DESIGN VERIFICATION TEST REPORT

Test Item	Interscale M
Identification	Interscale M 14825-197 Fan ebm-papst 412 Fan ebm-papst 412H
Test Order	Determine the total air flow and the acoustic noise of the case
Reported by	Daniel Dörflinger
Date	21.08.2013
Signature	

Daniel Dörflinger
Head of Test Lab Climate Control

Schroff GmbH
Langenalber Str. 96 - 100
75334 Straubenhardt,
Germany Office
+49.7082.794.624
Fax +49.7082.794.493
daniel.doerflinger@nvent.com

Table of contents

List of figures

List of tables

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:

- 5x axial fans, ebm-papst 412 and ebm-papst 412H

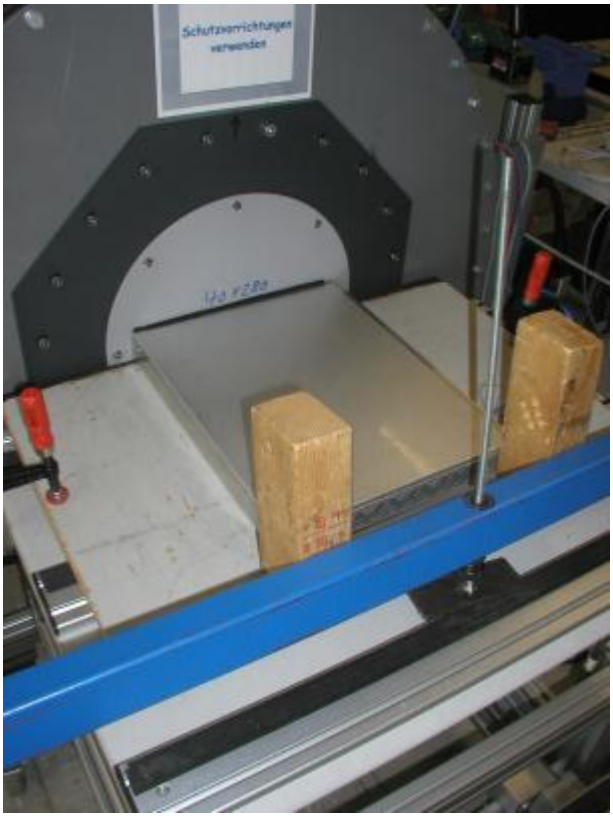

Figure 1 Interscale case fixed to Test stand for air flow volume measurement - 1

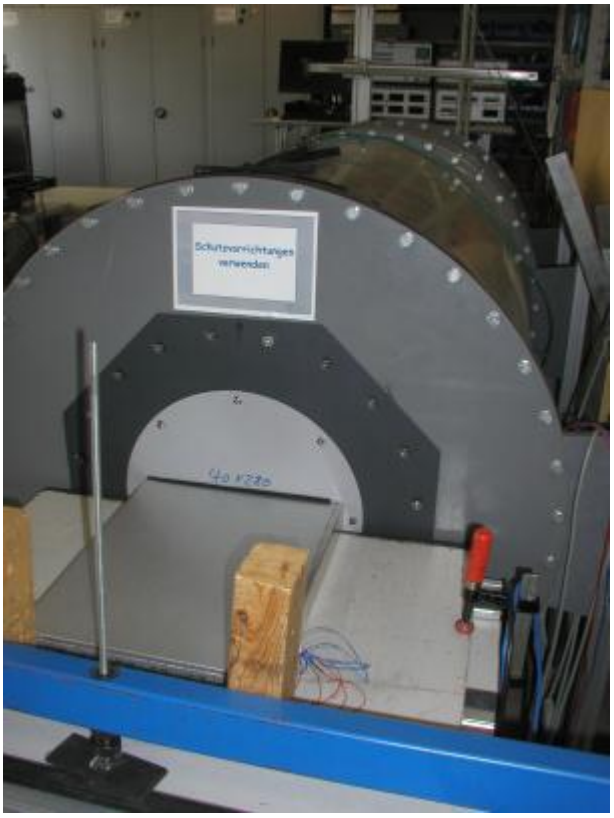

Figure 2 Interscale case fixed to Test stand for air flow volume measurement - 2

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

Figure 3 Test stand for air volume measurements

