 2005 and 7<sup>th</sup> April 2017 (inclusive), whilst this equipment may not be manufactured in accordance with the latest version of EN 12101-3, depending on its condition (when tested) it may be possible to refurbish the fan and motor in accordance with the manufacturer's recommendations.
- If the fan was manufactured after 8<sup>th</sup> April 2017, then it will have been manufactured in accordance with the latest version of EN 12101-3, so depending on its condition, it may be possible to service the fan in accordance with the manufacturer's recommendations.
- Irrespective of the date of manufacture, if after testing, the motor winding insulation has been found to have deteriorated to a level below the motor manufacturers defined limits, then the recommendation is to purchase a complete fan, which has been manufactured and certified fully in accordance with the very latest version of the EN 12101-3 standard.

# Fan Maintenance or Replacement Decision flowchart



## Fan and Motor Health Check Considerations and Test Intervals

As the fan is the key component within a smoke and heat control system, it is imperative that regular assessments are made to consider the key factors and potential issues (detailed below) which may increase the risk of the system not operating correctly.

The fan can either be a dedicated smoke extract fan or dual mode smoke extract fan (designed for normal ventilation plus a once off emergency depressurisation/smoke extract duty) or a pressurisation fan which is used to add external ambient temperature air to a system, but which may also be designed to handle hot smoke in some cases.

### Records

It is imperative that fan installation records and associated Declaration of Performance documents are held in a safe and accessible location, to allow these to be reviewed by fire authorities, risk assessors, service and maintenance operatives.

Records are a good starting point when conducting a risk assessment of smoke control systems and their key components, such as the fan. If information related to the system details, operation and maintenance instructions and location of components are readily available, then this generally indicates that the system is being maintained (see example check list in Figure 2).

### Smoke Control Fans and Motors

Smoke control fans and their associated motors are a life safety product, so maintenance rules differ from those applied to normal fans and motors, which generally have extended operating periods, often operating continuously. In contrast, smoke control fans (unless used as part of an environmental ventilation system in addition to their normal duties) often only run during testing or if called upon to perform that primary smoke control function. However, as they are a critical component, **all possible steps must be taken to ensure that they operate effectively during an emergency (Smoke control duty).**

Consequently, the concept of conducting maintenance, based on hours run, cannot be applied to smoke control fans where they are only dedicated to this function. If, however, fans are run as part of an environmental ventilation system as well as having an emergency smoke control function, then hours run should also be considered.

As un-serviced shaft seals and bearings can create a point of failure due to lack of use, it is imperative that fans are “run tested” regularly as part of the overall smoke control system tests, ideally on a weekly basis during normal operation. A record should be kept of each test, along with the date and time that it was conducted. The record should be signed by a competent operative. Run tests should also be conducted during building construction stages. This testing regime is an expectation stated within BS 9999 Annex I.

Test records should be kept as proof that regular assessments have been conducted. Bearings and seals should be replaced by a competent person such as the fan manufacturer (or nominated maintenance partner). It is essential that health checks are conducted on the fan (motor) bearings in order to ensure that they have not become noisy and/or present signs of unbalance.

Assessment of the bearings condition should be made at least every **3 months**, and the relubrication of the bearing grease made in accordance with the manufacturer’s recommendations / motor nameplate. If the fan will remain stationary for prolonged periods (aside from periodic energising of the motor), manufacturer’s recommendations should be respected. This will involve, for example, rotating the motor shaft (typically monthly) and replacing the bearings in line with the manufacturer’s recommendations.

### Minimum recommended test and service intervals: Table 1

Fan duty type	Test intervals #1	Service intervals #2	Bearing Check #2	Bearing / seal change intervals #2
Dual Mode Fan (sealed for Life Bearings)	Weekly	6 months	3 months	5 years or 20,000 running hours whichever occurs first
Dual Mode Fan (bearing with relubrication facilities)	Weekly	6 months	3 months	5 years or 40,000 running hours whichever occurs first
Dedicated Smoke Extract Fan	Weekly	6 months	3 months	Checks should take place every 3 months to determine if the fan (motor) bearings have become noisy or appear to have become unbalanced. Replace In line with the manufacturer’s recommendations.

#1 decided by site operator

#2 to be conducted by a **trained and competent engineer approved by the fan manufacturer.**

For detection based on PPM activation as defined within Section 6.18 of Approved Document F, as run time will not be known for systems which use Jet Fans.

