Certified/Matched HT fan and VSD package:

New EN12101-3: 2015 Certification

Andy Cardy MIET MCIM CMKtr

Product Manager – Axial Fans

13th April 2022

Version 5.3 *EXTERNAL*

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans : Topics

1. Introduction – Fläkt Woods & Danfoss
2. HT Fan and VSD Packaged Solution (HTF-VPS) Applications
3. Context / Options
4. VSD Fire Mode
5. Product Range Scope / Fan Selector
6. Testing/Certification

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FLÄKTGROUP – KEY FACTS

€630M	FLÄKTGROUP TURNOVER *
3600	EMPLOYEES
170	DEDICATED R&D EXPERTS
65	COUNTRIES SERVED WORLDWIDE
16	MANUFACTURING SITES
9	CENTRES OF EXCELLENCE

*BASED ON FLÄKTGROUP TURNOVER 2018

Danfoss Drives – KEY FACTS

€1.4bn	DANFOSS TURNOVER *
50	COUNTRIES SERVED WORLDWIDE
5000	DRIVES EXPERTS
12	MANUFACTURING SITES & R&D CENTRES
9	CENTRES OF EXCELLENCE
4	APPLICATION DEVELOPMENT CENTRES

*BASED ON TURNOVER IN 2017, AS STATED WITH IN THE DANFOSS ANNUAL REPORT FOR THE DRIVES BUSINESS SEGMENT

ENGINEERING TOMORROW

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans : Topics

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HT Fan and VSD packaged solution (HTF-VPS) applications

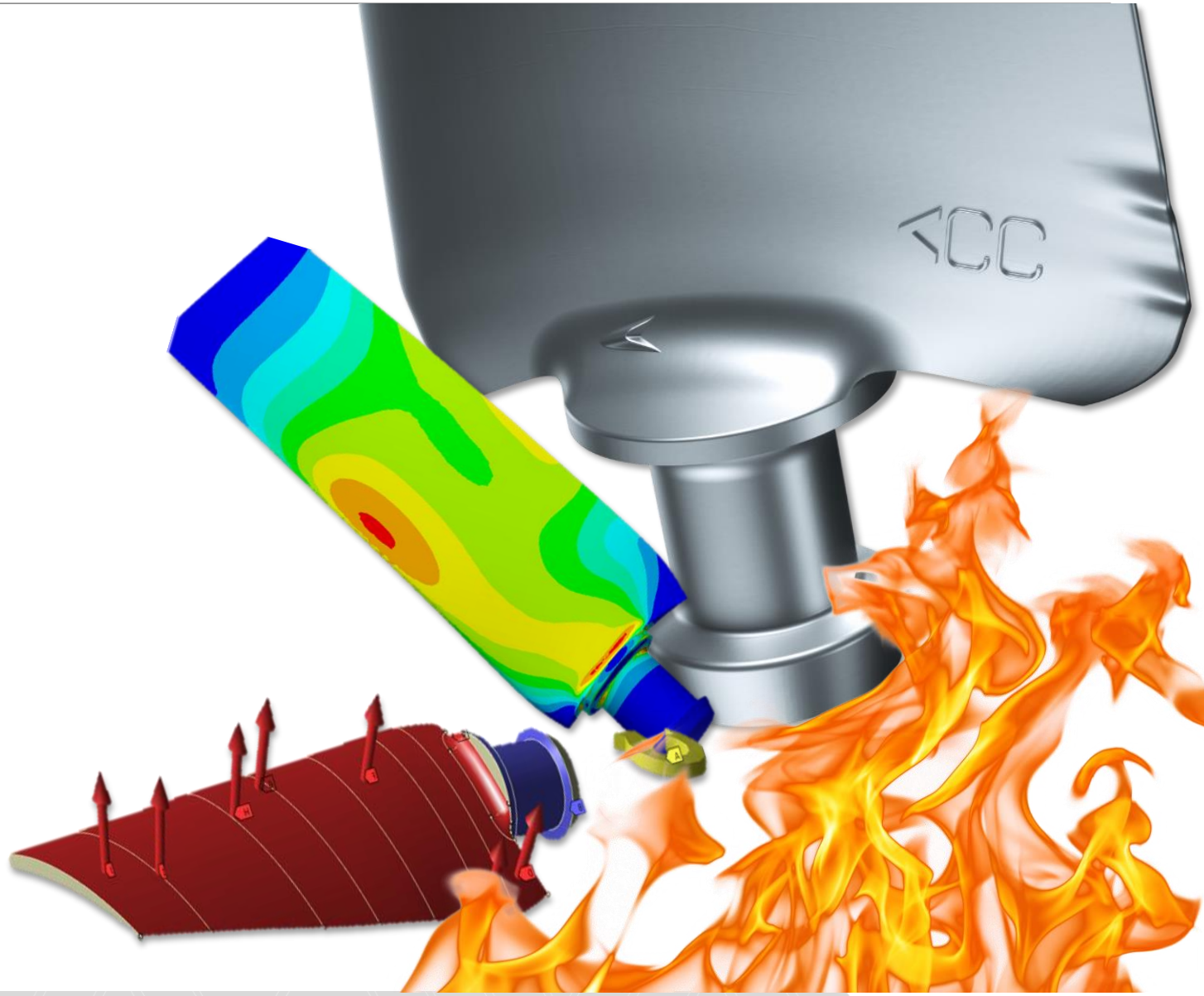
- Allows a Dual mode Axial fan to be speed controlled during normal ventilation mode and Emergency HT mode
- Fan and VSD combination tested and certified by BSRIA and BSI: FULLY complies with EN12101-3:2015 (F300 & F400)
- Packaged solution uses tried and tested design principles
- Advance VSD design allows multiple duty set points to be defined
- BMS compatibility adds additional control flexibility and high levels of design strategy confidence
- VSD “Fire Mode” ensures that the fan and VSD package performs a smoke extract function for a minimum of 2 hours
- Fläkt Woods / Danfoss package was the **FIRST FULLY EN12101-3:2015 CERTIFIED Fire Mode Packaged Solution in the UK.**

Woods AIR MOVEMENT + Danfoss

Woods AIR MOVEMENT

HT Fan Design Best Practice

- **Impeller Design Integrity is paramount** – Materials, Component Fit & Stress Limits
- **Correct impeller tip to casing gap is critical** for correct operation and performance
- **Finite Element Analysis design tools are used for critical component design**
- **Motor Specifications are also critical** – Bearing design/grease, cooling systems
- **Complete Impeller, motor, casing and motor mounting are HT tested in-house**
- **Third party testing at BSRIA, confirmed compliance (F300 and F400)**



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EN12101-3: 2015 – Standard Evolution

8th April 2017: Smoke and Heat control systems standard changed to include the option to use Frequency Converters during a fire event. This revision, we believe, is a *real game changer,* as it offers designers more solution possibilities and will contribute significantly to improving building occupant safety

2015 version of this certification standard states **3 basic approaches for using Variable Speed Drives (VSDs) with dual mode High Temperature smoke extraction / Normal Ventilation Axial fans**. These are:

1. **Third Party tested and Certified Fan/VSD range: Only 5% motor de-rate and no need to fit Voltage Waveform filters**

NEW

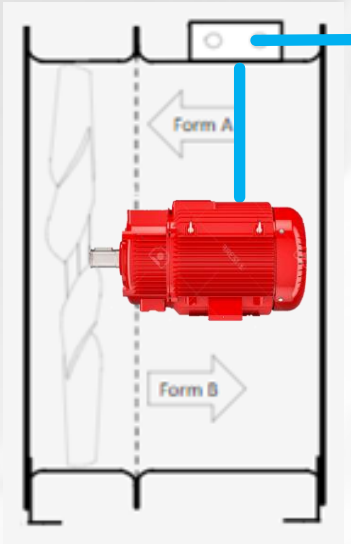
2. **By-pass the VSD during a fire event**

