



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

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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

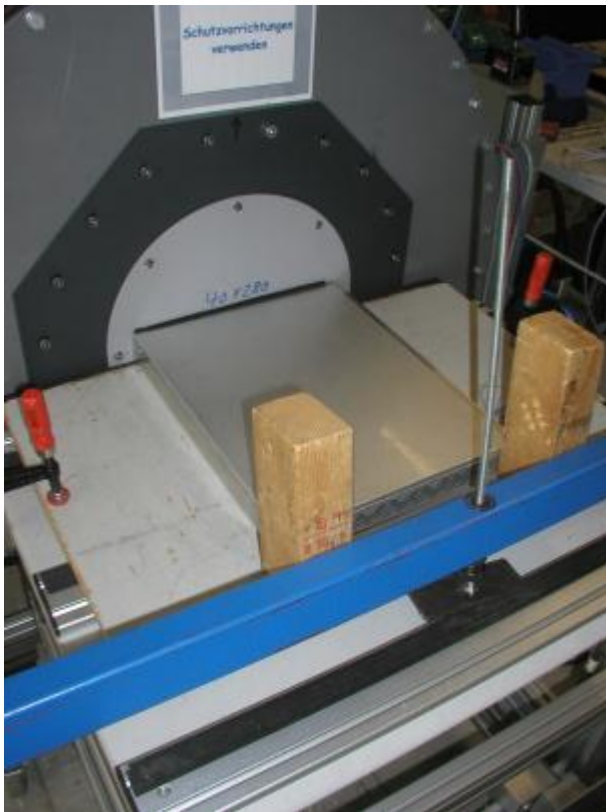


Figure 1 Interscale case fixed to Test stand for air flow volume measurement - 1



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
- 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