If evidence of imminent bearing failure is evident, new bearings should be fitted (in accordance with fan or motor manufacturers recommendations). Records of this activity must be kept. If it appears that bearings fail more often than expected (due perhaps to the fan operating in conditions which are outside normal design limits), then bearings should be changed more often to suit the installation. **Important: Failure to replace motor bearings with the same type / class of fit / clearance and grease will invalidate the certification.**

## Motor Health Check Test Criteria

One indication that a fan motor may fail during an emergency scenario is if, when measured, the motor winding resistance is found to have a very low value. This is a clear warning that the winding insulation is degrading. **The winding resistance value must either be greater than 10 MΩ (Megaohm), or the specific value stated in the motor manufacturer's O&M instructions, which in some cases can be in excess of 100 MΩ (Megaohm), when measured at 500 Volts DC to earth. However, before performing this test, the motor must be dry and free from condensation.** This test should be conducted at regular intervals by a competent person such as the fan or motor manufacturer (or their nominated service/maintenance partners). **Our recommended minimum service interval is typically every 3 months, but you are advised to check with the fan or motor manufacturer for more precise information, as bearing type or application operating conditions may vary the frequency of checks.**

## Motor winding resistance test failure – Corrective Actions

If the motor's winding resistance has fallen below the manufacturer's recommended values, then, as this is a fire safety product on which the lives of building occupants depend, it should be replaced with a new motor which has been designed, manufactured and tested within a fan certified in accordance with the latest version of EN 12101-3. The maintenance Engineer should therefore consider having smoke control fans refurbished and new motors fitted at 10 year intervals. Ideally, for optimum safety, the complete fan should be replaced with a new product which has been manufactured in accordance with the latest version of EN 12101-3.

**Motors used within Fire Safety fans must NOT be re-wound. It could potentially be extremely dangerous to refurbish such a motor using a standard motor rewind facility, as these motors are specially designed for the smoke control application.** Furthermore, if the smoke control fan is exposed to a fire situation, for however short a period of time, the motor must be replaced even if post fire measurements suggest that the motor is still intact.

**Service and maintenance decisions are the responsibility of a competent person,** who has the ultimate responsibility for the building and the lives of those people who use it. If you choose to ignore this advice, then if an emergency occurs and lives are lost, the condition and maintenance records associated with the smoke control system may be investigated.

## System Defects

The recommendation is that immediate action should be taken to remedy any smoke control system defects. This includes the fan. The maintenance company should issue an impairment notice which the owner of the building and the insurance company must be informed of; where a smoke control system is not operating effectively. It is important to note that fault rectification should not be left until the next scheduled maintenance visit, if there is clear evidence that a fault would compromise the correct and effective operation of the system, as this represents a high and unacceptable risk. Faults should be logged (noting the date/time when found), along with details of corrective action and measures to prevent recurrence. In addition, a written assessment of how the fault could impact the occupants of the building would be valuable – are their lives at risk because the system or a component is faulty?

Where rectification or repair cannot be carried out immediately, a fire risk assessment should be carried out to determine whether mitigation measures should be put in place. Mitigation measures will vary depending on the building or application, so professional advice should be sought from a suitably qualified and competent fire engineer. Local Fire and Rescue Services should also be informed and consulted with in relation to the planned mitigation measures.

There may also be other fire safety risks which need to be considered when developing mitigation measures (these measures are the responsibility of the FRA/Fire Engineer on a case by case basis). Issues around compartmentation should also be considered as defects, as although these may appear to be a low priority to remedy, considering more recent experience, these should now be considered as urgent. Mitigation measures should remain in place until the smoke control system is repaired and has been tested to evidence that it functions correctly and effectively.

## General Maintenance Advice and Assessment Intervals

Some general smoke control system maintenance advice is available within the BS EN 12101 and BS 9999 standards. However, our recommendation is that smoke control systems should ideally be tested weekly, while each fan should be tested at least once per week. This test should be conducted by the building owner (by his nominated maintenance Engineer) to ensure that their system will operate effectively. More detailed advice is available by referring to Figure 1 (Example of Fan Manufacturer's routine maintenance checklist), or figure 3 (Example of Motor O&M information related to bearing lubrication). As figures 1 and 3 are not exhaustive, reference needs to be made to all the available fan and motor O&M documentation.