- 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

Figure 4 Power supply

- 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 5 Measurement equipment

Test equipment acoustic noise

Figure 6 Test equipment acoustic noise measurements

- 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 7 Power supply

2.3 Fan Comparison

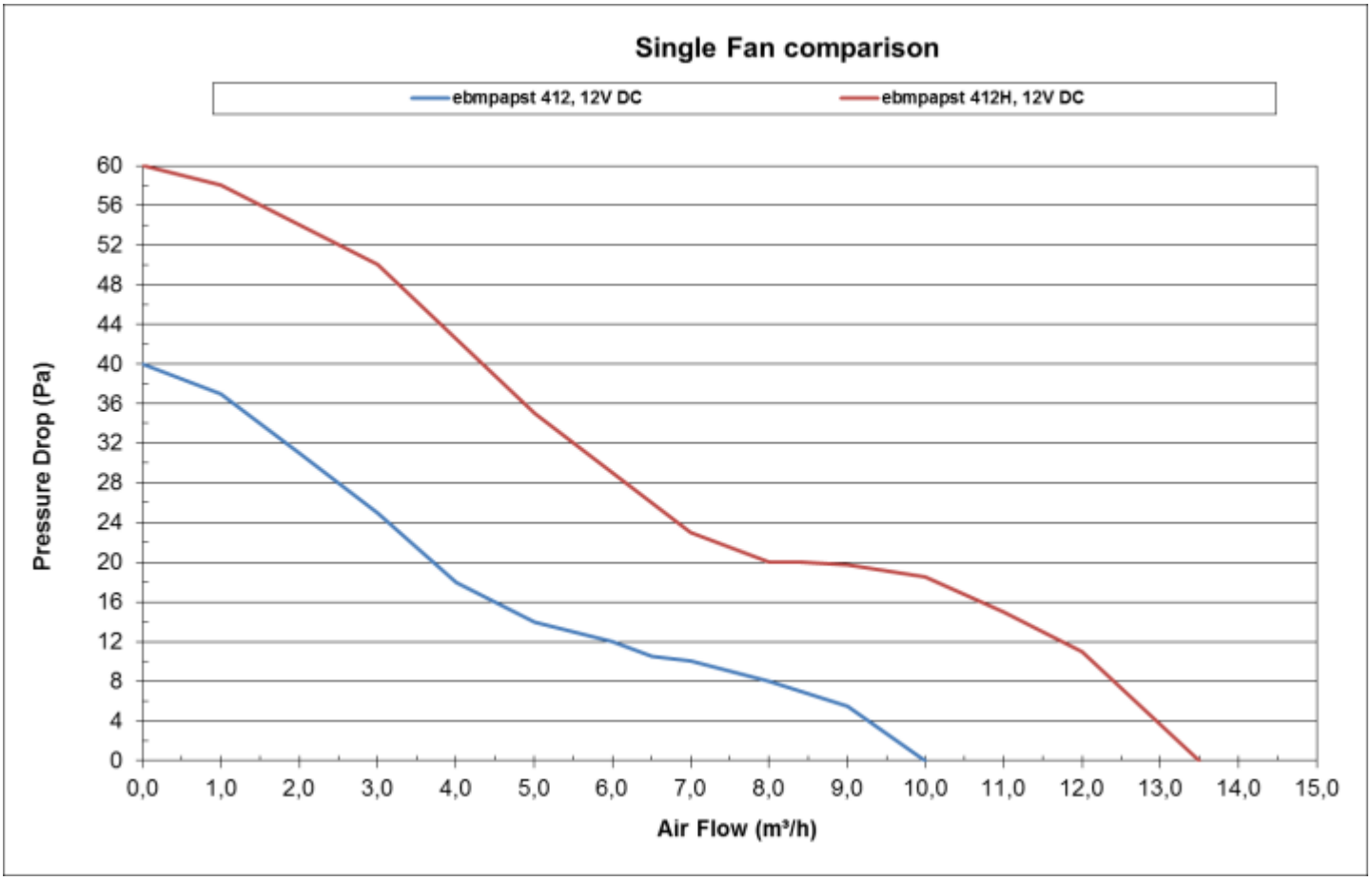

Figure 8 Single Fan comparison

3. Results

3.1 Pull cooling with ebm-papst 412 and without impedance

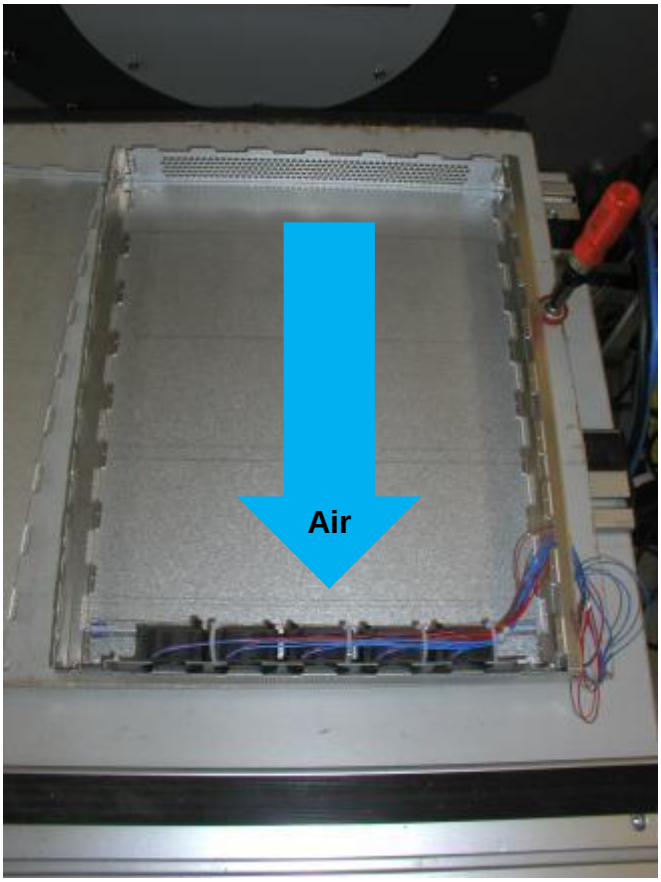

Figure 9 Pull cooling without Impedance-1

	without Impedance	
	[m³/h]	[cfm]
Bulk air flow	31	18

Table 1 Pull cooling without impedance-1

3.2 Pull cooling with ebm-papst 412 and with impedance

Figure 11 Pull cooling with impedance-1

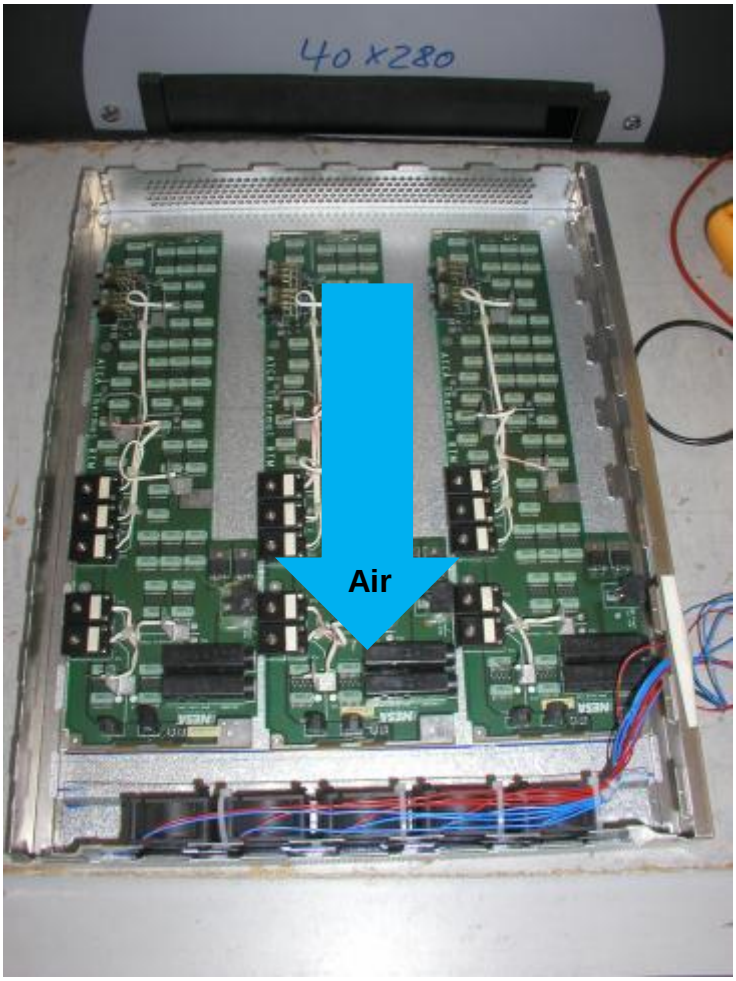

Figure 10 Pull cooling with impedance-2

	with Impedance	
	[m³/h]	[cfm]
Bulk air flow	31	18

Table 2 Pull cooling with impedance-1

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.

