

# DESIGN VERIFICATION TEST REPORT

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**Test Item** Interscale M

**Identification** Interscale M 14825-397  
Fan ebm-papst 4412 F

**Test Order** Determine the total air flow and the acoustic noise of the case

**Reported by** Daniel Dörflinger

**Date** 18.09.2013

**Signature**



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## Table of contents

1. Assessment.....	4
2. Description of the test.....	4
2.1 Sample(s) .....	5
2.2 Test resources/equipment .....	6
2.3 Fan .....	8
3. Results .....	9
3.1 Pull cooling with ebm-papst 4412 F and without impedance .....	9
3.2 Pull cooling with ebm-papst 4412 F and with impedance .....	10
3.3 Advice-1 .....	11
3.5 Push cooling with ebm-papst 4412 F and without impedance .....	12
3.6 Push cooling with ebm-papst 4412 F and with impedance .....	13
3.7 Advice-2 .....	14
3.8 Comparison Push vs. Pull ebm-papst 4412 F.....	15
3.9 Résumé .....	16
4. Acoustic Noise .....	17

## List of figures

Figure 1 Interscale case fixed to Test stand for air flow volume measurement - 2 .....	5
Figure 2 Interscale case fixed to Test stand for air flow volume measurement - 1 .....	5
Figure 3 Test stand for air volume measurements.....	6
Figure 4 Power supply .....	6
Figure 5 Measurement equipment .....	6
Figure 6 Test equipment acoustic noise measurements.....	7
Figure 7 Power supply .....	7
Figure 8 ebm-papst 4412 F.....	8
Figure 9 Pull cooling without Impedance-1 .....	9
Figure 10 Pull cooling without Impedance-2 .....	9
Figure 11 Impedance .....	10
Figure 12 Case with Impedance .....	10
Figure 13 Pull cooling with Impedance .....	10
Figure 14 Advice-1 .....	11
Figure 15 Push cooling without Impedance-2 .....	12
Figure 16 Push cooling without Impedance-1 .....	12
Figure 17 Push cooling with Impedance-1 .....	13
Figure 18 Push cooling with Impedance-2 .....	13
Figure 19 Advice-2 .....	14
Figure 20 Comparison Push vs. Pull ebm-papst 4412 F.....	15
Figure 22 Measurement setup Acoustic Noise-1 .....	17
Figure 21 Measurement setup Acoustic Noise-2 .....	17

## List of tables

Table 1 Pull cooling without impedance.....	9
Table 2 Pull cooling with impedance.....	10
Table 3 Push cooling without impedance .....	12
Table 4 Push cooling with Impedance-1 .....	13
Table 5 Résumé .....	16
Table 6 Acoustic Noise .....	17

## 1. Assessment

In this report you will find the measurement results of the **total air volume** of the case. The case was tested with the **test stand for air flow volume measurements** (description see page 6) at **normal operation**.

Furthermore you will find the measurement results of the **acoustic noise measurement**. The case was tested at **normal operation**. The description of the test equipment see page 7.

## 2. Description of the test

On the one hand the case was fixed to the **test stand for air volume measurements**. Operating voltage of the fans was 12V DC and the operating conditions for the fans were **maximum speed**.

On the other hand the case was placed on the floor and tested with the **sound intensity measuring method**. Operating voltage of the fans was 12V DC and the operating conditions for the fans were also **maximum speed and the measurement distance was 0,2m**.

## 2.1 Sample(s)

The Interscale case was equipped with following components:

- 2x axial fans, ebm-papst 4412 F

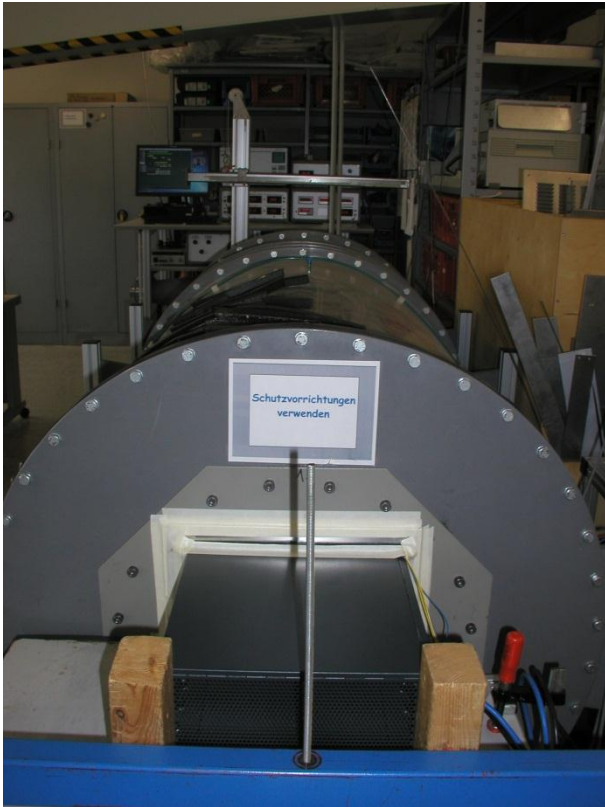


Figure 2 Interscale case fixed to Test stand for air flow volume measurement - 1



Figure 1 Interscale case fixed to Test stand for air flow volume measurement - 2

## 2.2 Test resources/equipment

### Total air flow (Test stand for air flow volume measurements)

- Chamber test stand works on the vacuum side in accordance to DIN 24163
- Specially developed from the university of Cologne (Germany)
- Measurements:
  - Air flow volume of fans in cases, cabinets and systems
  - Determination, air drag characteristic curves of filter mats, perforations and openings
  - Fan comparison, air flow volume, speed, power input, power, AC, DC clamping
- Output characteristic curves of fans with characteristic drag curves or characteristic systems curves
- Measurement equipment for the wind tunnel, Linseis Datalogger
- Power supply EA-PS 9080



Figure 3 Test stand for air volume measurements

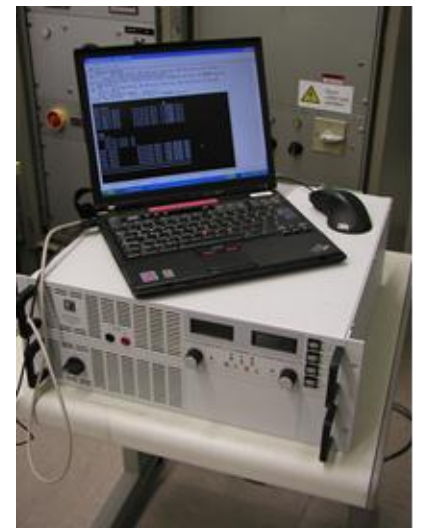


Figure 4 Power supply



Figure 5 Measurement equipment

## Test equipment acoustic noise

- Measurement of the sound intensity in accordance to DIN EN ISO 9614-2
- Determination of the sound power with the results from the sound intensity measurement
- Measurement in all rooms with constant background sound possible
- Determination of frequency spectrums of all measurement areas
- Measurement of sound pressure level
- Measurement of mechanical vibration (oscillating acceleration) with acceleration sensor
- Sound Intensity Investigator B & K – 2260
- Microphone B & K – 4181
- Sound Level Calibrator B & K - 4231
- Power supply EA-PS 9080