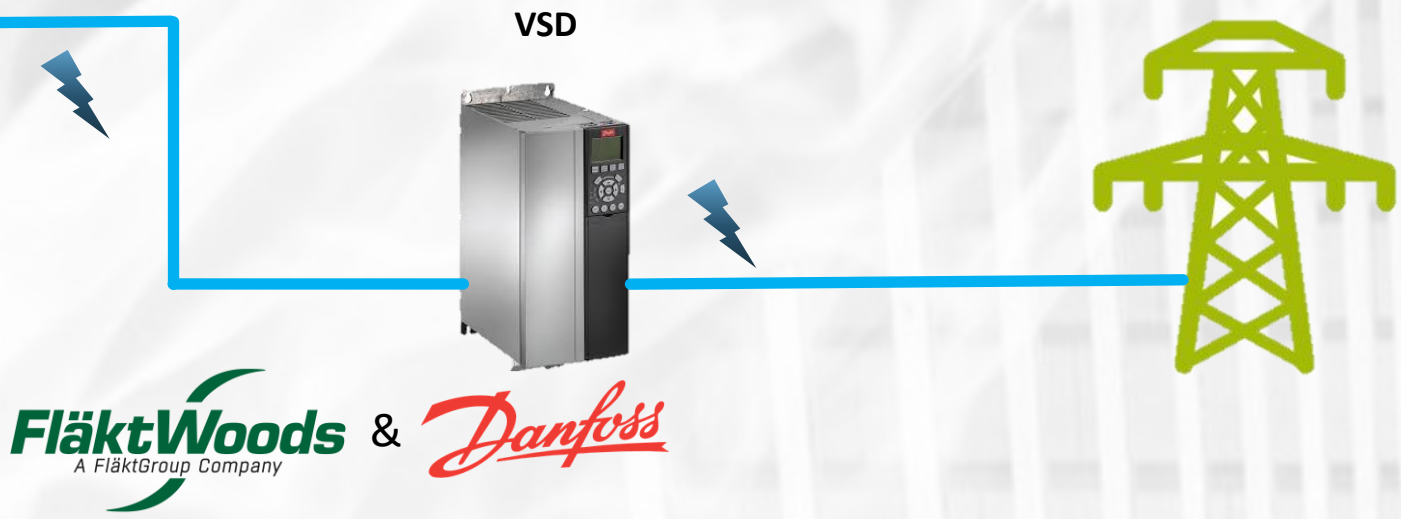
3. **De-rate drive motors by 20% and fit Voltage Waveform filters between VSD and Fan Motor**

EN12101-3: 2015 – *Third Party tested and Certified Fan and VSD range*

1 **Our tested and certified range, delivers Fan Speed control during a fire event, but with a…. minimal motor de-rate and NO requirement for a Voltage Waveform filter**

- **Fan motor only requires a minimal de-rate (over-sized by 5%) : same as if it were operating at normal ambient air temperature**
- **Tested / proven fan, motor and VSD packaged solution means that the Installer does NOT need to fit voltage waveform filters. Our solution is based on ONLY using Danfoss HVAC VLT FC101 or FC102 drives to deliver a safe and reliable fire safety package**





THIS IS OUR RECOMMEND SOLUTION

EN12101-3: 2015 – *Third Party tested and Certified Fan and VSD range*

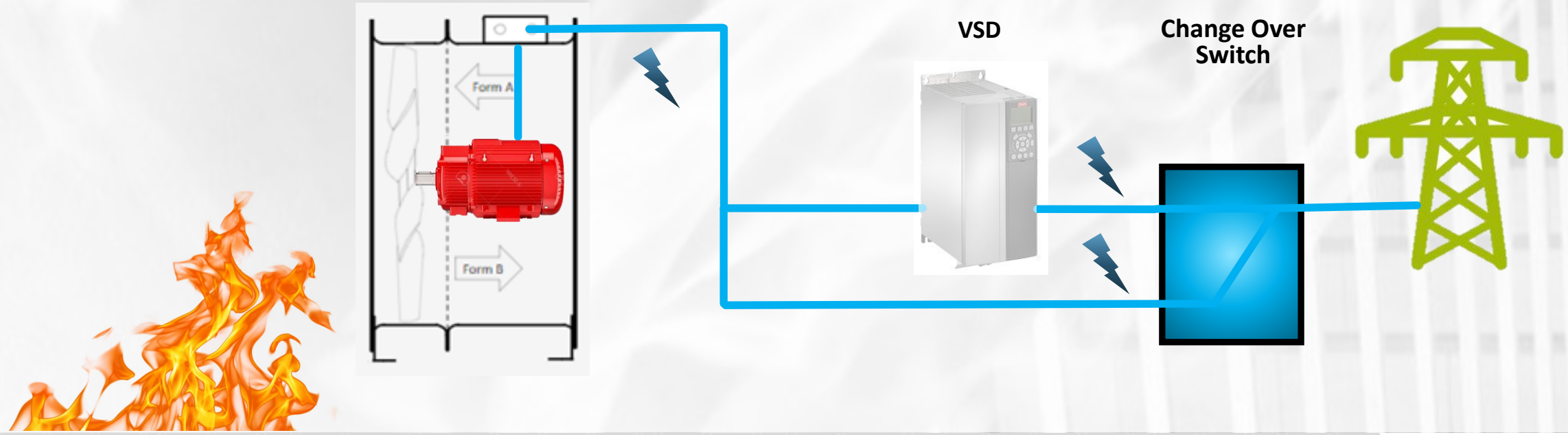
Historically, system designers have often opted to switch out or by-pass the VSD during a fire event

Using a VSD during an emergency smoke extraction event is *increasingly becoming more desirable*, as VSDs *add additional control flexibility to enable smoke control and extraction performance to be optimised*

VSDs offer a practical way of achieving desired smoke control strategies, as *zonal control and the ability to reverse smoke extraction flows, then becomes possible without the need for additional equipment such as dampers and contactors*

EN12101-3: 2015 – *By-pass the VSD during a fire event*

2 **By-pass the VSD during a fire event**. When using this option, the **fan motor must be connected directly to the mains electrical supply during a fire event**, as the VSD must be by-passed so that it is not "within the electrical circuit" which supplies power to the fan drive motor. VSD control can therefore only be used when the fan is performing a normal ventilation function.



EN12101-3: 2015 – *By-pass the VSD during a fire event*

By-passing the VSD during a fire event does, on the face of it, provide a more robust solution, but doing this would *force the fan to run at full speed*

If the fan is used within a pressurisation system then doing this could *cause system component damage, caused by over-pressurising them*

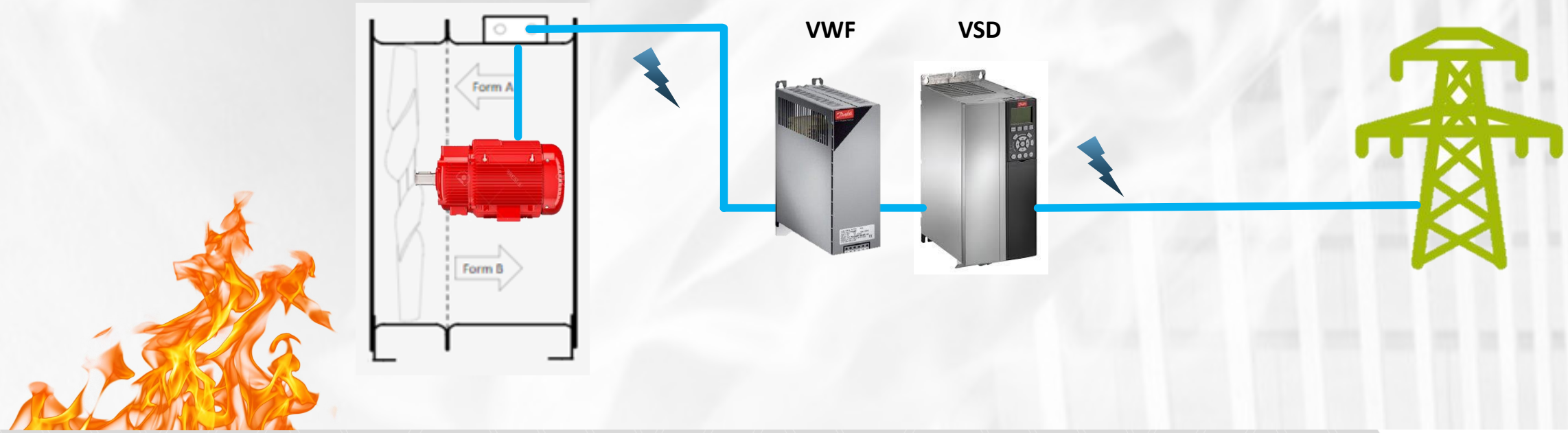
Over-pressurising stairwell pressurisation systems would have very serious consequences, as this *may then make it impossible for occupants to open escape route doors*