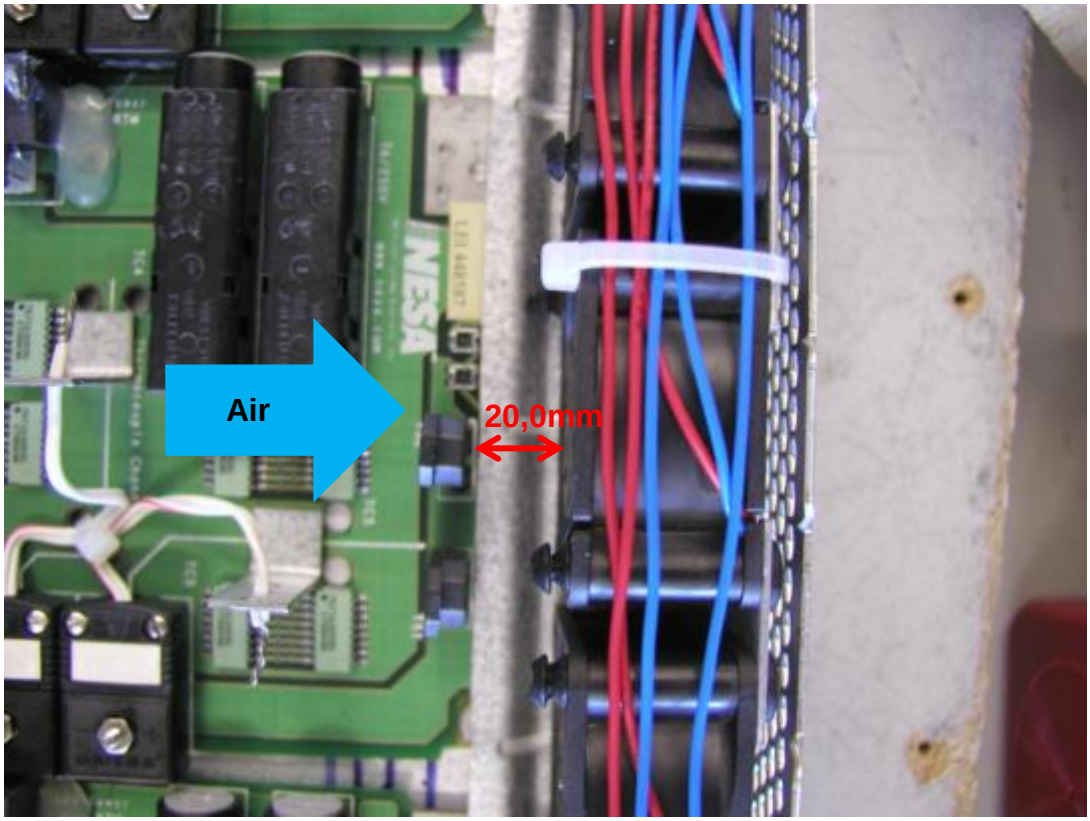

Figure 12 Advice-1

3.5 Push cooling with ebm-papst 412 and without impedance

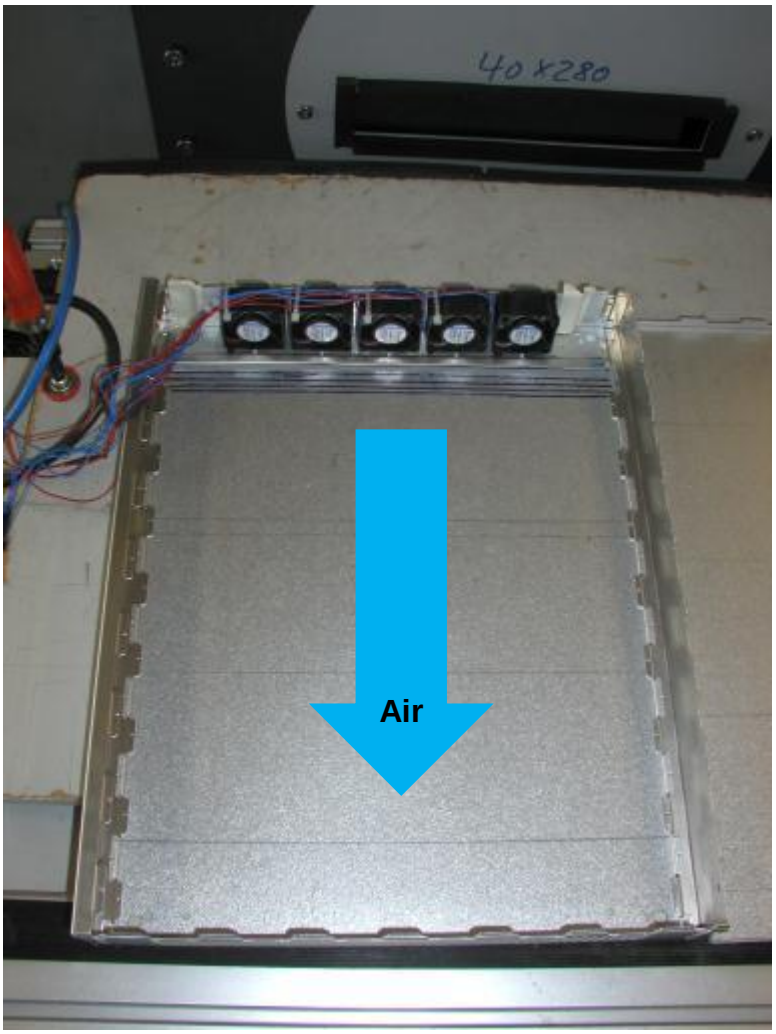

Figure 13 Push cooling without Impedance-1

	without Impedance	
	[m³/h]	[cfm]
Bulk air flow	36	21

Table 3 Push cooling without impedance-1

3.6 Push cooling with ebm-papst 412 and with impedance

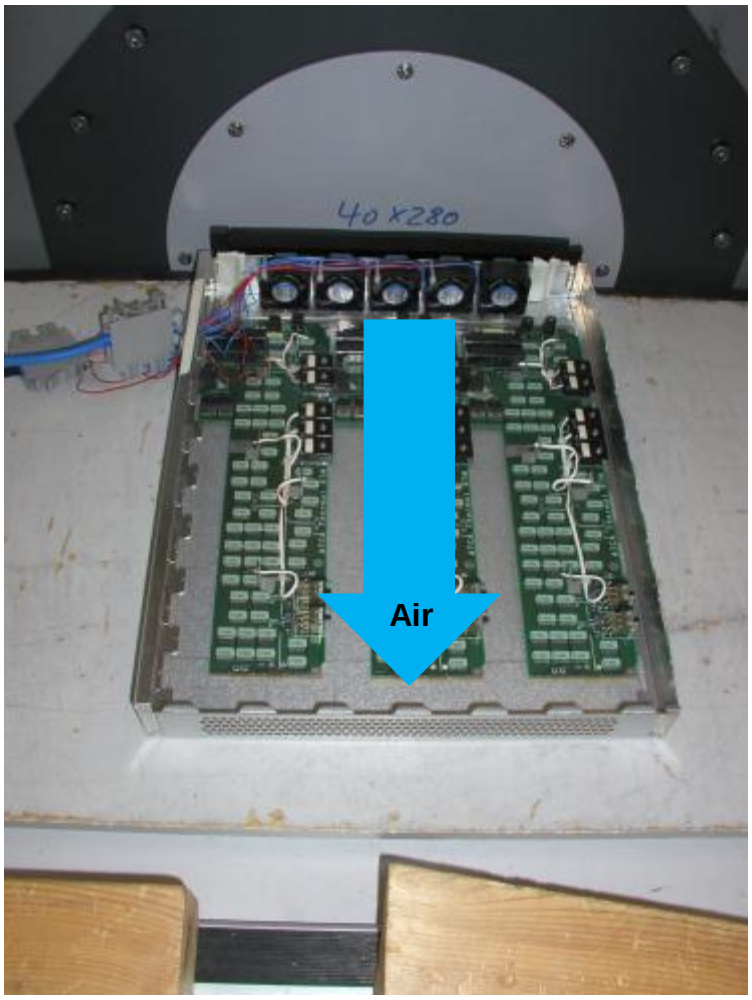

Figure 14 Push cooling with Impedance-1

	with Impedance	
	[m³/h]	[cfm]
Bulk air flow	36	21

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.