Figure 6 Test equipment acoustic noise measurements

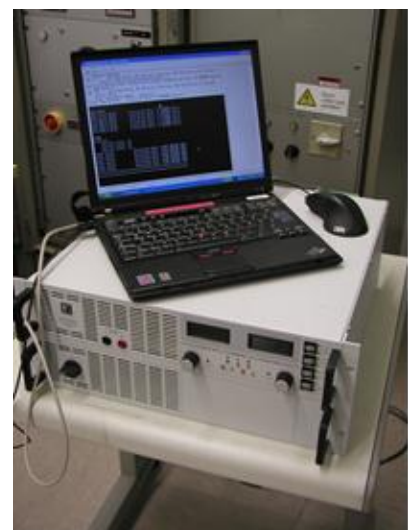


Figure 7 Power supply

### 2.3 Fan

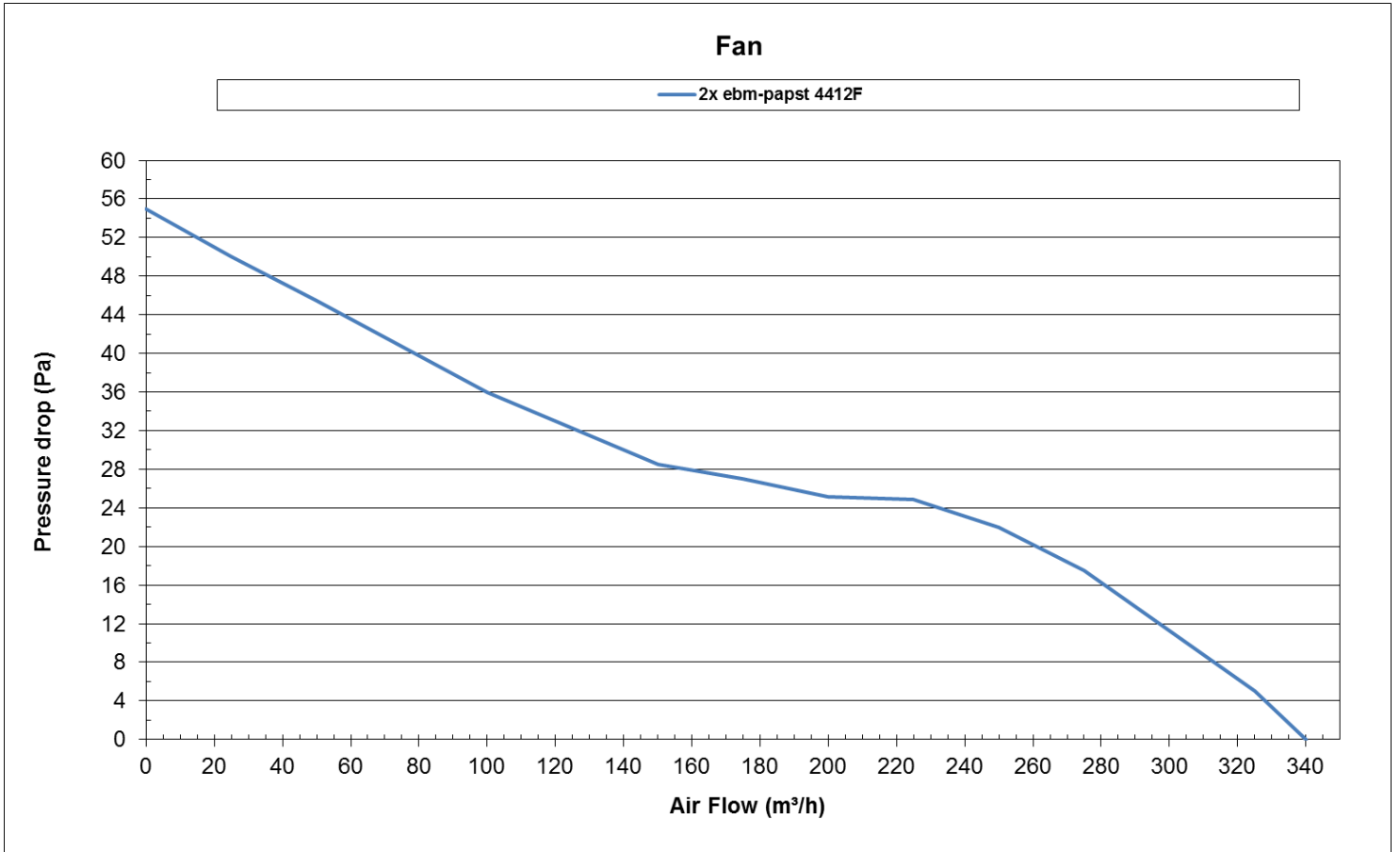


Figure 8 ebm-papst 4412 F



### 3. Results

#### 3.1 Pull cooling with ebm-papst 4412 F and without impedance

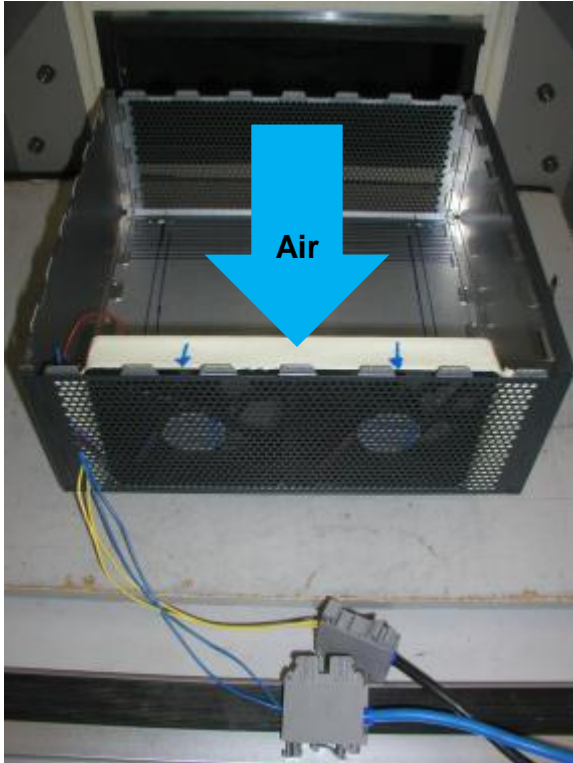


Figure 9 Pull cooling without Impedance-1

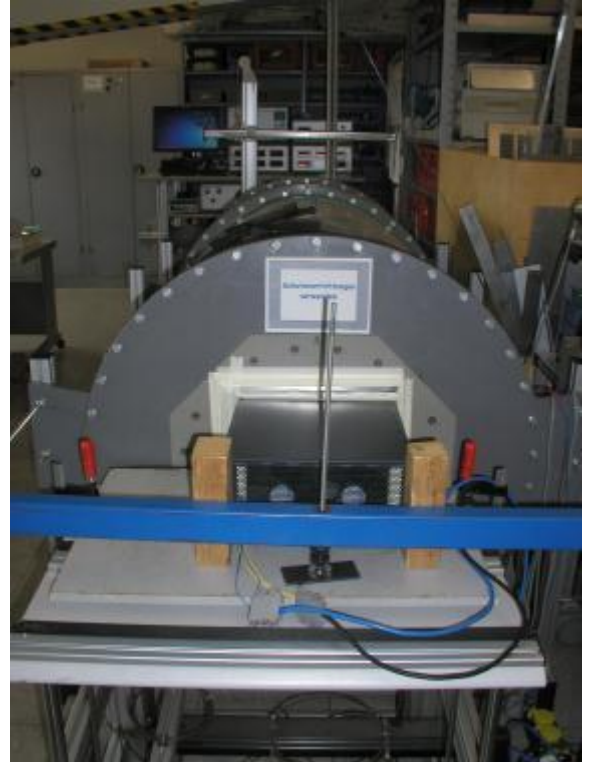


Figure 10 Pull cooling without Impedance-2

	without Impedance	
	[m <sup>3</sup> /h]	[cfm]
Bulk air flow	181	107

Table 1 Pull cooling without impedance

### 3.2 Pull cooling with ebm-papst 4412 F and with impedance



Figure 11 Impedance



Figure 12 Case with Impedance



Figure 13 Pull cooling with Impedance

	with Impedance	
	[m <sup>3</sup> /h]	[cfm]
Bulk air flow	174	103

Table 2 Pull cooling with impedance

### 3.3 Advice-1

To get the best working point for the fans, the distance between air inlet and impedance has to be approx. 20,0mm.