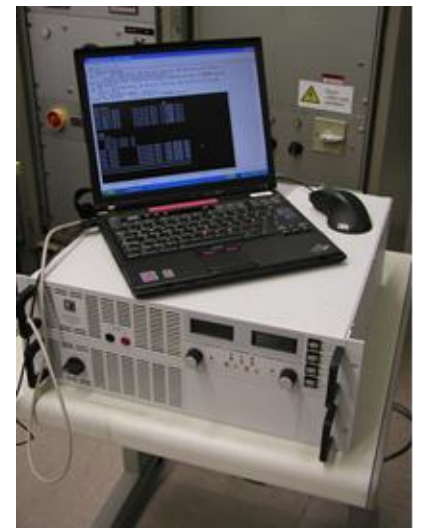


Figure 4 Power supply



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 Comparison

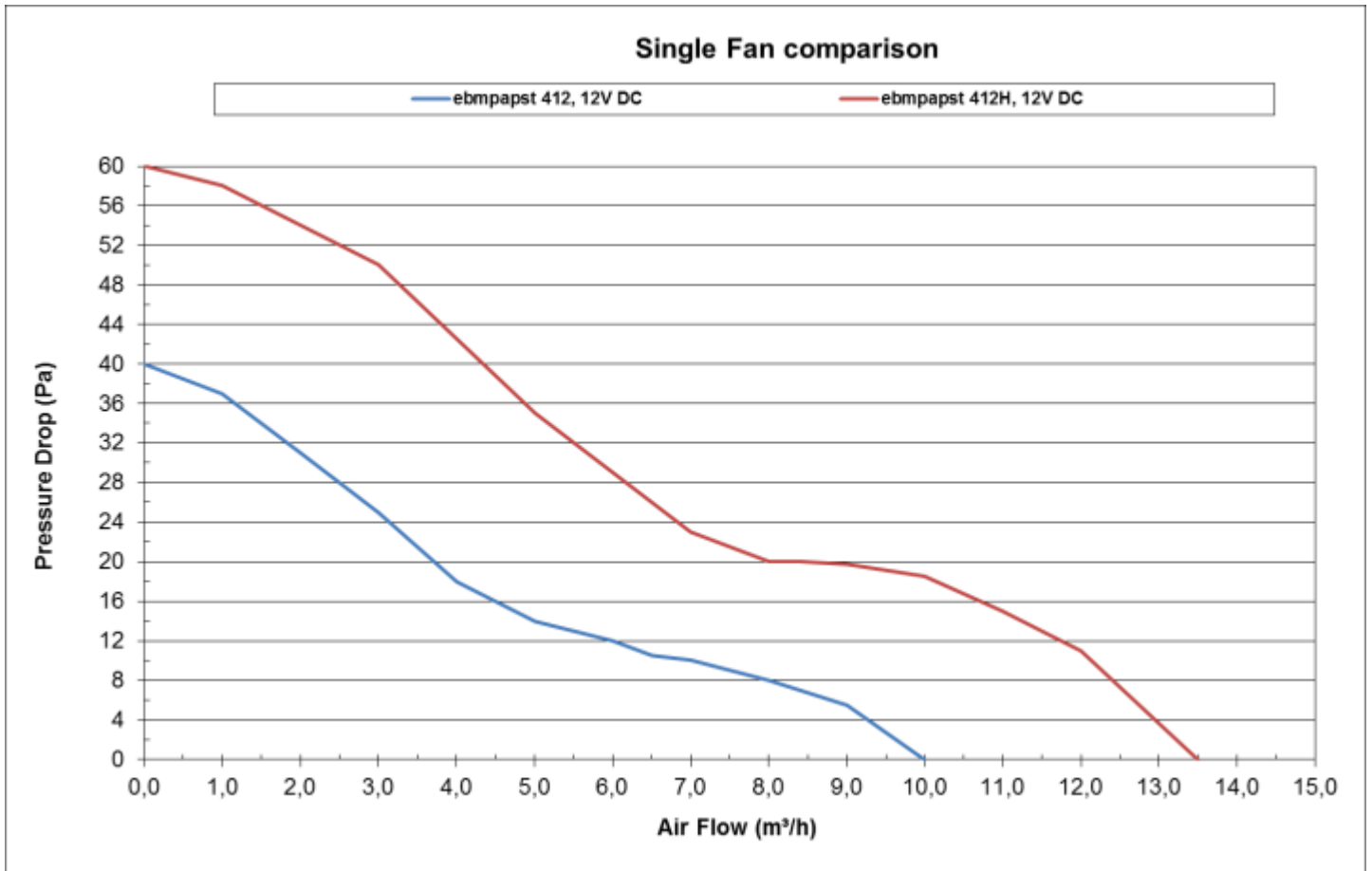


Figure 8 Single Fan comparison

3. Results

3.1 Pull cooling with ebm-papst 412 and without impedance

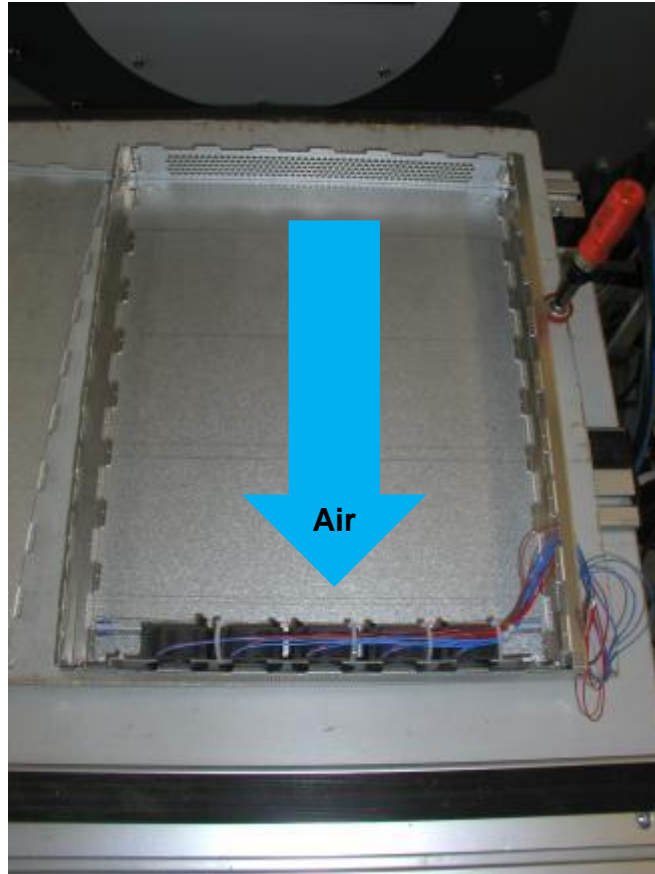


Figure 9 Pull cooling without Impedance-1

	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

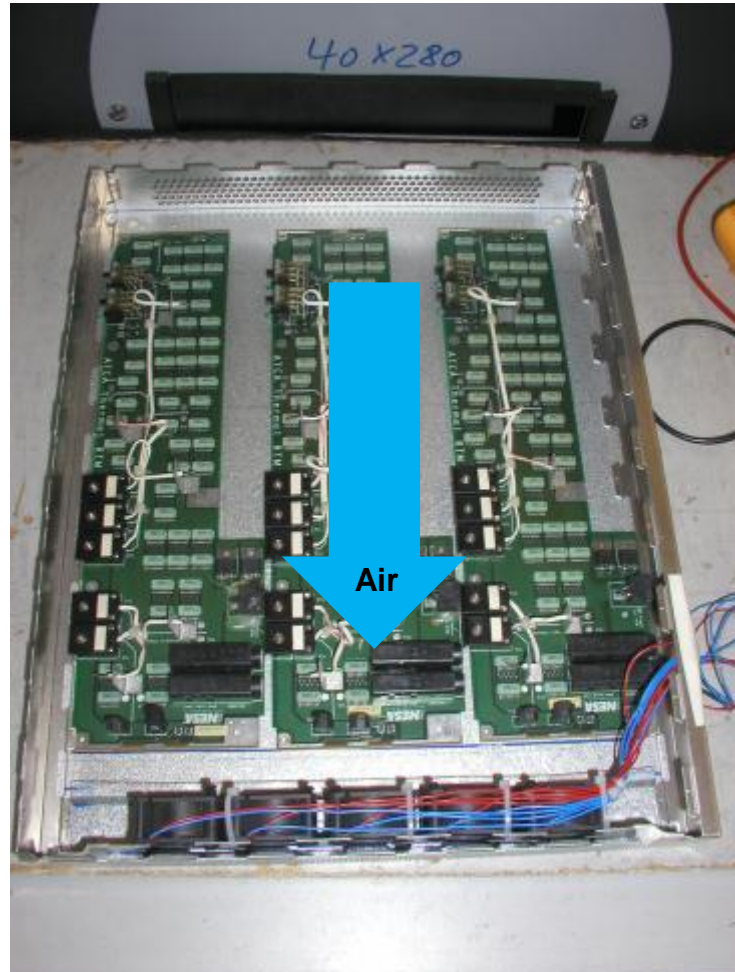


Figure 10 Pull cooling with impedance-2

	with Impedance	
	[m ³ /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.