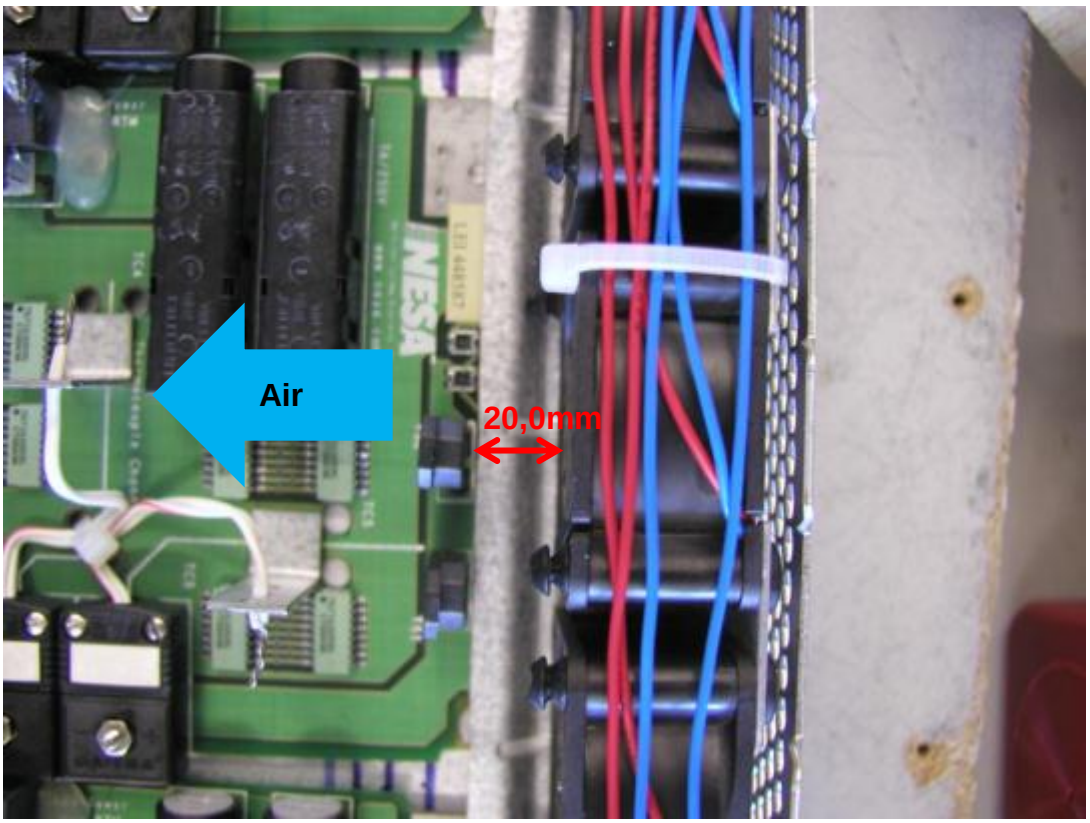

Figure 15 Adice-2

3.8 Comparison Push vs. Pull ebm-papst 412

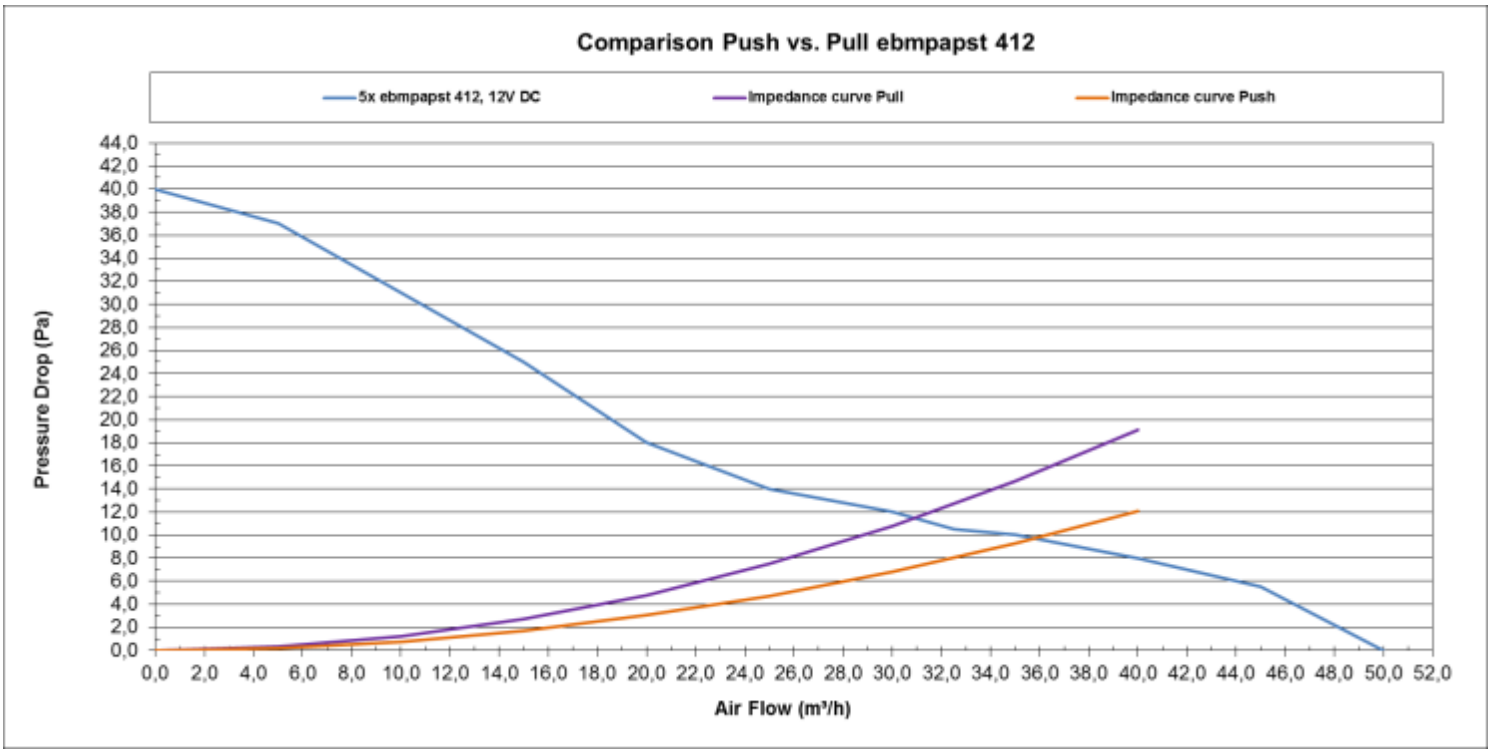

Figure 16 Comparison Push vs. Pull ebm-papst 412

3.9 Pull cooling with ebm-papst 412H and without impedance

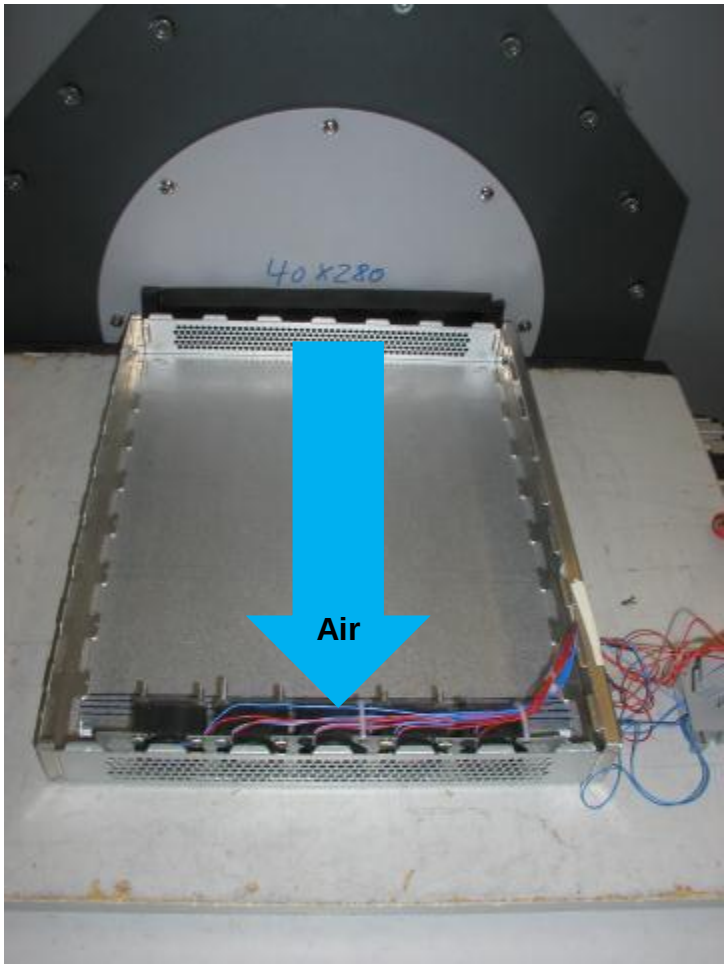

Figure 17 Pull cooling without Impedance-2

	without Impedance	
	[m³/h]	[cfm]
Bulk air flow	37	21

Table 5 Pull cooling without impedance-2