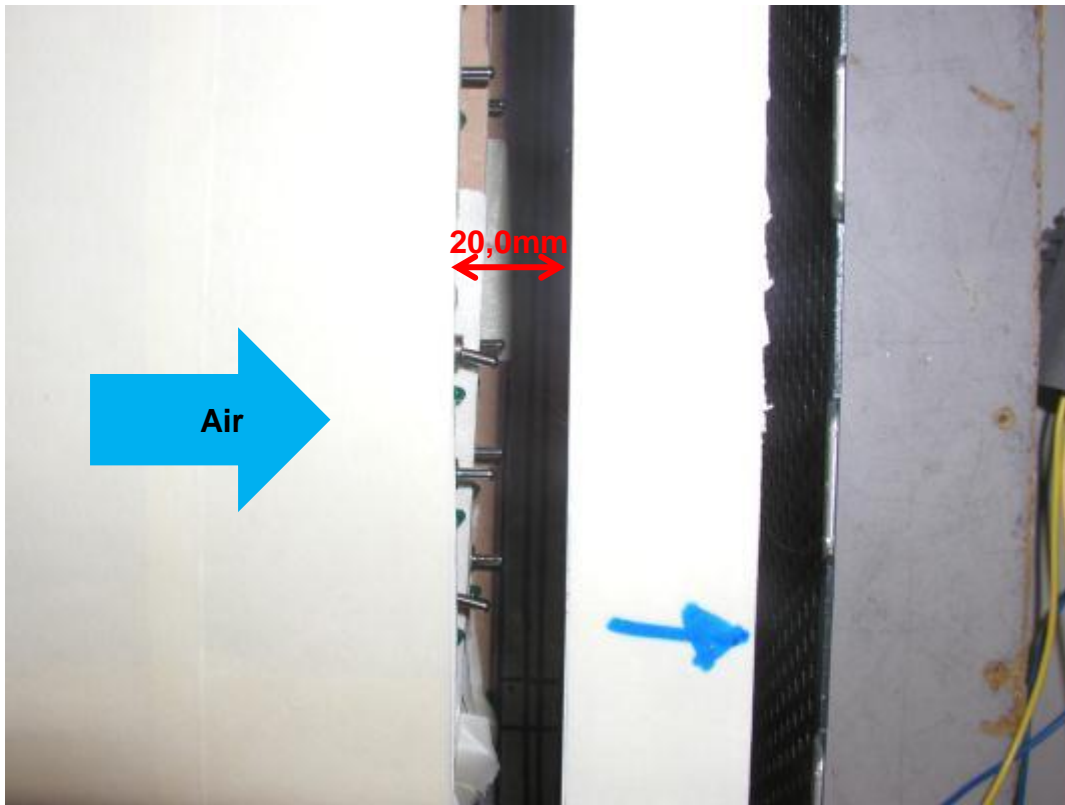


Figure 14 Advice-1

### 3.5 Push cooling with ebm-papst 4412 F and without impedance

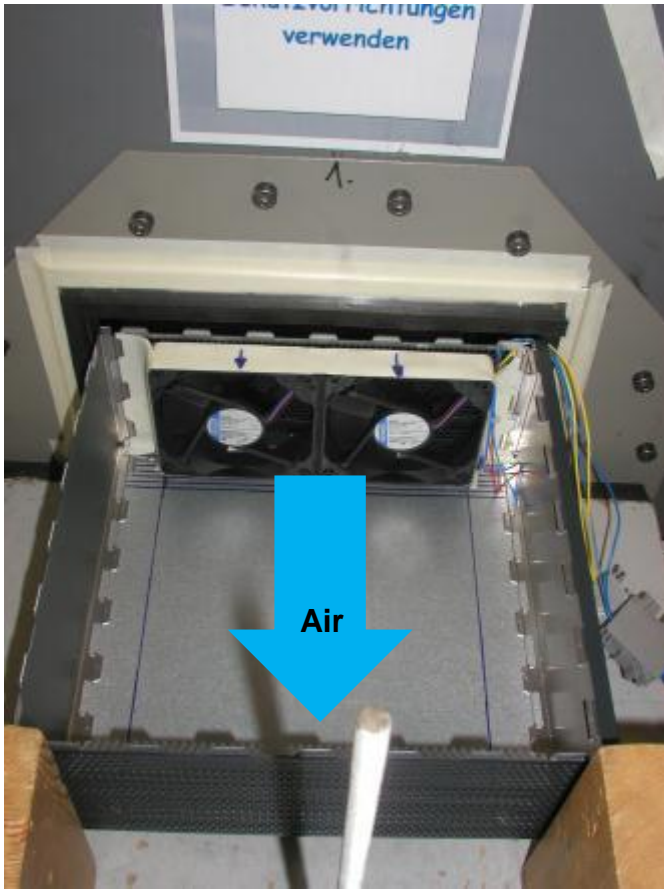


Figure 16 Push cooling without Impedance-1

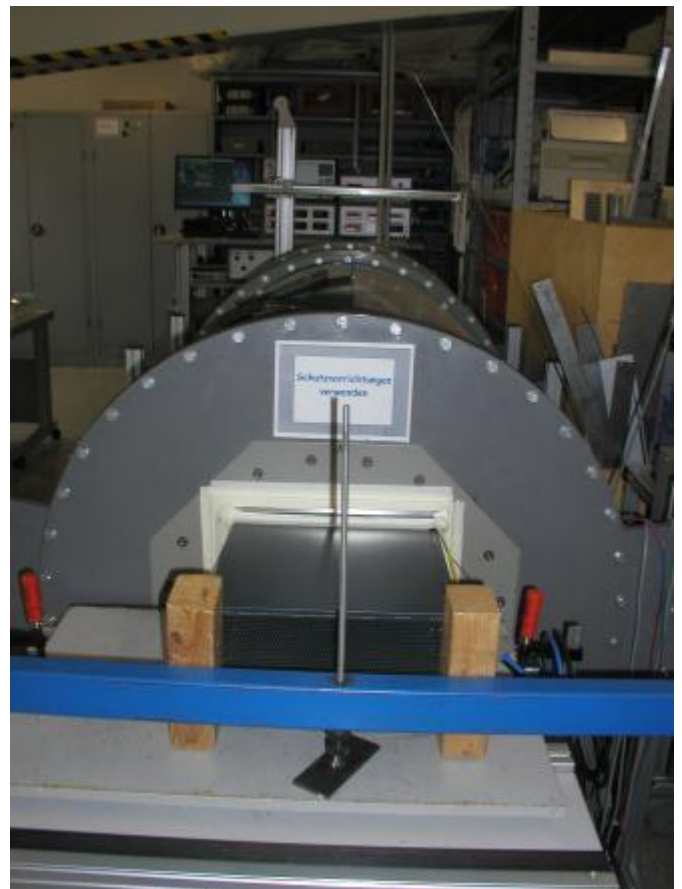


Figure 15 Push cooling without Impedance-2

	without Impedance	
	[m <sup>3</sup> /h]	[cfm]
Bulk air flow	194	114

Table 3 Push cooling without impedance