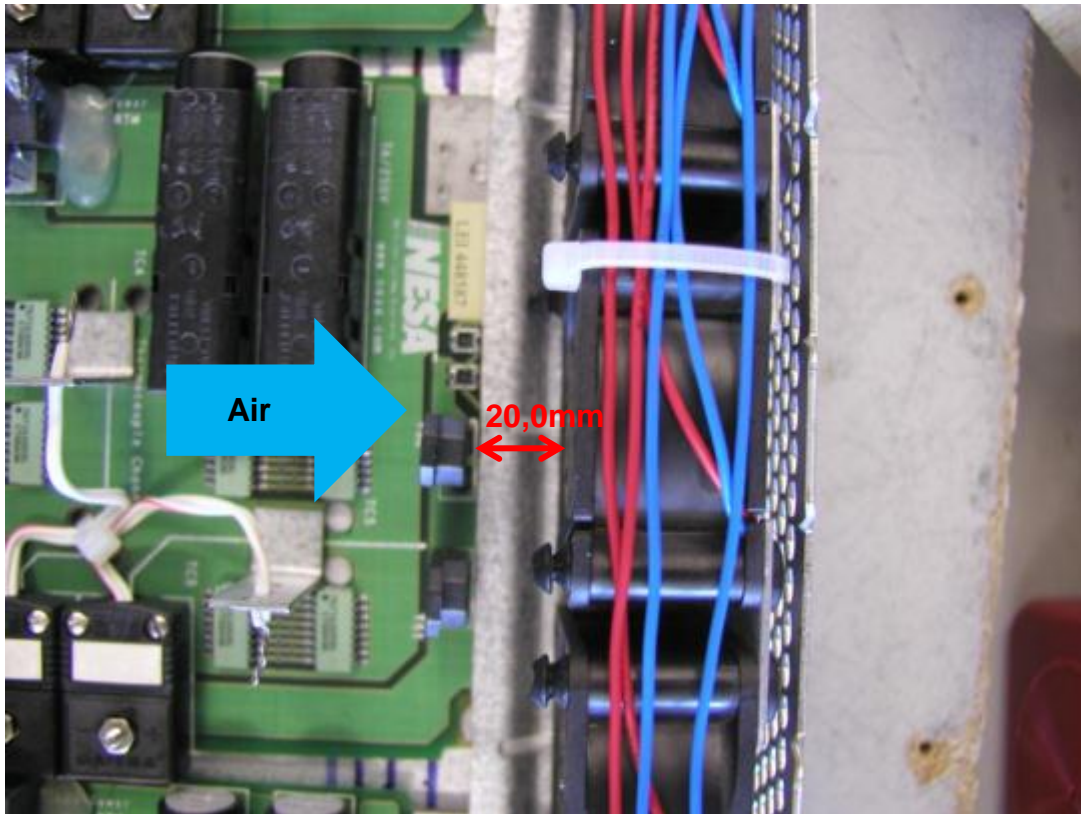


Figure 12 Advice-1

3.5 Push cooling with ebm-papst 412 and without impedance

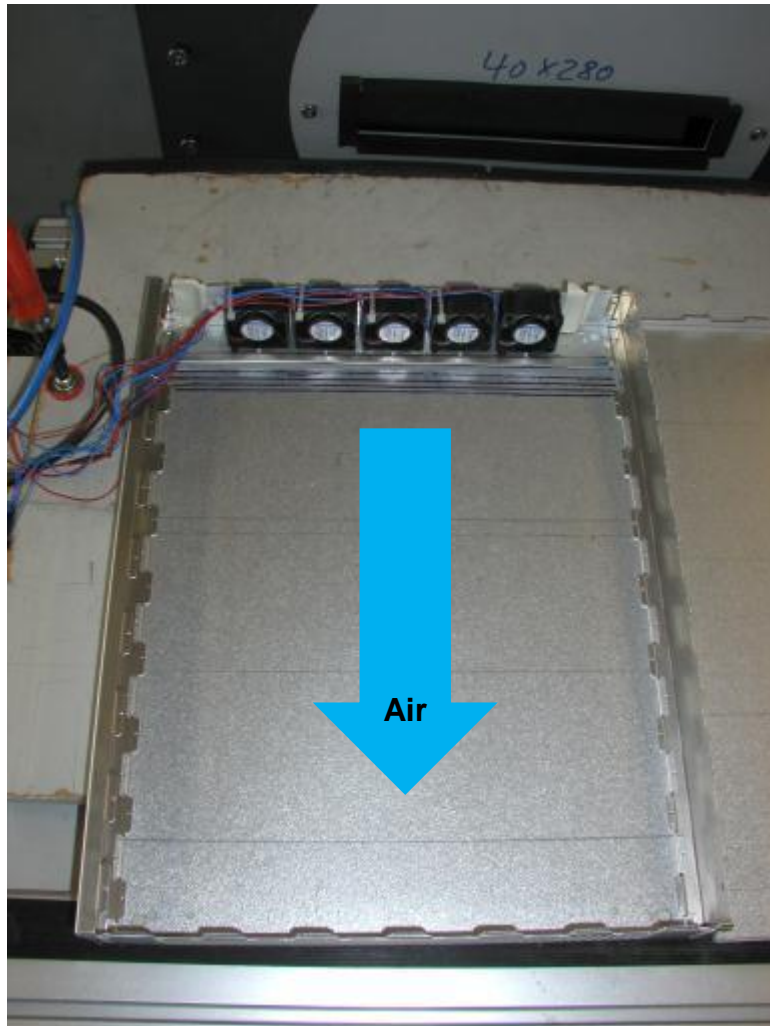


Figure 13 Push cooling without Impedance-1

	without Impedance	
	[m ³ /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

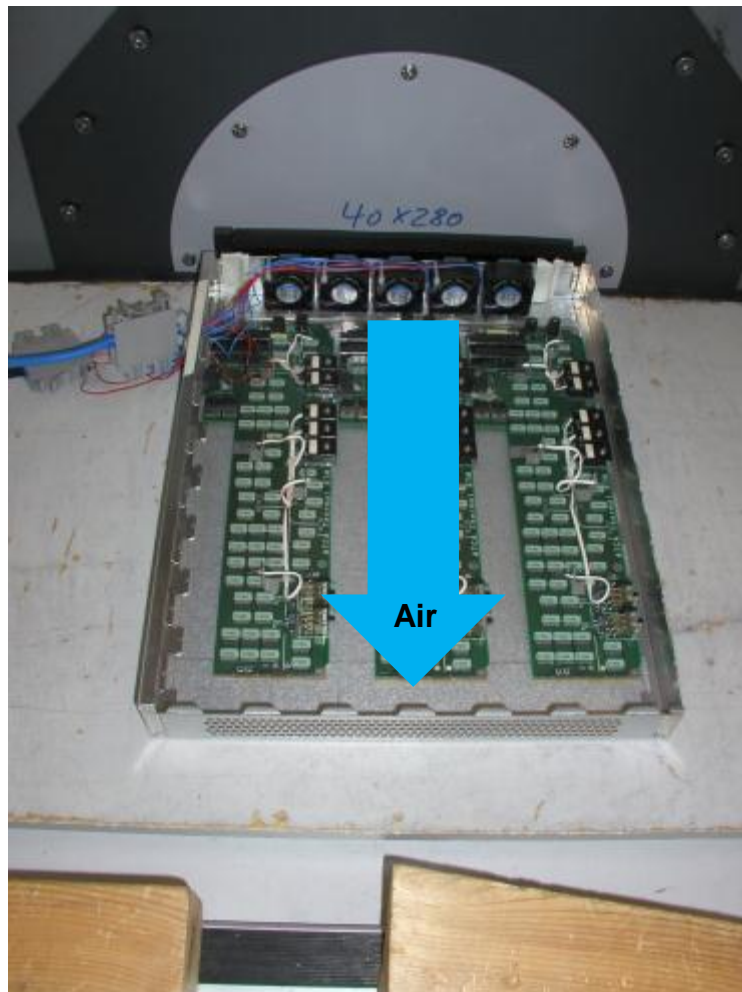


Figure 14 Push cooling with Impedance-1

	with Impedance	
	[m ³ /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.