3.10 Pull cooling with ebm-papst 412H and with impedance

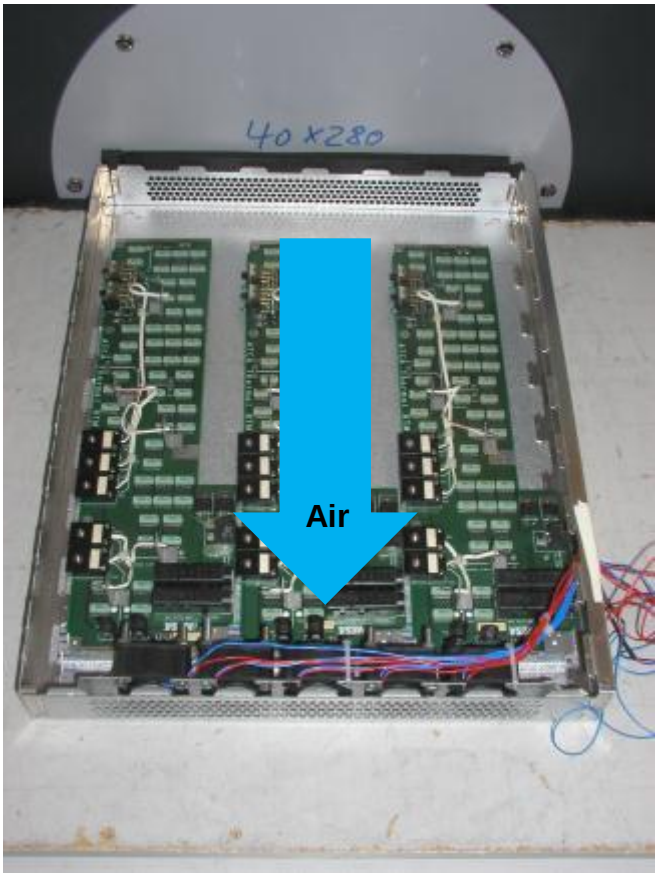

Figure 18 Pull cooling with Impedance-2

	with Impedance	
	[m³/h]	[cfm]
Bulk air flow	37	21

Table 6 Pull cooling with impedance-2

3.11 Advice-3

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

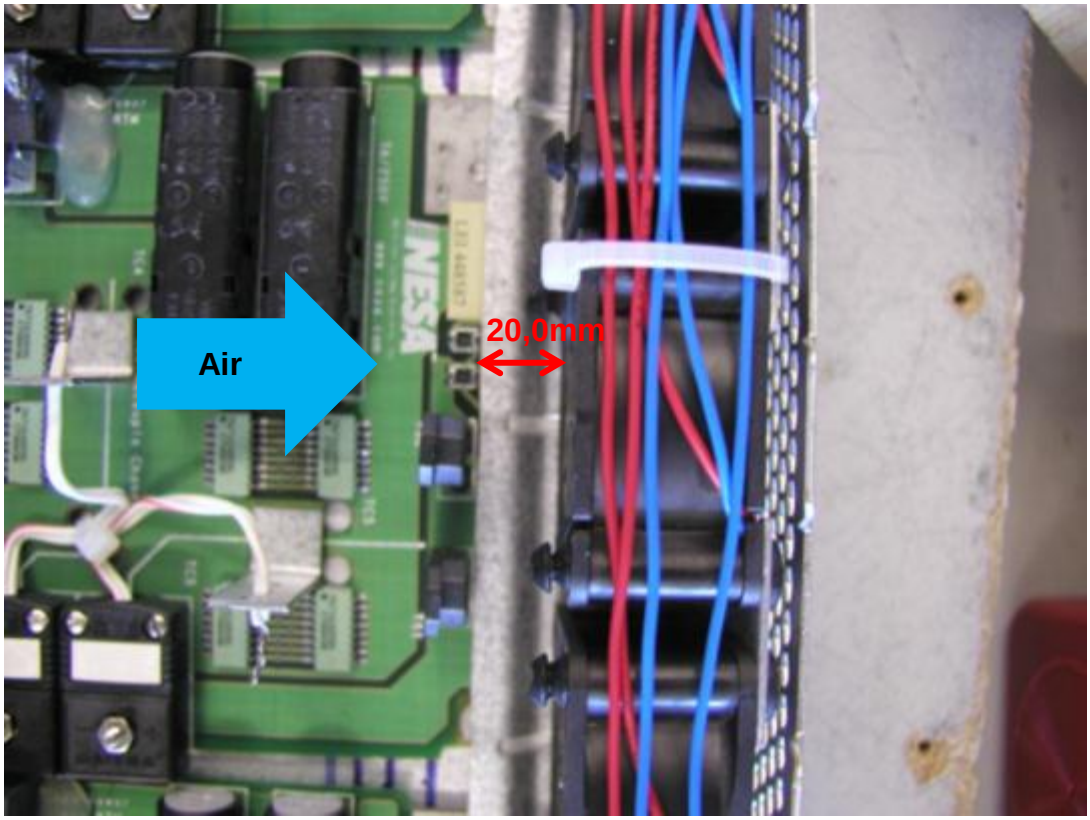

Figure 19 Advice-3

3.12 Push cooling with ebm-papst 412H and without impedance