### 3.6 Push cooling with ebm-papst 4412 F and with impedance

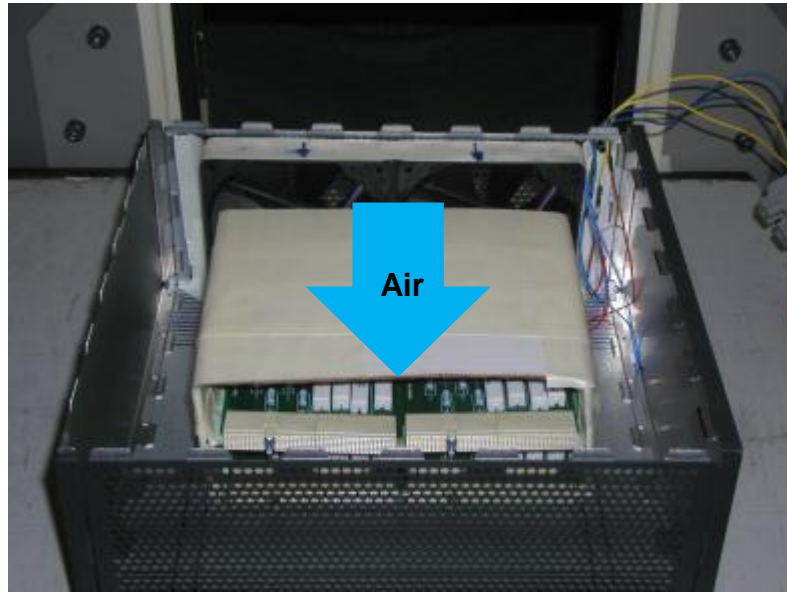


Figure 17 Push cooling with Impedance-1

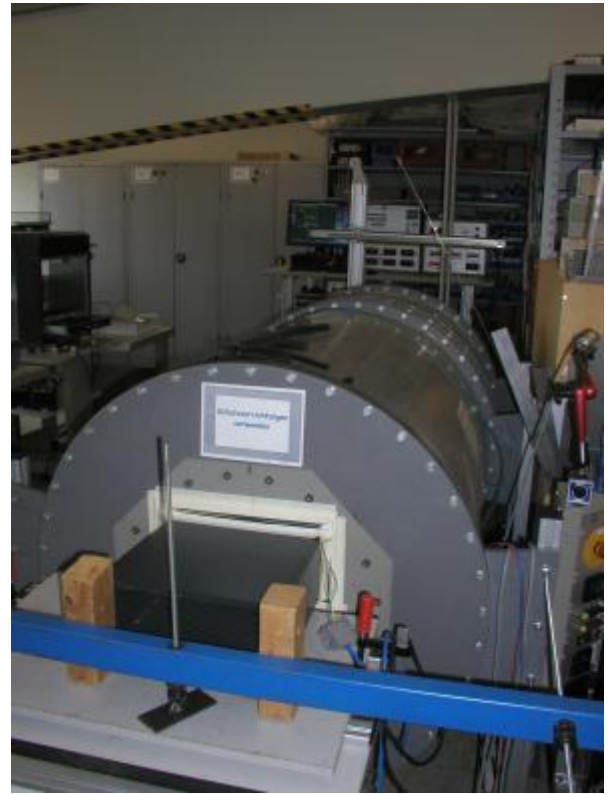


Figure 18 Push cooling with Impedance-2

	with Impedance	
	[m <sup>3</sup> /h]	[cfm]
Bulk air flow	194	114

Table 4 Push cooling with Impedance-1



### 3.7 Advice-2

To get the best working point for the fans, the distance between air outlet and impedance has to be approx. 20,0mm.