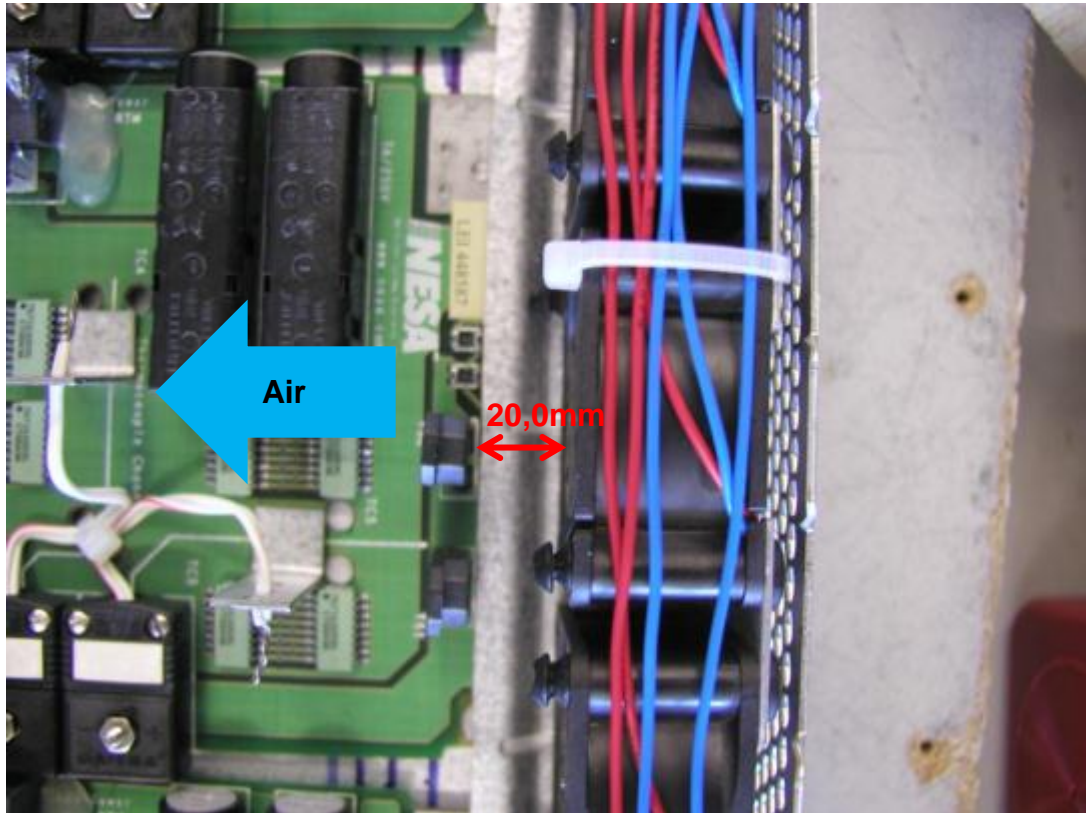


Figure 15 Advice-2



3.8 Comparison Push vs. Pull ebm-papst 412

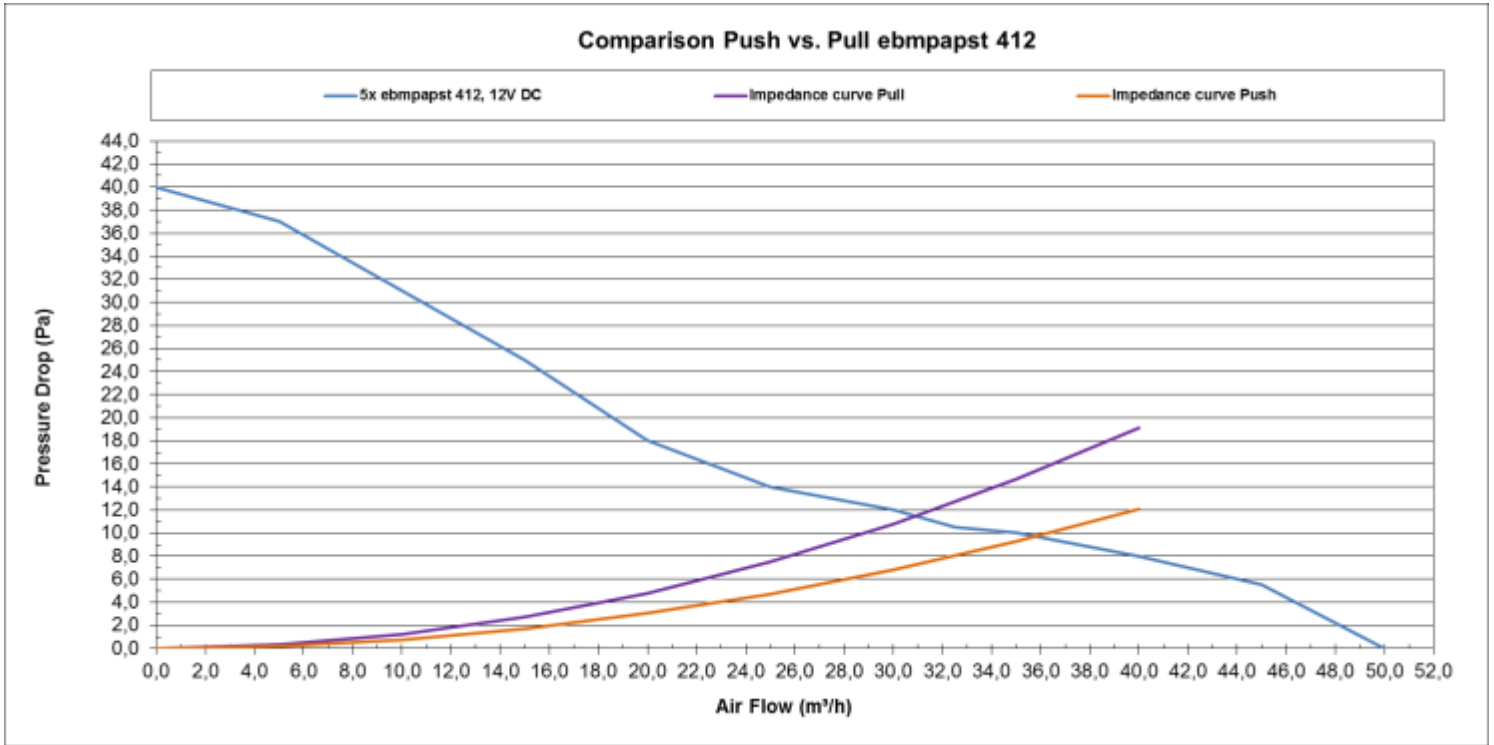


Figure 16 Comparison Push vs. Pull ebm-papst 412

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

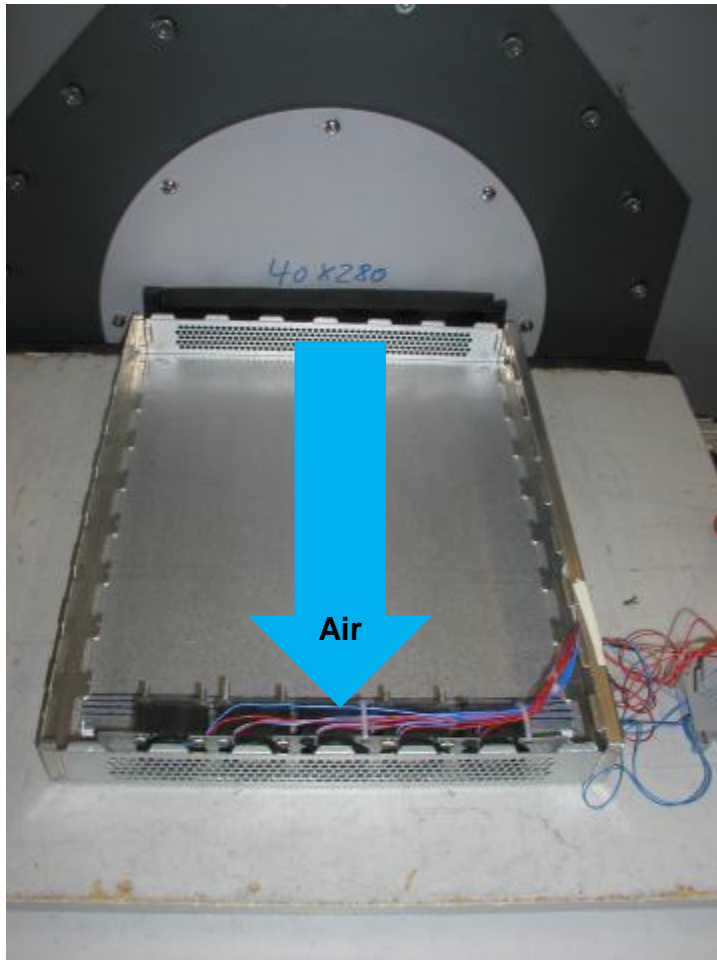