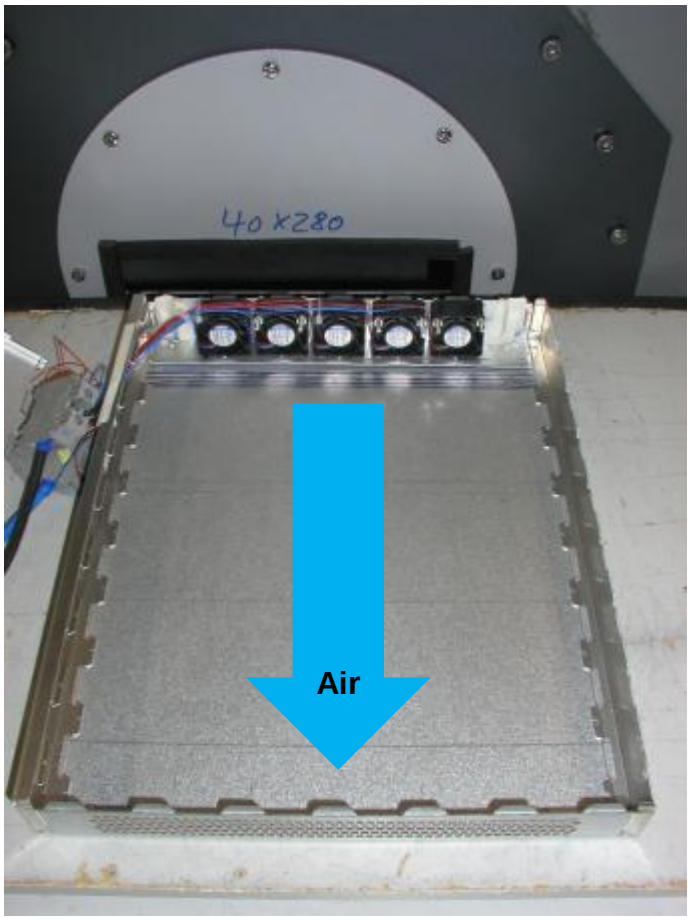

Figure 20 Push cooling without Impedance-2

	without Impedance	
	[m³/h]	[cfm]
Bulk air flow	45	26

Table 7 Push cooling without impedance-2

3.13 Push cooling with ebm-papst 412H and with impedance

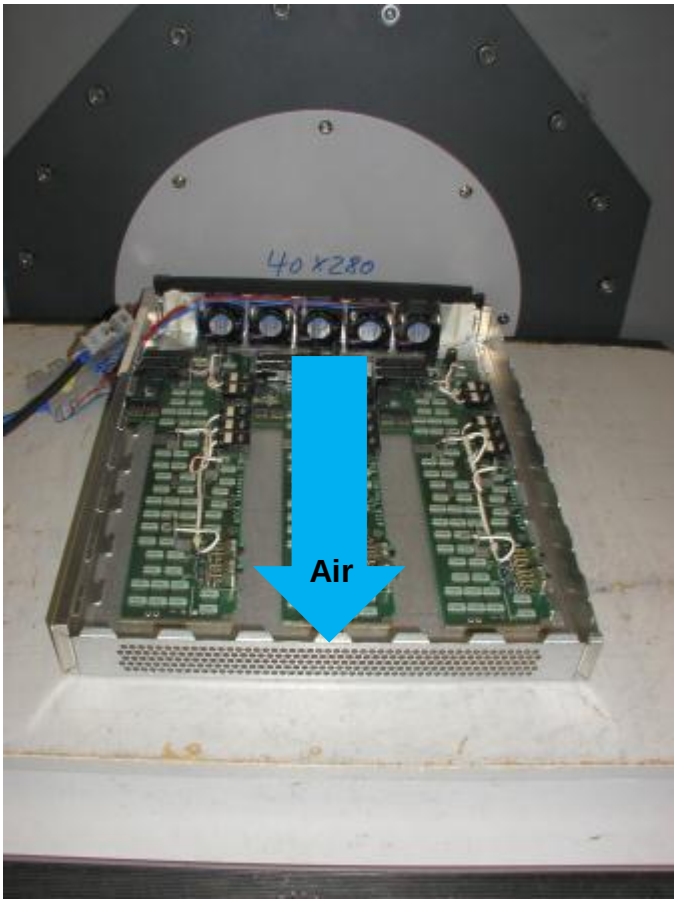

Figure 21 Push cooling with Impedance-2

	without Impedance	
	[m³/h]	[cfm]
Bulk air flow	45	26

Table 8 Push cooling with Impedance-2

3.14 Advice-4