A full system inspection and test (which includes a fan and motor "health check") should be carried out by a suitably trained, qualified and competent person. Recommended maintenance intervals are dependant of the fan function. Refer to table 1.

**Where the fan is a dedicated hot smoke extract or pressurisation device, then maintenance intervals should not be more than every 6 months, even if the fan has not been run.**

It is recommended that fans (both run & standby) should be run up in accordance with the manufacturer's operation and maintenance documentation and that they should be run for between 15 and 30 minutes (to allow time for key components to attain their normal running temperature) and to minimise the risk of the lubrication grease hardening, whilst also helping to reduce bearing corrosion.

If you are in any doubt as to what specifically should be tested, then you should contact the specific component manufacturer or system installer for further information. The maintenance regime shall include the creation and updating of a maintenance log for

the system and its components. This should detail regular maintenance tasks and any faults found, as well as details of mitigating actions taken. Maintenance may be undertaken by trained competent local personnel at the shorter intervals.

Twice yearly visits by a third-party competent organisation (e.g. the original supplier or their nominated service / maintenance provider), who should provide a full and comprehensive report assessing the system condition and commenting upon its associated maintenance record. Competency of third-party organisations can be evidenced through accreditation to a third-party system such as IFC SDI 19. Local proficiency should be checked via other competency and training records.

### **System effectiveness and its components**

Physically check the system and components to see if they operate in accordance with the design intent of the system.

### **Fan checklist and required evidence**

#### **Fans:**

Fans are the main airflow driver within a smoke control system and respond to alarms (and environmental requirements, if this is part of the system design). For smoke extract systems where fans have been installed since 2012, these should be CE / UKCA labelled to confirm compliance with EN 12101-3. This is a legal requirement.

If a fan does not have a CE / UKCA label affixed to it, then further investigation into the system design is recommended, in order to determine if the fan should be replaced. Note: Fans manufactured from 1<sup>st</sup> January 2021 onwards, may also display a UKCA mark in addition to a CE mark.

Fans connected to the system for pressurisation or the supply of air directly from outside do not need to be EN 12101-3 certified, as the fan and motor should not be used to extract hot smoke. Some systems require a duty / standby fan arrangement, so this functionality should be noted.

#### **General:**

Are maintenance records available? If so, inspect and note evidence and take photographs to confirm the following:

- Are fans clean, easily accessible and is there evidence of maintenance?
- Are fans running correctly? Are fans running because an alarm is active or is it because fans are running in an environmental (normal ventilation) mode?
- Do fans run when the system alarm is activated? If not, determine the root cause.
- If the system is more than 5 years old, is there evidence of an electrical thermal test being performed on fan motor(s) within the last five years?
- If the system is more than 5 years old, is there evidence of an electrical fixed wire test being performed on the fan motors(s) within the last five years?
- If the system is more than 10 years old, is there evidence of a motor winding resistance test being performed on the fan motors(s) within the last ten years and does this meet the manufacturers' recommendations?
- Do fans have a CE or UKCA mark label? If so, is the stated temperature class in accordance with the system design?