Figure 17 Pull cooling without Impedance-2

	without Impedance	
	[m ³ /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

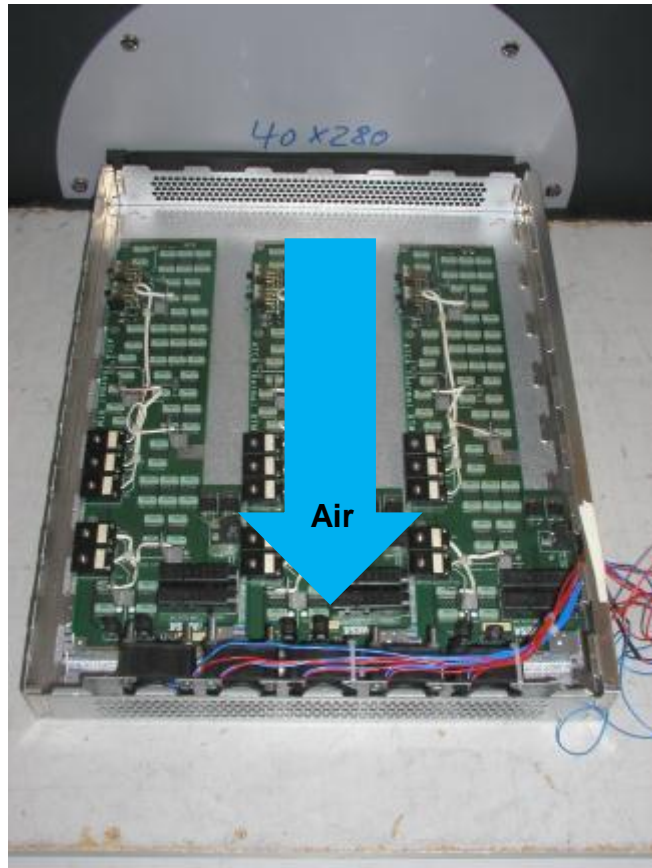


Figure 18 Pull cooling with Impedance-2

	with Impedance	
	[m ³ /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.