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

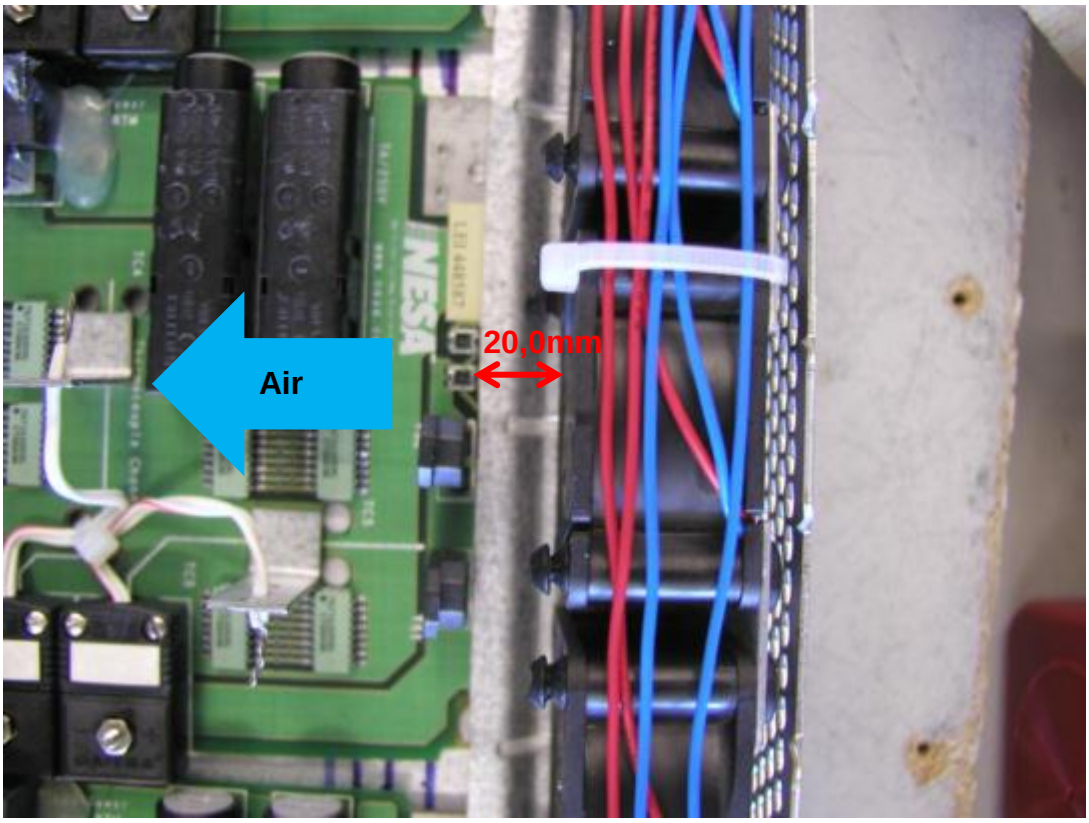

Figure 22 Advice-4

3.15 Comparison Push vs. Pull ebm-papst 412H

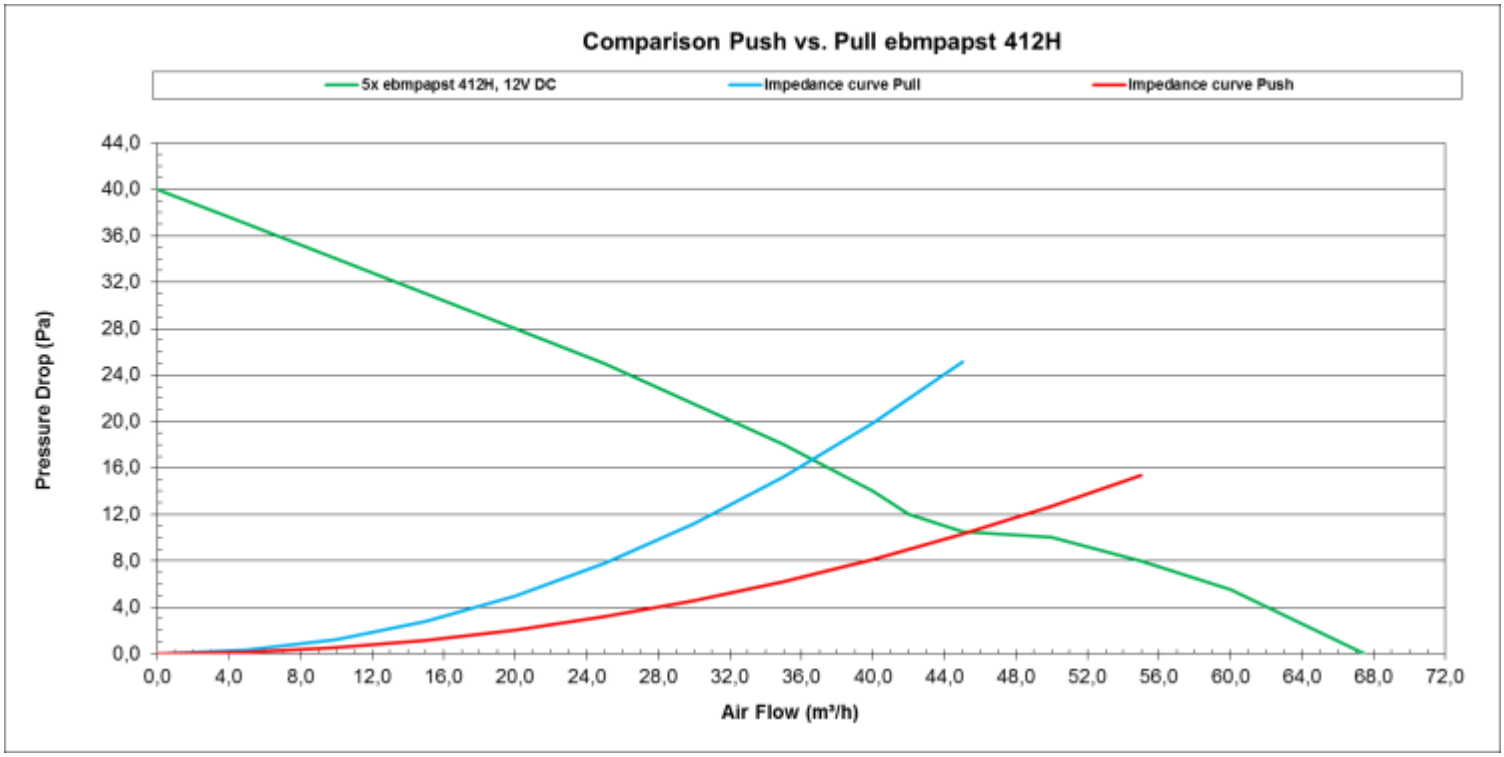

Figure 23 Comparison Push vs. Pull ebm-papst 412H

3.16 Résumé

	ebm-papst 412				ebm-papst 412H			
	Pull cooling		Push cooling		Pull cooling		Push cooling	
	[m³/h]	[cfm]	[m³/h]	[cfm]	[m³/h]	[cfm]	[m³/h]	[cfm]