By not using a VSD it could make it much *more difficult for the system designer to achieve desired smoke control and extraction strategies*

EN12101-3: 2015 – *De-rate drive motors by 20% and fit Voltage Waveform filters*

3 **Where fans and VSDs have *not* been tested and certified** as a packaged solution, **drive motors *must* be de-rated and Voltage Waveform filters *must* be fitted**.

- **De-rate (over-size) Motor by 20%**
- **Installer MUST also fit either Sinusoidal or du/dt voltage waveform filter between the drive motor and the VSD**.



EN12101-3: 2015 – *De-rate drive motors by 20% and fit Voltage Waveform filters*

EN12101-3:2015 allows VSD speed control for a dual mode fan, even during a fire event. HOWEVER….
If the Fan, drive motor and VSD have *NOT been third party tested and certified, some considerations must be made:*

Drive motor rating must be *increased 20%.*

In addition, the *Installer MUST fit a voltage waveform filter between the VSD and motor*.

Other Implications Include:

Cost and practicality: *Voltage waveform filters are very expensive*, often costing more than the VSD

As filters should be housed inside a remotely mounted control panel (with the VSDs), the panel enclosure needs to be larger, while extra wiring would also be needed

As the fan drive motor must also be larger, fan cost will increase, while higher amp ratings could impact on wiring and associated control equipment ratings and costs. Fan Size could also increase.

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WHY IS A VARIABLE SPEED DRIVE "FIRE MODE" (SMOKE CLEARANCE FUNCTION) NEEDED?

- **Smoke obscures vision, preventing occupants from finding safe escape routes**
- **Smoke hinders the fire brigade in its search and rescue operations**
- **Smoke can kill by asphyxiation or by poisoning people (if toxic), well before the temperature of the fire or smoke causes any physical injuries**
- **Fire Protection should always be classed as a "System". System elements must work together in order to achieve a consolidated/co-ordinated approach to life safety**
- **Smoke Control systems can be categorised as "Dedicated" or "Non-Dedicated"**
- Smoke-control system **reliability decreases** as the number of system components **increases**, unless the system includes component redundancy
- **VSD Fire Mode creates a priority function which over-rides all other functions**, to ensure that the drive performs its primary task for the fire event design duration

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SPEED DRIVE "FIRE MODE" FUNCTIONS

- All safety devices within the VSD (or VFD) are automatically over-ridden
- The VSD will ignore overloads, but will trip and reset automatically on 'critical' faults
- In ***Fire Mode***, the VSD ignores the ambient conditions and keeps operating. However, this Mode is only designed for *short-term use*, but is designed to be *long enough to ensure System Reliability*…. Offering an improved life safety solution
- VSD can be enabled either automatically or via a Digital Input
- Fire rated cable should always be used (especially between the motor and VSD)
- Non-critical faults or warnings will NOT be active when the VSD is in Fire Mode

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VARIABLE SPEED DRIVE APPLICATIONS

- Stairwell Pressurisation (Multi-Storey buildings) – Multi-Zone Controls
- Lift Shaft Pressurisation (Multi-Storey buildings) – Multi-Zone Controls
- Smoke Extract Fans (Buildings) – Multi-Zone Controls
- Smoke Extract & Pollution Control Fans (Car Parks) – Multi-Zone Controls
- Tunnel Ventilation, Pollution Control and Smoke control / Extraction

Advantages of using VSD control with Axial Fans

- Precise speed control allows actual design duty to be accurately achieved
- Adaptive speed control (via NOx / CO sensors) delivers optimum pollution control
- Flexibility to adapt fan performance based on evolving system needs
- Energy saving opportunities based on using “on demand” control logic

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CERTIFIED RANGE SCOPE – TOP LEVEL ATTRIBUTES

- Any HT Axial flow fan with JM, JMv, JM2, JMTS, JMTSP, JT and JTv impeller variants
- Fläkt Woods approved motor frame size range: **71 to 280 inclusive (Foot/Pad/Flange)**
- **Maximum motor and VSD rating is 104kW. Larger motors are not currently certified**.
- Approved multi-voltage motor electrical supply: **380-420v 50Hz or 440-480v 60Hz (3 phase)**
- Maximum Fan speed must be equal to, or less than the impeller maximum speed
- HT Categories: 300°C/1 hour, 300°C/2 hours & 400°C/2 hours
- If HT 200°C/2 hours specification is required, offer 300°C/2 hour specification
- **Approved VSD: Danfoss VLT HVAC FC101 (or FC102) range**

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Product Range Scope

Range Exclusions

- **Product Exclusions** are: **Bifurcated fan** and **Car Park Jet Induction fans**
- Motor frame sizes **less than 71 (Brook) /80 (WEG) or larger than 280 frame sizes**
- **Any motor or VSD rated at greater than 90kW (WEG) or 104kW (Brook)**
- No single phase motors are within our certification scope
- **HT Category Exclusions: F200 (200°C/2 hours) and F600 (600°C/1 Hour, 600°C/2 hours)**
- Danfoss FC51 (single phase in/three phase out) drive is outside the certification scope

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Product Range Scope

Out of scope Options

- Offer on the basis that the VSD will be by-passed during a fire event
- Where the specification requires VSD control during a fire event, then the cost of HT tests and certification should be added into the project price/delivery time
- Offer VSD controlled fans on the basis of having Voltage Waveform filters fitted (by others) with an associated fan drive motor de-rate.

Considerations

We cannot, of course, ignore a customer's specification requirement to use VSD speed control during a fire event. *If we do, we would then have to retrospectively fit larger motors (very costly option)*

If VSDs are supplied by others, then No VSD manufacturer can claim to comply with BS EN12101-3:2015 HT certification. ONLY Fläkt Woods can offer certification, as the VSD is *part of our FAN Certification*

EN12101-3: 2015 – Selection of VSDs with HT (Smoke Extraction) Fans

Fan Selection software functionality

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Fan Selector

Fan Selection Options

1. Offer on the basis that the VSD will be by-passed during a fire event
2. Where a specification requires VSD control during a fire event and when the motor power is greater than 90kW (or 104kW if Brook), then …. We need to de-rate the fan drive motor … and installers MUST Fit a Sinusoidal or du/dt filter between the VSD and Motor
3. Choose a fan and VSD combination from our fully tested and certified range

PREFERRED OPTION!