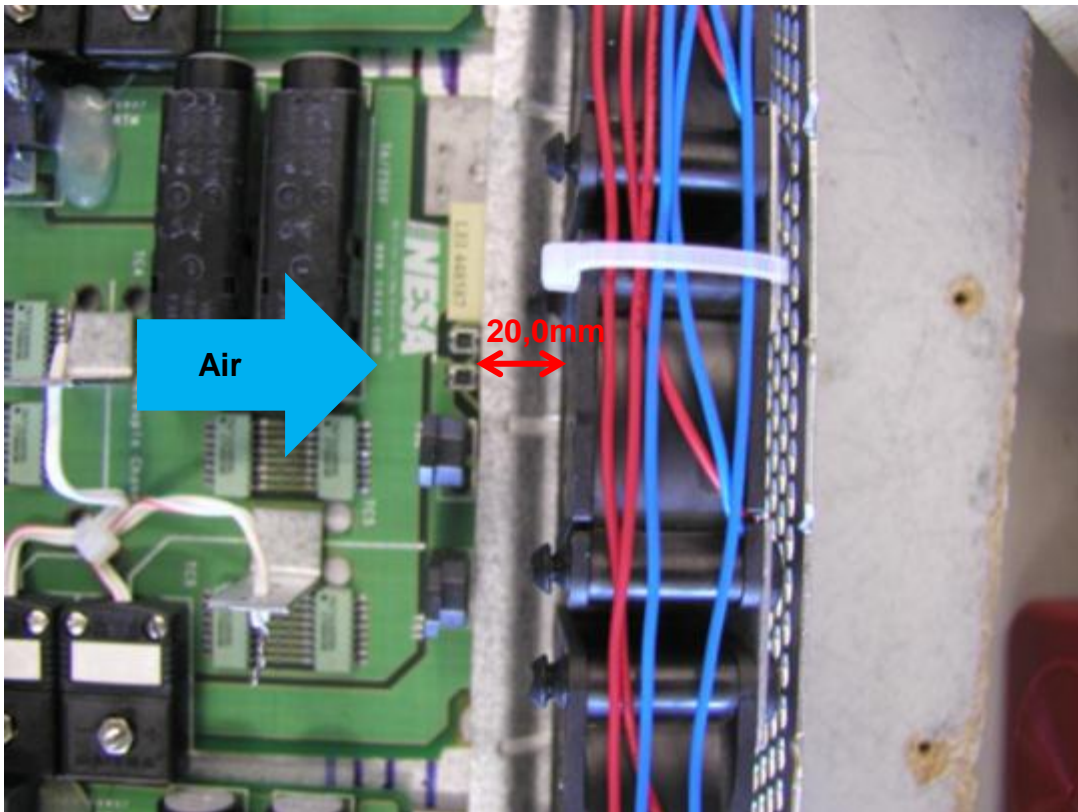


Figure 19 Advice-3

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

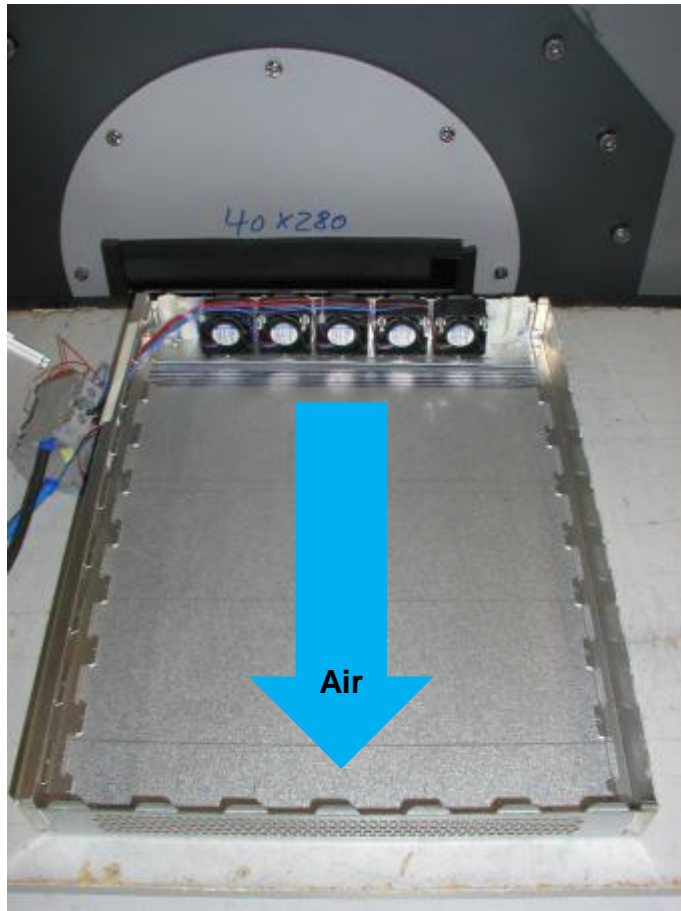


Figure 20 Push cooling without Impedance-2

	without Impedance	
	[m ³ /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

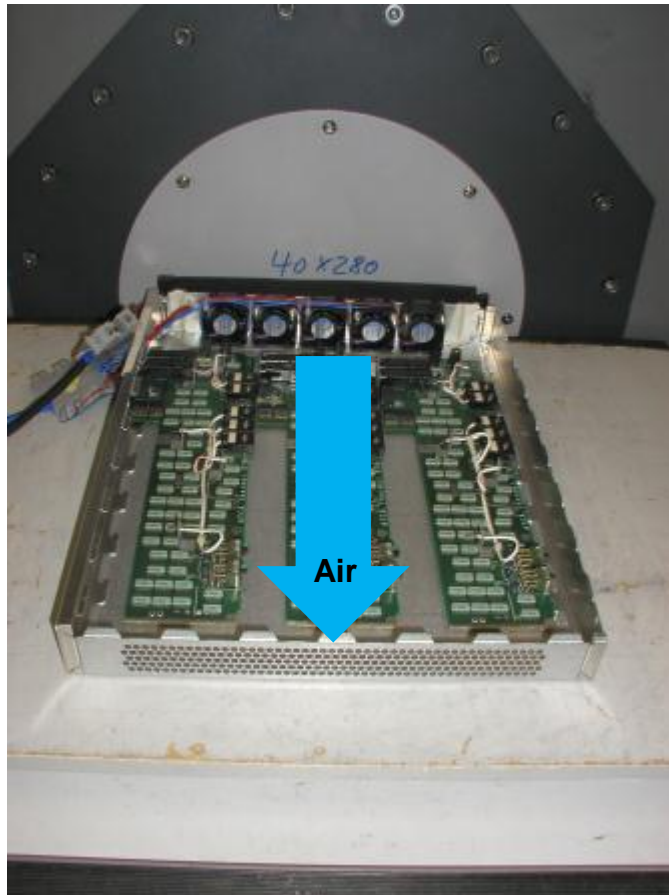


Figure 21 Push cooling with Impedance-2

	without Impedance	
	[m ³ /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.