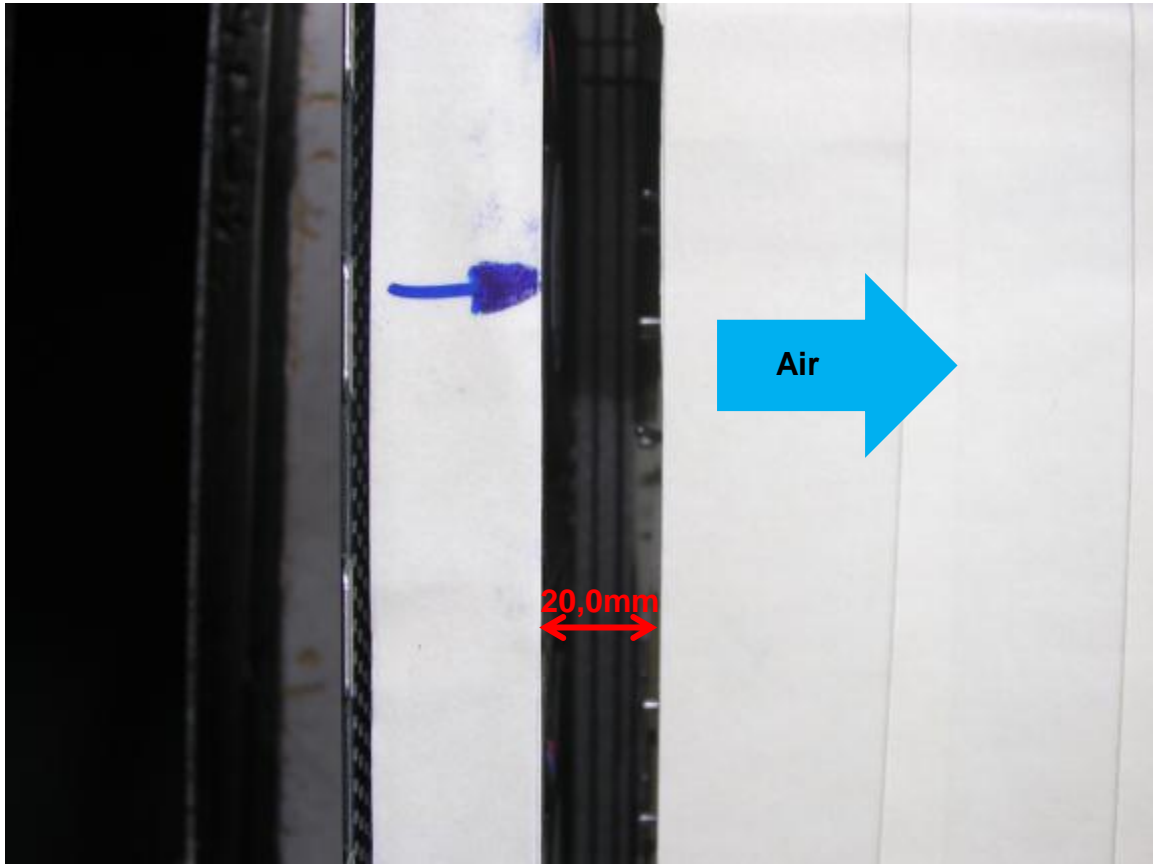


Figure 19 Advice-2

### 3.8 Comparison Push vs. Pull ebm-papst 4412 F

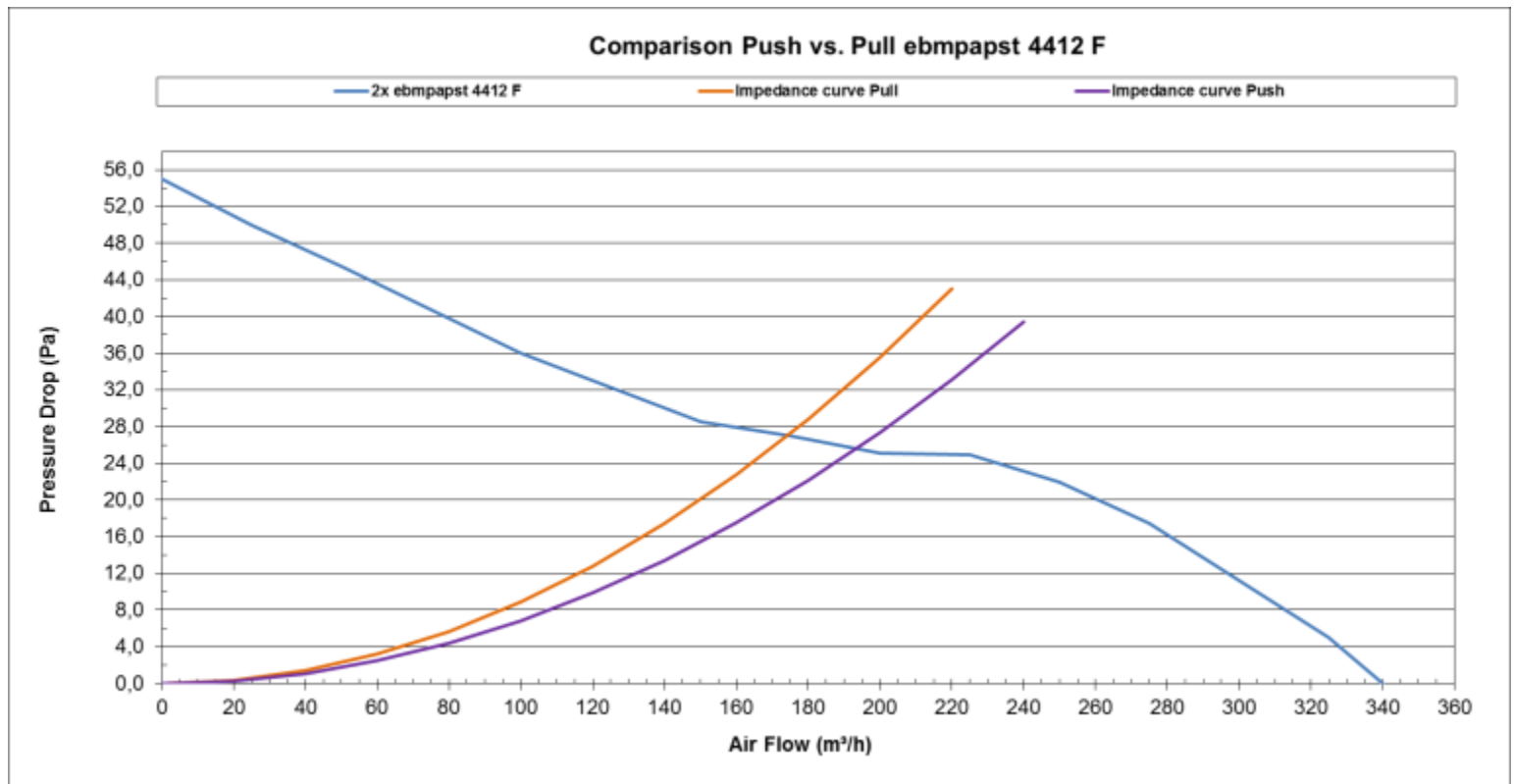


Figure 20 Comparison Push vs. Pull ebm-papst 4412 F

### 3.9 Résumé

	<b>ebm-papst 412</b>			
	<b>Pull cooling</b>		<b>Push cooling</b>	
	<b>[m³/h]</b>	<b>[cfm]</b>	<b>[m³/h]</b>	<b>[cfm]</b>