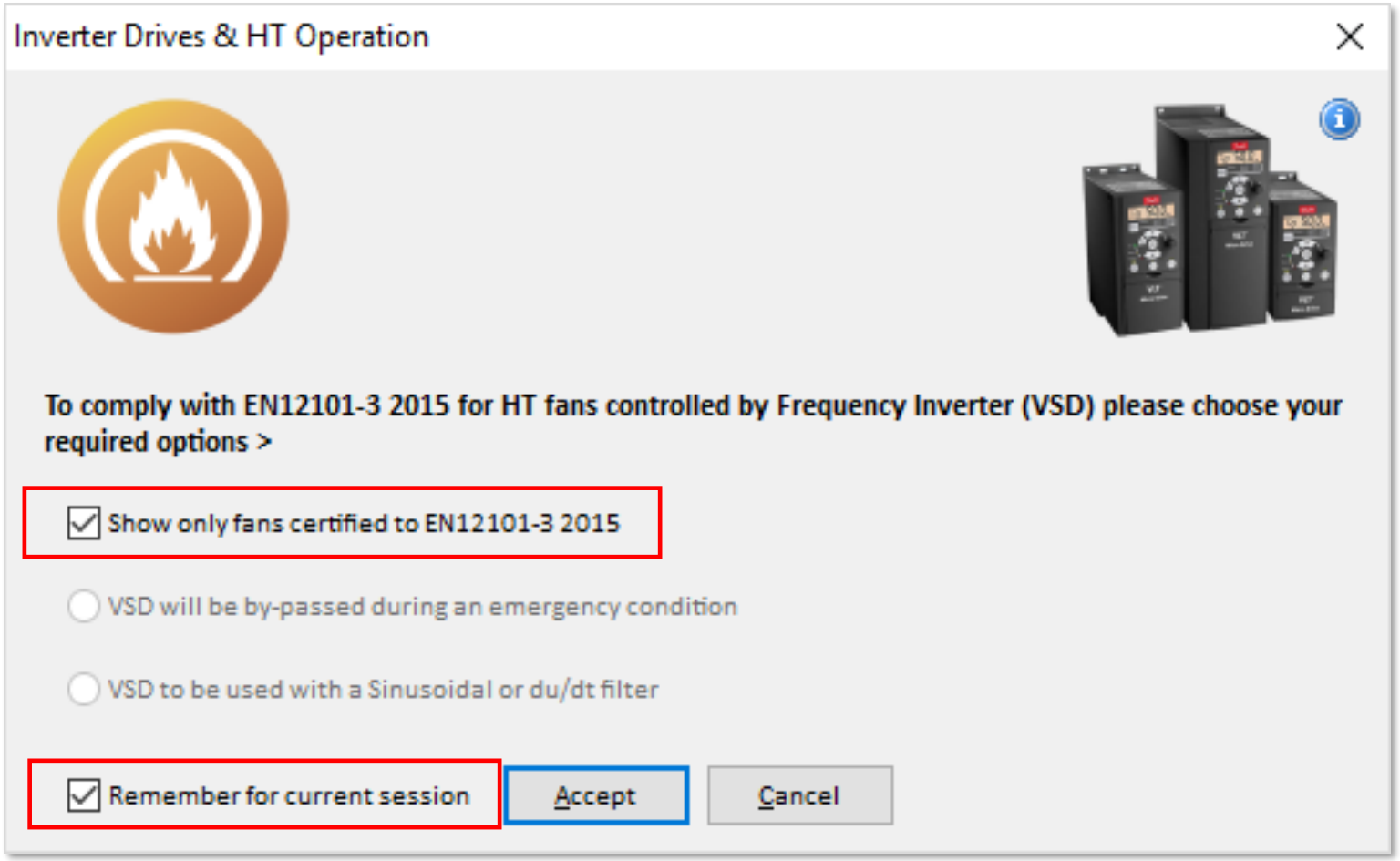
EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Desktop Fan Selector

This dialogue appears when…

An HT Axial fan is selected when **“*Inverter control*”** has been selected from the **“*Speed Control and Motor*”** menu

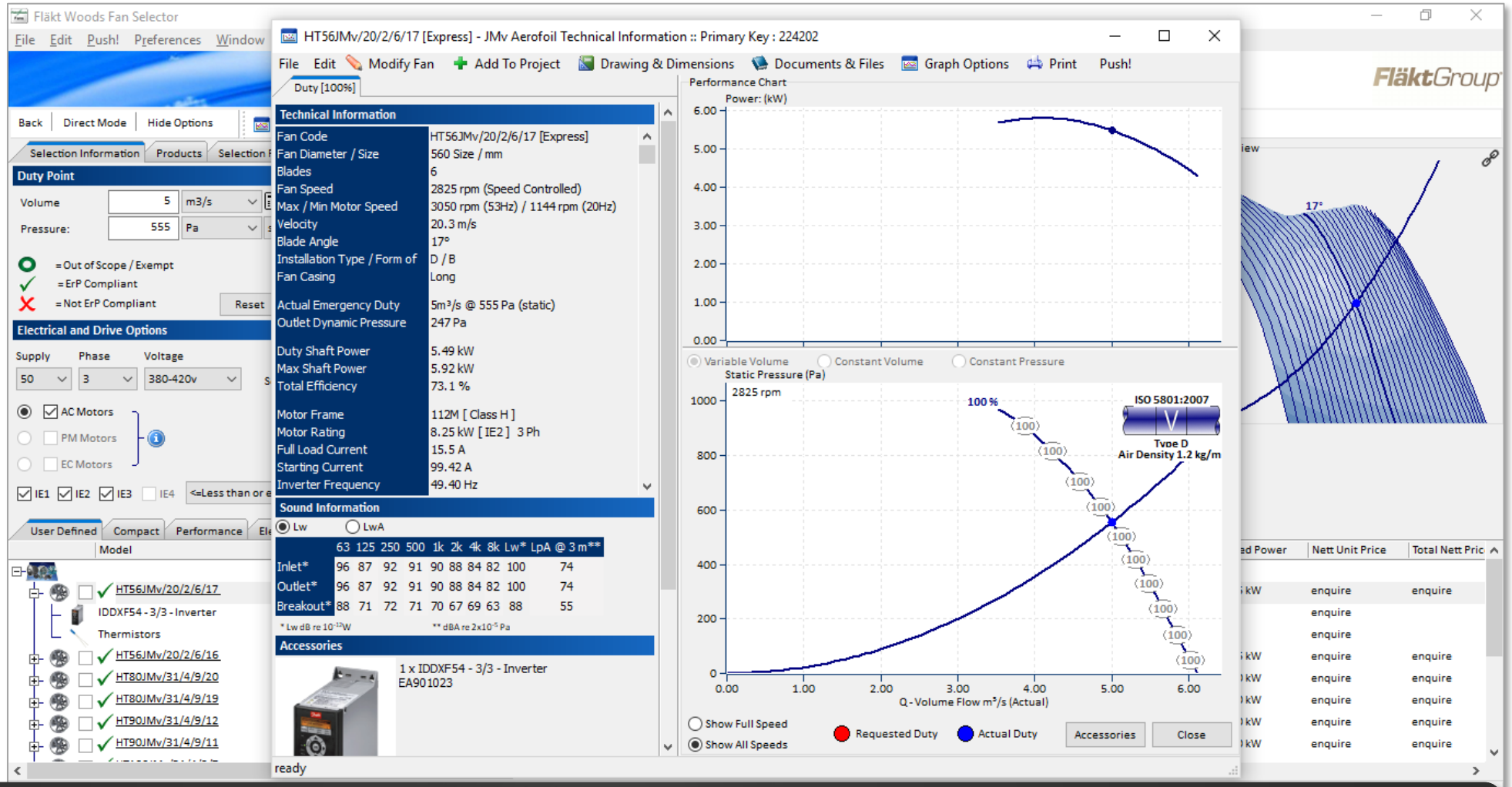
By default the “**Show only fans certified to EN12101-3 2015**” checkbox is pre-ticked

If doing multiple selections,
It is recommended that the “**Remember for current session**” checkbox is ticked.



EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Desktop Fan Selector

This selection option offers **ONLY fully certified combinations** of our **HT Axial fans and Danfoss VSDs**

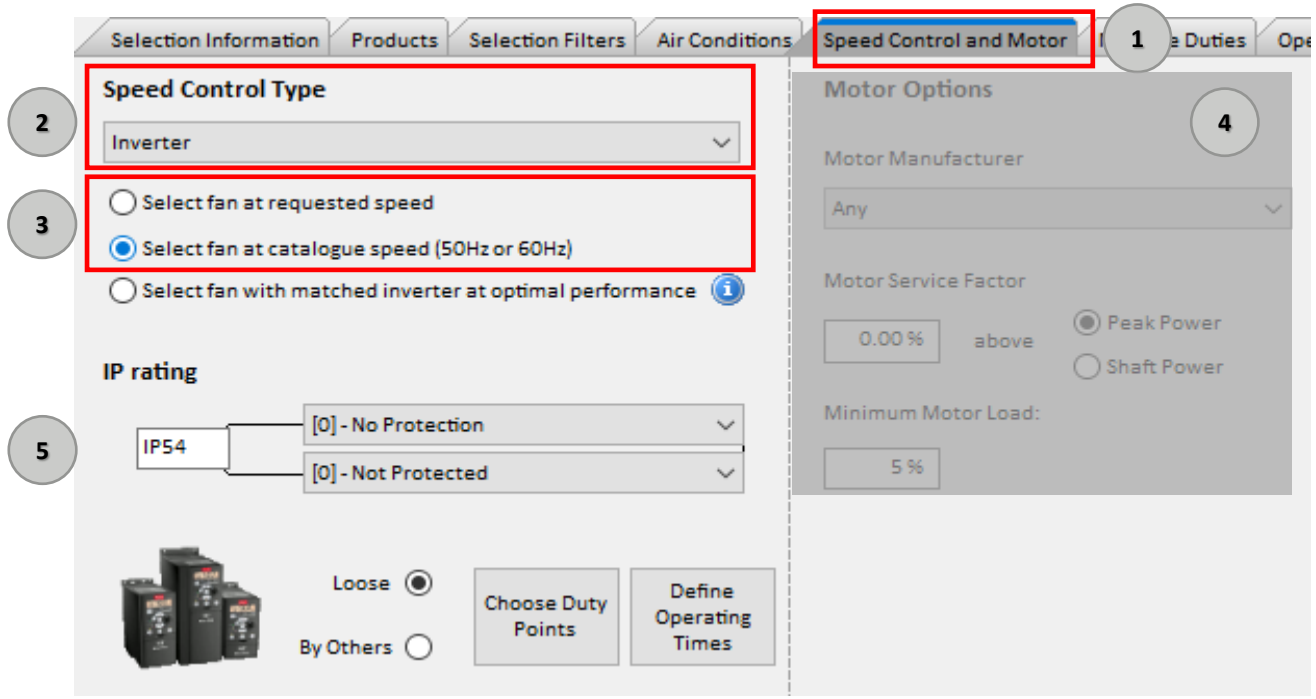


Compliance to EN12101-3 2015 is confirmed on each fan datasheet

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Desktop Fan Selector

Before making an HT fan selection, first select the VSD by following the steps shown below:

1. Choose the "**Speed Control and Motor**" tab.
2. Select "**Inverter**" from the "**Speed Control Type"** dropdown menu.
3. Choose "**Select fan at catalogue Speed (50Hz or 60Hz)**" or "**Select fan at requested Speed**".
4. Note**: Don't change any options under "Motor Options".**
5. **See VSD Variant Notes….**



VSD Variant Notes

Selecting an **IP54** drive will default to the **Danfoss HVAC VLT FC101** drive…

… while the **IP66** option defaults to the **Danfoss HVAC VLT FC102** drive, which as it has additional functionality, is the more expensive option.

The FC102 may only be needed for more complex BMS connectivity solutions or where advanced control logic is required (i.e. multiple duty set-points etc.).

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EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Testing/Certification

BSRIA TEST RIG & EXAMPLE JM AXIAL TEST FAN

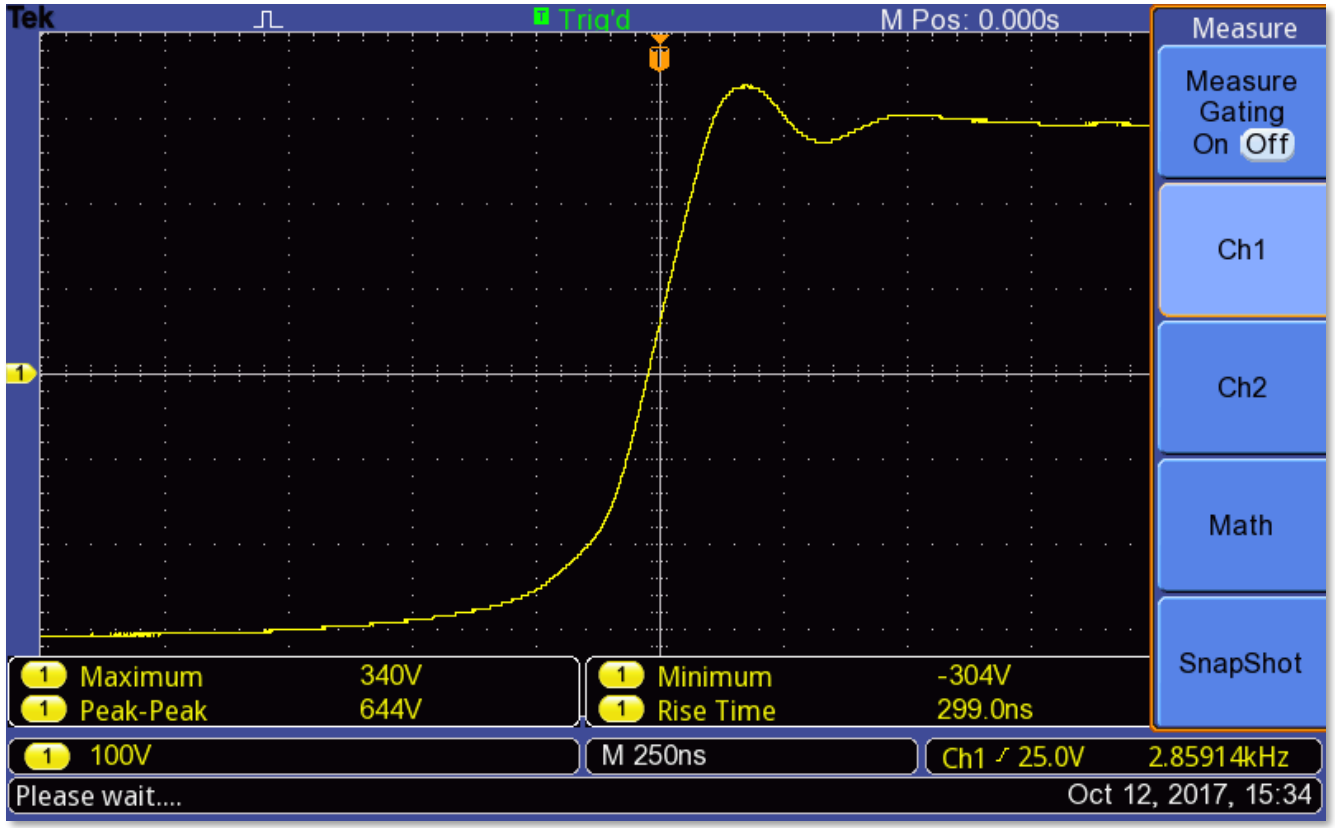
FläktWoods A FläktGroup Company BSRIA

Fläkt Woods worked closely with BSRIA to develop the test arrangement, methodology and equipment package to allow each high temperature fan and associated VSD test to be conducted in accordance with the very latest version of BS EN12101-3:2015.