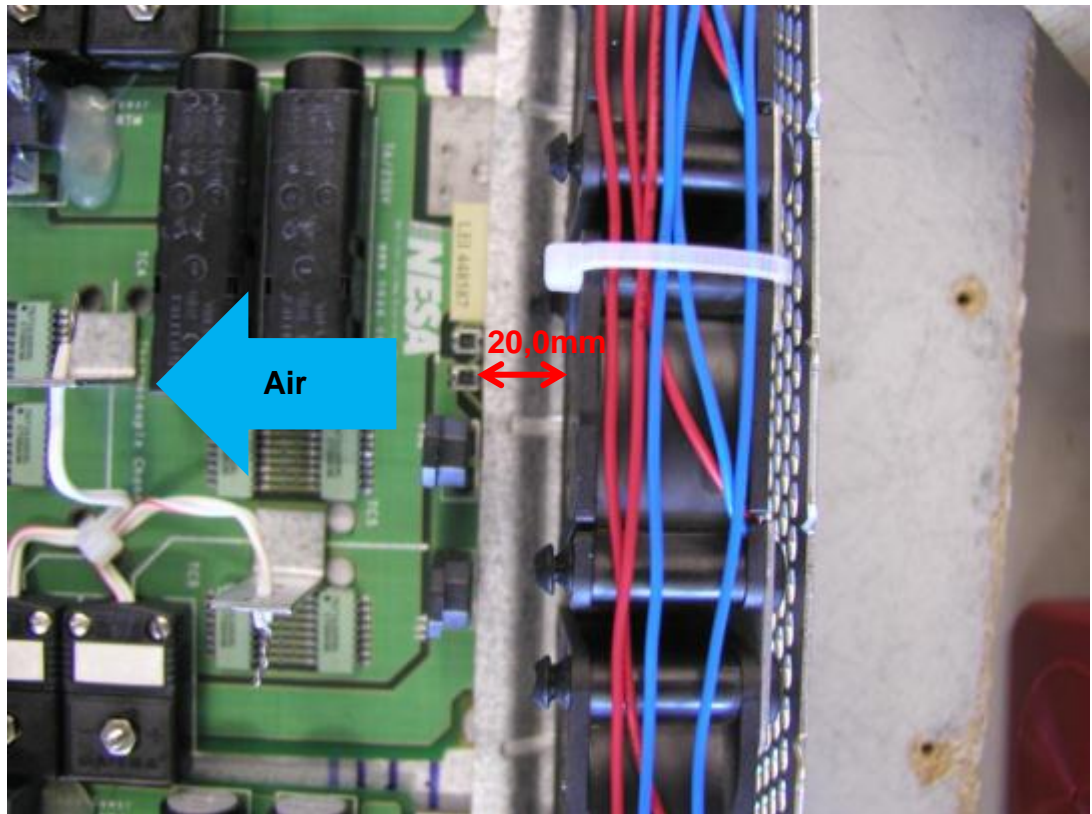


Figure 22 Advice-4



3.15 Comparison Push vs. Pull ebm-papst 412H

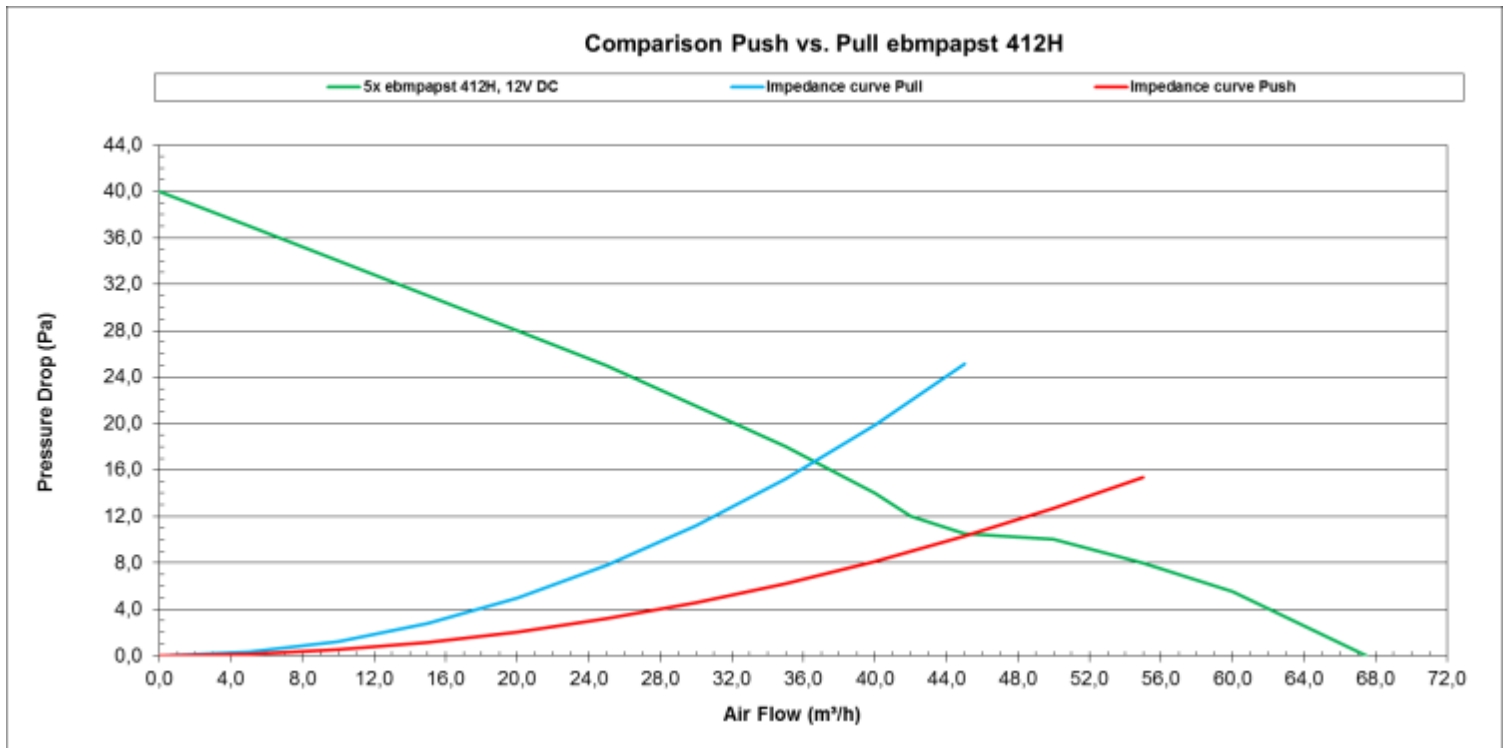


Figure 23 Comparison Push vs. Pull ebm-papst 412H