Without Impedance	31	18	36	21	37	21	45	26
With Impedance	31	18	36	21	37	21	45	26

Table 9 Résumé

4. Acoustic Noise

Fan	**Sound Power L_{WA} [dB(A)]**	Sound Pressure L_{PA} [dB(A)] 0,2m distance
ebm-papst 412	50,7	51,7
ebm-papst 412H	57,3	58,1

Table 10 Acoustic Noise

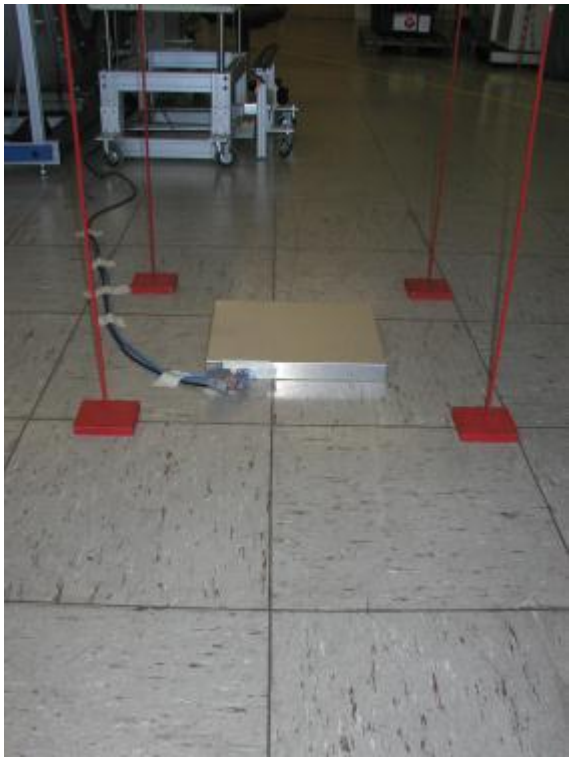

Figure 24 Measurement setup Acoustic Noise-1

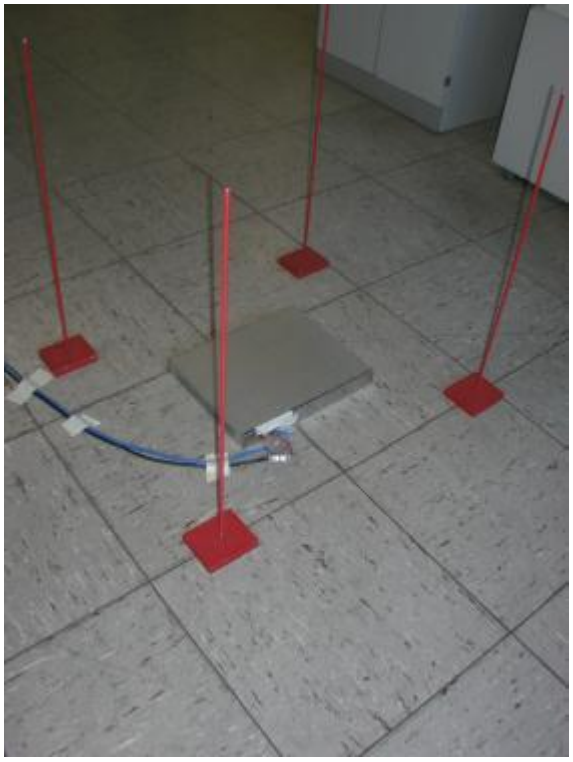

Figure 25 Measurement setup Acoustic Noise-2