Featured fan is a 315mm diameter Fläkt Woods Axial HT Fan Product rated for 300°C/2hours

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Testing/Certification

VSD data measurements and capture

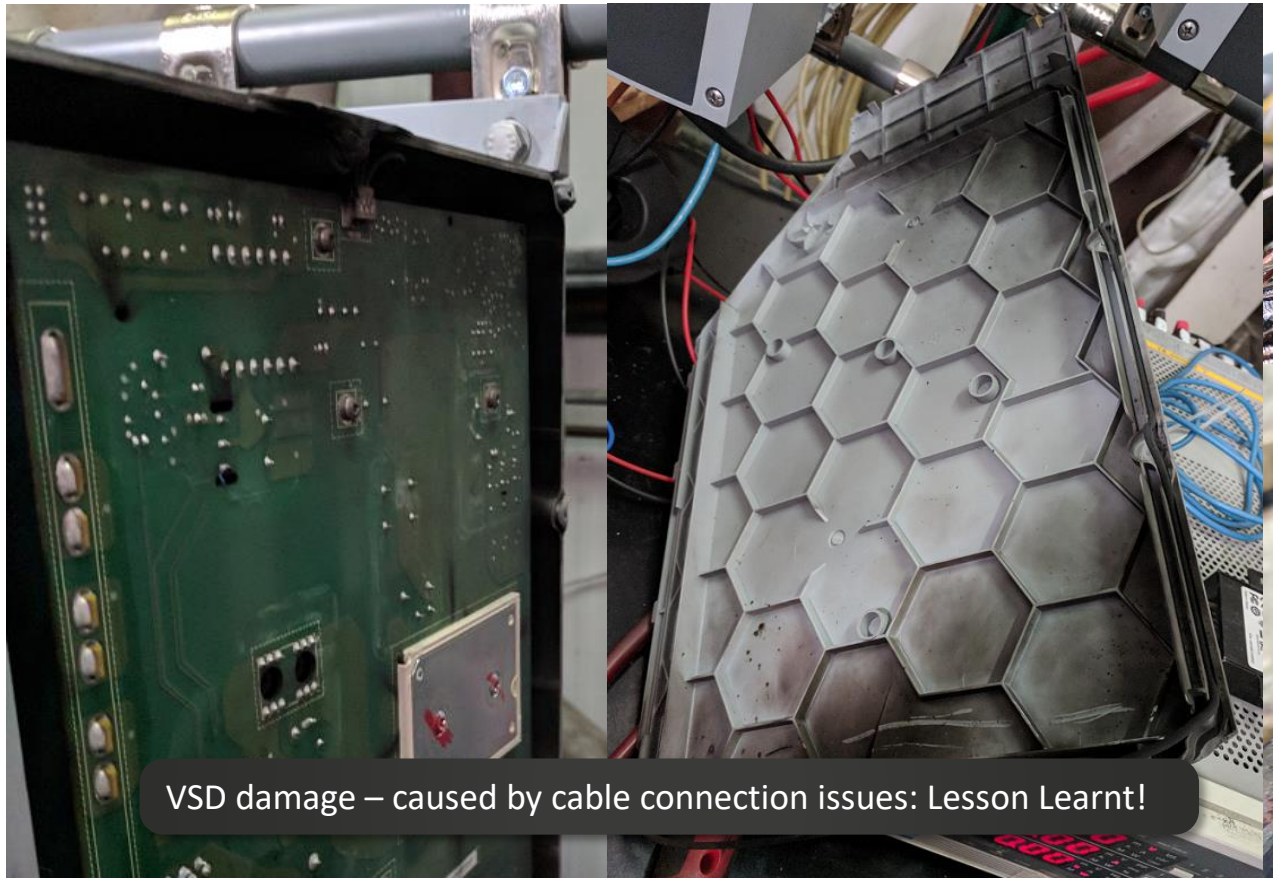


During VSD testing, **Peak to Peak Voltage** and the associated **Rise Time** values where measured and recorded. These data are key to proving compliance with the test standard. **Du/dt** values are derived from the ratio of the peak-peak voltage and rise time.
These data (captured during tests) are our Intellectual property… so will not, of course, be disclosed to third parties

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Testing/Certification

Test Experiences

Implications of getting the fan/motor/VSD/installation wrong can be dramatic!



VSD damage – caused by cable connection issues: Lesson Learnt!

Key components are checked after certification tests

Post Test: Motor Bearings checked for over heating

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Certification

Certificate Update

- New EN12101-3:2015 Certificate issued by BSI: dated 10th February 2020 (Updated July 2021)
- While our certificate has NO statement on page 1, to confirm that a defined range of VSDs (Danfoss) can be used to control our fans during a fire event, an *associated document does confirm this*
- Only Fan Manufacturers who can provide a copy of their Technical Annex file …. can PROVE and CONFIRM that they FULLY comply with EN12101-3:2015
- Full Compliance is confirmed by the existence of an associated Technical Annex file: "*Fans Driven by PWM frequency converter at ambient and at high temperature A.1.n*". This defines precise attributes of the tested and approved VSD range

bsi.

Certificate of Constancy of Performance

By Royal Charter

This is to certify that:

Fläkt Woods Limited
Axial Way
Colchester
CO4 5ZD
United Kingdom

Holds Certificate Number: 2797 CPR 474878

In respect of:

EN 12101-3:2015 - Smoke and heat control systems. Specification for powered smoke and heat exhaust ventilators.

In compliance with Regulation 305/2011/EU of the European Parliament and of the Council of 9 March 2011 (the Construction Products Regulation or CPR), this certificate applies to the above construction product. This certificate attests that all the provisions concerning the assessment and verification of constancy of performance described in Annex ZA of the above standard(s) under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the constancy of performance of the construction product(s). This certificate was first issued on the date below and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods, nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body.

For and on behalf of BSI, a Notified Body for the above Regulation (Notified Body Number 2797):
Previous Notified Body: BSI 0086
First Issued: 2004-09-07

Drs. Dave Hagenaars, Managing Director

Latest Issue: 2020-02-10

Page: 1 of 26

...making excellence a habit.

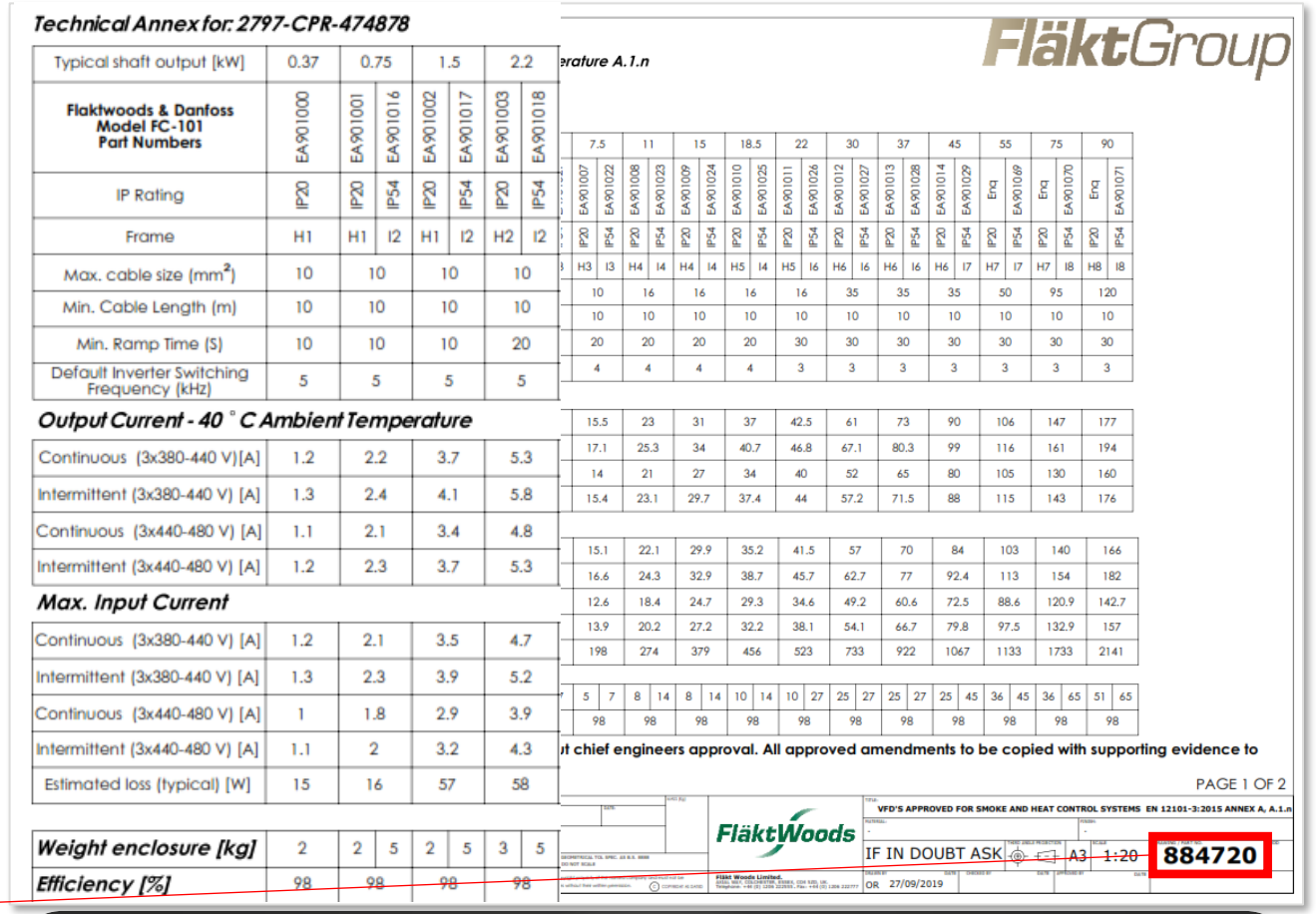
EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: Certification