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

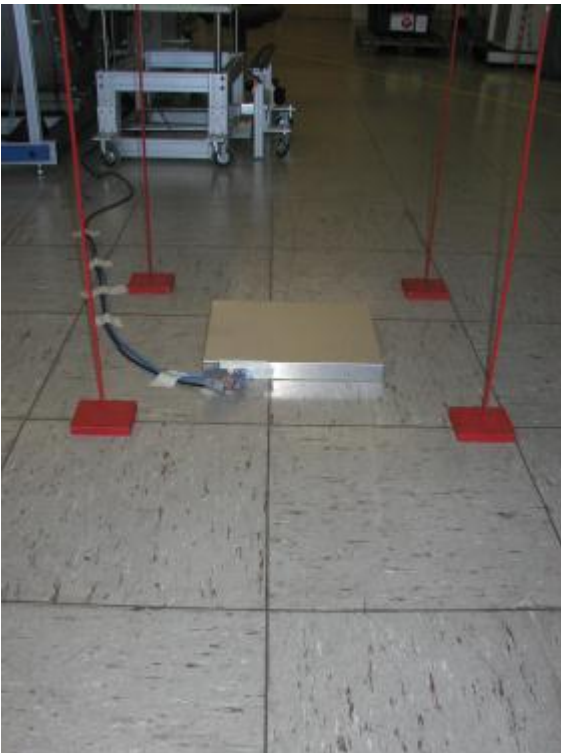


Figure 24 Measurement setup Acoustic Noise-1

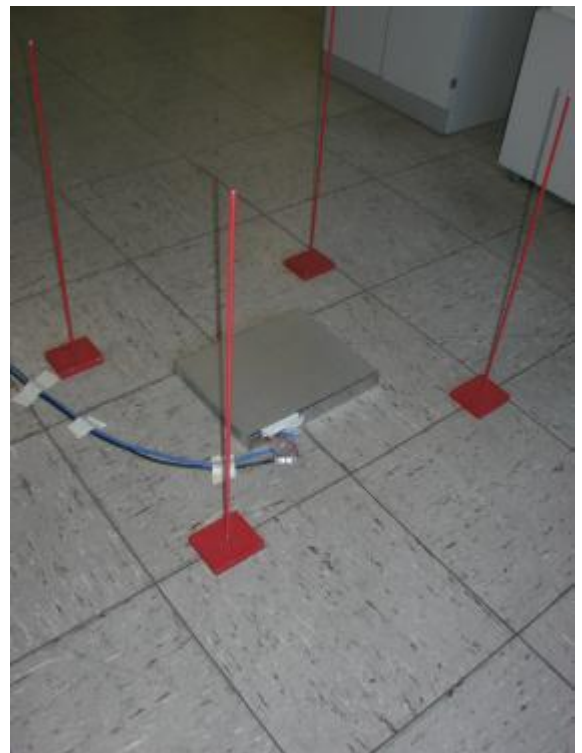


Figure 25 Measurement setup Acoustic Noise-2