<b>Without Impedance</b>	181	107	194	114
<b>With Impedance</b>	174	103	194	114

Table 5 Résumé



#### 4. Acoustic Noise

Fan	Sound Power $L_{WA}$ [dB(A)]	Sound Pressure $L_{PA}$ [dB(A)] 0,2m distance
ebm-papst 4412 F	57,5	59,3

Table 6 Acoustic Noise

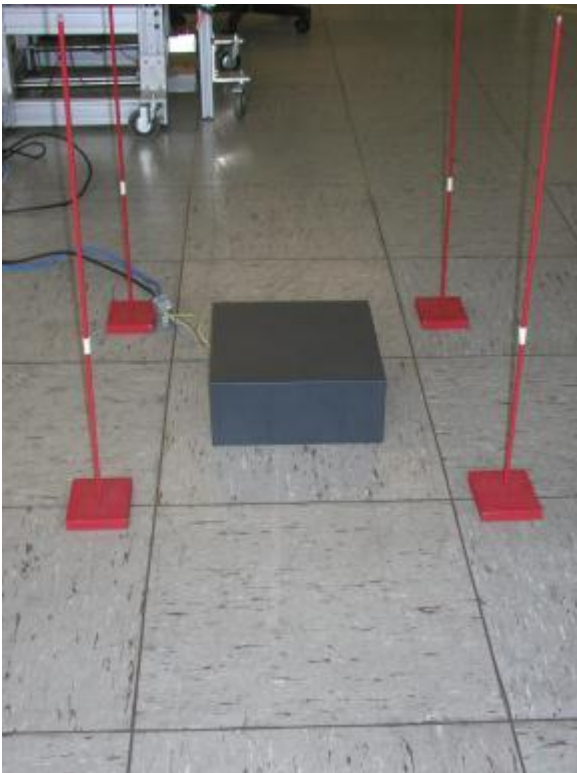


Figure 21 Measurement setup Acoustic Noise-1



Figure 22 Measurement setup Acoustic Noise-2