Technical Annex File

Specific Product detail pages refer to BSRIA reports which have an associated "*Technical Annex File*"

JM HT Aerofoil Class F300 **Aluminium Blade & Hub**	125JM/31	125JM/40	125JM/50	140JM/40	140JM/50
	140JM/63	160JM/40	160JM/50	160JM/63	31JMv/14
	31JMv/16	35JMv/14	35JMv/16	40JMv/14	40JMv/16
	40JMv/20	45JMv/16	45JMv/20	50JMv/16	50JMv/20
	56JMv/20	63JMv/20	63JMv/25	63JMv/25	71JMv/25
	71JMv/25	80JMv/25	80JMv/25	80JMv/31	90JMv/31
	100JMv/31	31JMTS/16	35JMTS/16	40JMTS/16	40JMTS/20
	45JMTS/20	50JMTS/20	50JMTS/25	56JMTS/25	63JMTS/25
	63JMTS/31	71JMTS/31	80JMTS/25	80JMTS/31	90JMTS/31
	100JMTS/31	100JMTS/40	100JMTS/50	112JMTS/40	112JMTS/50
	125JMTS/40	125JMTS/50	140JMTS/40	140JMTS/50	140JMTS/63
	160JMTS/50	160JMTS/63			
Response Delay	N/A				
Resistance to Fire Class	F200 & F300 *(Tested to 300°C, 120 mins)*				
Motor Rating	Class F / Class H				
Ancillaries	Mounting brackets, Matching Flanges, Fire Resistant Flexible Connectors, Bell mouth, Guard, Silencers, Air Deflector vanes, Downstream guide vanes, Air operated Dampers, Vibration isolators, Craig and Derricott isolators, Moeller Isolators, Anti stall rings & Thermistors.				
BSRIA Reports	53868/25 Edition 4, 53868/27 & 61438/2 refer				
Inverters	Refer to technical annex 884720 ~~or manufacturer approved drives~~				

Use of Inverters is specifically confirmed



Technical Annex for: 2797-CPR-474878

FläktGroup

Typical shaft output [kW]	0.37	0.75		1.5		2.2	
Flaktwoods & Danfoss Model FC-101 Part Numbers	EA901000	EA901001	EA901016	EA901002	EA901017	EA901003	EA901018
IP Rating	IP20	IP20	IP54	IP20	IP54	IP20	IP54
Frame	H1	H1	I2	H1	I2	H2	I2
Max. cable size (mm^2)	10	10		10		10	
Min. Cable Length (m)	10	10		10		10	
Min. Ramp Time (S)	10	10		10		20	
Default Inverter Switching Frequency (kHz)	5	5		5		5	

Output Current - 40 ° C Ambient Temperature

Continuous (3x380-440 V)[A]	1.2	2.2	3.7	5.3
Intermittent (3x380-440 V) [A]	1.3	2.4	4.1	5.8
Continuous (3x440-480 V) [A]	1.1	2.1	3.4	4.8
Intermittent (3x440-480 V) [A]	1.2	2.3	3.7	5.3

Max. Input Current

Continuous (3x380-440 V) [A]	1.2	2.1	3.5	4.7
Intermittent (3x380-440 V) [A]	1.3	2.3	3.9	5.2
Continuous (3x440-480 V) [A]	1	1.8	2.9	3.9
Intermittent (3x440-480 V) [A]	1.1	2	3.2	4.3
Estimated loss (typical) [W]	15	16	57	58

Weight enclosure [kg]	2	2	5	2	5	3	5
Efficiency [%]	~~98~~	~~98~~		~~98~~		~~98~~	

	7.5		11		15		18.5		22		30		37		45		55		75		90	
	EA901007		EA901022		EA901008	EA901023	EA901009	EA901024	EA901010	EA901025	EA901011	EA901026	EA901012	EA901027	EA901013	EA901028	EA901014	EA901029	Enq	EA901069	Enq	EA901070	Enq	EA901071
	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54	IP20	IP54
	H3	I3	H4	I4	H4	I4	H5	I4	H5	I6	H6	I6	H6	I6	H6	I6	H6	I7	H7	I7	H7	I8	H8	I8
	10		16		16		16		16		35		35		35		50		95		120	
	10		10		10		10		10		10		10		10		10		10		10	
	20		20		20		20		30		30		30		30		30		30		30	
	4		4		4		4		3		3		3		3		3		3		3	
	15.5		23		31		37		42.5		61		73		90		106		147		177	
	17.1		25.3		34		40.7		46.8		67.1		80.3		99		116		161		194	
	14		21		27		34		40		52		65		80		105		130		160	
	15.4		23.1		29.7		37.4		44		57.2		71.5		88		115		143		176	
	15.1		22.1		29.9		35.2		41.5		57		70		84		103		140		166	
	16.6		24.3		32.9		38.7		45.7		62.7		77		92.4		113		154		182	
	12.6		18.4		24.7		29.3		34.6		49.2		60.6		72.5		88.6		120.9		142.7	
	13.9		20.2		27.2		32.2		38.1		54.1		66.7		79.8		97.5		132.9		157	
	198		274		379		456		523		733		922		1067		1133		1733		2141	
	5	7	8	14	8	14	10	14	10	27	25	27	25	27	25	45	36	45	36	65	51	65
	98		98		98		98		98		98		98		98		98		98		98	

...t chief engineers approval. All approved amendments to be copied with supporting evidence to

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VFD'S APPROVED FOR SMOKE AND HEAT CONTROL SYSTEMS EN 12101-3:2015 ANNEX A, A.1.n

IF IN DOUBT ASK — A3 ~~1:20~~ — 884720

OR 27/09/2019

Our "*Technical (Annex) file*" gives details of the VSD range, which we qualified through physical third party testing, defining exactly what we can offer as an integral part of our fully certified smoke extract fan and VSD solution

Woods AIR MOVEMENT

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: DoP

"DoP" - Declaration of Performance

9. Declared performance:

Essential characteristics	Performance	Harmonised technical specification
Response delay Opening under snow/wind load in a given time	Not determined	Annex ZA of the standard EN12101-3:2015
Operational reliability Application categories	Thermally Insulated or Thermally Uninsulated Installed inside or outside Smoke Reservoir Horizontal or Vertical, Form A and Form B Driven by frequency converter (up to/including 280 motor frame) Driven by frequency converter with VWF filter (above 280 frame) Direct feed (DOL) with no speed variation Dual purpose use Emergency Only use No ducted cooling air required	
Effectiveness of smoke/heat gas extraction Gas flow and pressure maintenance during smoke and heat extraction test	-10% ≤ flow ≤ +25%	
Resistance to fire	F400 (120)	
Ability to open under environmental conditions Opening under snow/wind load in a given time	Not determined	
Durability of operational reliability	Class H, 105K	