**If you are unsure, please contact the Smoke Control Association for more information and advice**

**Figure 1: Example of Fan Manufacturer’s routine maintenance checklist**

**TABLE 1**

Routine Maintenance Schedule	Every 6 Months	Every 12 Months	Comments
1. Examine fan guards (if fitted)	✓		Remove any debris that may have accumulated round or on the guard surface.
2. Examine motor cooling fins	✓		Remove any material or dirt which has build-up between the motor cooling fins.
3. Examine impeller for dirt build-up or any physical damage	✓		Remove any build-up of dirt. Ensure impeller is secure. Replace impeller if it is damaged.
4. Check condition and tautness of fan safety support chains / harnesses /ropes (if fitted)	✓		Clean and inspect safety supports. Replace if there is any deterioration / corrosion detected.
5. Examine and operate vibration sensors (if fitted), and temperature sensors (if fitted)	✓		Check operation using built-in sensor test features or dummy signals. Check that the fan is automatically switched off, or that a warning indication is provided, when the sensors / switches indicates a fault.
6. Examine condition of safety guards (if fitted) and associated fixings	✓		Clean safety guards. Replace if there are any signs of excessive corrosion or damage
7. Check operation of anti-condensation heaters (if fitted)	✓		Switch off power to the motor. Check that the anti-condensation heater is energised (i.e. it is drawing current).
8. inspect the condition of the packing located behind the motor shaft-seal retaining plate where the fan is of the 'bifurcated' type	✓		Replace the 130mm Duramid seal if it is damaged
9. Examine the clearance between the fan impeller blade tips and fan duct. Check the angle, and the security of the impeller blades		✓	Ensure that the gap between the impeller blade ends and the fan duct is even and adequate. If in doubt, please contact the fan manufacturer for advice related blade tip gap. Ensure that the impeller blades are secure. Blade angle must not be changed before contacting the fan manufacturer for advice.
10. Check torque of fixings used to secure the fan to its support structure.		✓	It is essential to confirm that all fixings are properly fitted, are tight, and are fully driven home (see Paragraph 17.1). If in doubt, please contact the fan manufacturer or advice related to the torque value of a particular fixing.
11. Examine motor, fan and ancillary equipment fixings.		✓	It is essential to confirm that all fixings are properly fitted, are tight and are fully driven home (see Paragraph 17.1) If in doubt about the torque of a fixing contact the fan manufacturer for advice.
12. Check movement (deflection) of vibration isolators (if fitted).		✓	Check freedom of movement. Tighten anti-vibration mount fixings if necessary.
13. Check motor voltage and current consumption.		✓	Ensure voltage and full load current are as specified on the motor nameplate.
14. Inspect paintwork / galvanising finish.		✓	Treat any areas of damage with suitable anti-corrosion paint.
15. Grease motor bearings.		✓	Check requirement in accordance with paragraph 17.2
16. Check fan assembly wiring		✓	Check security and condition of all wiring (including the earth).
17. Check fan operation for excessive vibration levels		✓	Vibration levels, whilst the fan is operating, should not be excessive. If levels are seen to have increased since the previous inspection, the fan must not be operated until the root cause has been identified and rectified.





**Figure 3: Typical example of Motor O&M information related to bearing lubrication**

## 14. LUBRICATION



**ATTENTION!**

It is necessary to record the number of hours the motor is running in order to determine when bearing relubrication is required.

If the motor is not running continuously, the date of installation must be recorded, since relubrication is recommended every six months, even when the motor was never run during this time.



**ATTENTION!**

Beware of all rotation parts!

Grease can cause skin and eye irritation. Follow all safety precautions specified by the grease manufacturer.

### 14.1 SHIELDED/SEALED BEARINGS

Small motors (frame 80-132), when fitted with ZZ/2Z bearings, greased for life must be replaced after 20,000 running hours.

Check motor nameplate for determining the used bearing type.

### 14.2 MACHINES FITTED WITH GREASE NIPPLES

Grease nipples are usually used in motors frame above and included 160. The purpose of this maintenance is to extend bearing lifespan.

The bearings life depends essentially from the maintenance cares and regreasing procedures, otherwise, the bearings may have their life shortened drastically.

**Maintenance includes:**

- a) Attention to the overall bearing status;
- b) Cleaning and lubrication;
- c) Detailed inspection of the bearings.

The motor noise should be checked at regular intervals as recommended before. A well-tuned ear is perfectly capable of distinguishing unusual noises, even with rudimentary tools (such as a screwdriver, etc). For more reliable and preventive bearing analysis, sophisticated equipment is required.

Bearings should be lubricated to avoid metallic contact of the moving parts, and also for protection against corrosion and wear. Lubricant properties deteriorate in the course of time and due to mechanical operation and, furthermore, all lubricants are subject to contamination under working conditions. For this reason, lubricants must be renewed or replenished from time to time.



**NOTE!**

Bearings with grease nipples facilities must be replaced after 40,000 running hours.

### 14.3 LUBRICATION INTERVALS



**ATTENTION!**

If Krytox GPL226 is the grease, it may cause higher noise levels particularly at low temperatures, or when intermittent duty does not allow a running temperature above 20 °C in the bearing. Please contact if the service temperature is below -5 °C.

*Type of grease, lubrication intervals, amount of grease and type of bearing and clearance are indicated on the motor nameplate.*

Lubrication intervals depend on motor size, speed, working conditions, type of grease used and ambient temperature.