"DoP" now confirms that HT fans can be VSD controlled during a fire event when fans are designed for either "Dual Mode" or "Emergency Only" use

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A FläktGroup Company

Declaration of Performance

EC Certificate and Declaration of Performance in accordance with Construction Products Regulation (EU) No. 305/2011 (CPR)

Powered Smoke and Heat Control Ventilator (Fan)

1. Unique identification code of the product type: **40JT-4SP-RDD-TB 3 S D90 400120 T/BOX LH**
2. Type, batch, or serial number or any element allowing identification of the construction product as required pursuant to Article 11 (4): **SO-0012345 / 67**
3. Intended use or uses of the construction product, in accordance with the applicable harmonized technical specification, as foreseen by the manufacturer: **Smoke and heat control systems**
4. Name, registered trade name or registered trade mark and contact address of the manufacturer as required pursuant to Article 11 (5): **Fläkt Woods Limited, Axial Way, Colchester CO4 5ZD, United Kingdom, Registered in England no. 233771**
5. Where applicable, name and contact address of the authorized representative whose mandate covers the tasks specified in Article12 (2): **Not applicable**
6. System or systems of assessments and verification of constancy of performance of the construction product as set out in Annex V: **System 1**
7. In case of the declaration of performance concerning a construction product covered by a harmonized standard: **BSI Group The Netherlands B.V., John M. Keynesplein 9, 1066 EP Amsterdam, The Netherlands (Notified Body No. 2797)** performed type tests on products, inspection of manufacturing plant and continuous surveillance of factory production control under system 1 of Annex V and issued certificate no. 2797-CPR-474878
8. In case of the declaration of performance concerning a construction product for which a European Technical Assessment has been issued: **Not applicable**
9. Declared performance:

Essential characteristics	Performance	Harmonised technical specification
Response delay Opening under snow/wind load in a given time	Not determined	Annex ZA of the standard EN12101-3:2015
Operational reliability Application categories	Thermally Insulated or Thermally Uninsulated Installed inside or outside Smoke Reservoir Horizontal or Vertical, Form A and Form B Driven by frequency converter (up to/including 280 motor frame) Driven by frequency converter with VWF filter (above 280 frame) Direct feed (DOL) with no speed variation Dual purpose use Emergency Only use No ducted cooling air required	
Effectiveness of smoke/heat gas extraction Gas flow and pressure maintenance during smoke and heat extraction test	-10% ≤ flow ≤ +25%	
Resistance to fire	F400 (120)	
Ability to open under environmental conditions Opening under snow/wind load in a given time	Not determined	
Durability of operational reliability	Class H, 105K	

10. The performance of the product identified in points 1 and 2 is in conformity with the declared performance in point 9. This declaration of performance is issued under the sole responsibility of the manufacturer identified in point 4.

Signed for and on behalf of the manufacturer by:

Place: Colchester
Date: 23/09/2019

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EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: DoP

DoP – Appendix/Annex

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Declaration of Performance

Appendix

Additional information related to installation method and application, in accordance with Table F.8 EN12101-3:2015

	Mechanically driven exhaust appliances for Smoke and Heat Control ventilators (Fan)		
	Fire resistance: classification		
	Class	**Temperature (°C)**	**Time (Min)**
X	F_{200}	200	120
X	F_{300}	300	60
X	F_{400}	400	120
X	F_{600}	600	60
	F_{842}	-	30
	Fire resistance: Free classification for informative purposes		
X	Ff_{250}	250	120
X	Ff_{300}	300	120
X	Ff_{400}	400	60
X	Ff_{600}	600	120
X	Ff_{θ}	θ	A
	Motor Range/Manufacturer	WEG/ABB/Brook Crompton	

HT rated motor manufacturers used within our fans are stated. We also confirm which Accessories are within the scope of our HT certification

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	5) Application
X	Direct On line electrical connection to mains electrical supply
X	With frequency converter under following conditions: Peak to peak; Values are motor dependent Filter; du/dt voltage waveform type
X	Dual purpose operation
X	Suitable for Emergency Only operation
X	Thermally insulated
X	Not Thermally insulated
X	Horizontal motor shaft, floor standing

Fan Accessories

Additional information related to Fan Accessories, suitable for use with smoke and heat control ventilators (Fans)

	Fan Accessory Type
X	Matching flange for duct connection, Horizontal
X	Matching flange for duct connection, Vertical
X	Bellmouth inlet
X	Fan guard (Grille)
X	Anti-Vibration Mount (spring type)
X	Anti-Vibration Mount (spring type) - travel limiter
X	Flexible connector
X	Mounting Feet, brackets – Horizontal
X	Mounting brackets – Vertical
X	Deflector
X	Diffuser
X	Inspection Hatch
X	Sound Attenuator
X	Air Operated Backdraught damper (Horizontal)
X	Air Operated Backdraught damper (Vertical)
X	Flow straighteners
X	Frequency inverter/converter drive
X	Main electrical connection terminal box
X	Electrical Isolator switch
X	Electrical Isolator switch with functional integrity as per fan classification

Woods AIR MOVEMENT

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans

FLÄKTGROUP HT FAN & VSD PACKAGE • FULLY CERTIFIED IN ACCORDANCE WITH EN12101-3:2015 •

FULLY COMPLIANT EN12101-3: 2015 FAN AND VSD SOLUTION

WORKING TOGETHER… TO DELIVER ENHANCED FIRE SAFETY WITHIN BUILDINGS

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www.woodsairmovement.com

Appendix

EN12101-3: 2015 – Use of VSDs with HT (Smoke Extraction) Fans: VWF Filters

- Using our fully CERTIFIED fan and VSD packaged solution means that NO Voltage Waveform Filters are needed
- HOWEVER, fitting a filter is beneficial in some applications

- During normal operation, VSDs can, very occasionally, produce a voltage spike within the Motor
- Over prolonged periods of time these spikes can cause minor motor winding insulation and bearing damage
- If motor insulation is weakened enough it could (when under stress) breakdown causing a failure
- The amount of damage which voltage spikes can cause is VERY MINOR, but it is not zero
- Using a Voltage Wave form filter between the VSD and the motor does reduce this damage risk

We have conducted extensive testing, without VWF Filters fitted, to ensure that this solution is both robust and safe

ENGINEERING TOMORROW

VARIABLE SPEED DRIVE "BY-PASS" CONSIDERATIONS

- When the VSD is by-passed (during a fire event) the fan can ONLY run at full speed
- Not every system is designed to allow fans to be run at full speed
- Some pressurisation systems could have their duct work or other components damaged, if the fan over pressurises the system
- Stairwell pressurisation systems should ***NEVER*** be over-pressurised, otherwise it may be impossible to open escape route doors
- Systems which use the VSD "By-Pass" solution can be very difficult to integrate smoke direction control logic into them (they may not work effectively in all scenarios)
- The "By-Pass" option (in terms of an overall system approach) may ***not*** be more reliable

ENGINEERING TOMORROW

VARIABLE SPEED DRIVE RELIABILITY

- Where the VSD is used to control a **dual mode (non-dedicated) fan** which is used for both day-to-day HVAC ventilation and smoke extract fan, the Fan and VSD are effectively being "run tested" every day, so reliability could be deemed as being *higher*
- Dedicated fire mode fans (and associated equipment) would only (typically) be tested at monthly, 6 monthly or even yearly intervals.
- *Dedicated fan mode fan maintenance:* If fan/motor bearings are not turned regularly, they can degrade (flat spot) and then prematurely fail (especially when stressed)

ENGINEERING TOMORROW