Technical Fact Sheet – FCU acoustics calculation assessment.

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It has become common practice for fan coil manufacturers to specify acoustic installation requirements, and base installation noise predictions on that specification. This is usually referred to as a "*Guide NR*" but is not a guarantee that a specific room NR level can be achieved.

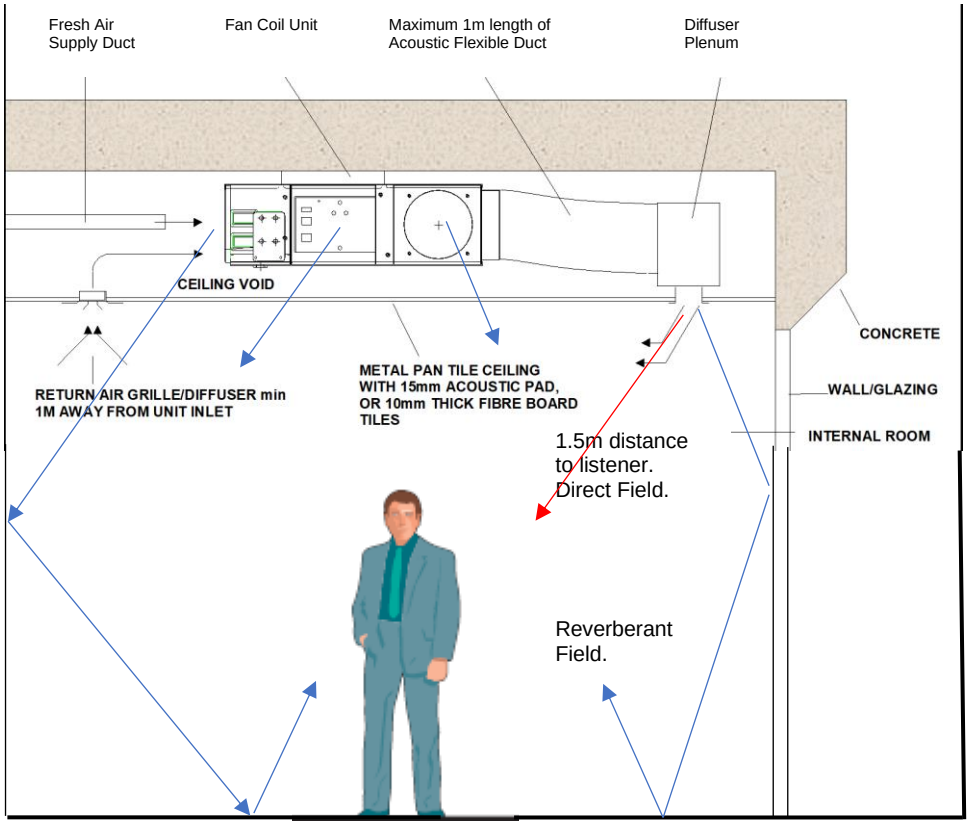

Figure 1. Typical Horizontal Fan Coil Unit arrangement.

There is no industry standard methodology for calculating NR level from Octave band sound power levels [SWL] measured in accordance with BS EN 16583:2022 @ 30 Pa external static pressure.
Acoustic assumptions must be made which affect the specification of other equipment / subcontract work: -

- CIBSE Guide B has guidance for sound reduction indices for various building fabric, reverb time and room volume.
- Sound Research Laboratories book Noise Control in Building Services.
- The spacing of the units affects the resulting noise level.
- Ceiling attenuation is crucial.
- Discharge duct attenuation is more important than inlet attenuation (unless FCUs are "exposed").
- The fabric of the served environment affects the resulting noise level.

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Manufacturers will advise the assumptions behind their Guide NR figures and supply Octave Band Sound Power level data for their FCU performance to be verified using project specific data by the project acousticians.

Typical FCU acoustic calculation (omitting all other noise sources)

Concealed FCU in Cat A office application.

		Octave centre frequency							
	Hz	63	125	250	500	1k	2k	4k	8k
Discharge SWL leaving FCU [in-duct]	**dB**	**61**	**58**	**54**	**50**	**46**	**38**	**36**	**31**
End Reflection correction	250 dia	-14	-9	-4	-1	0	0	0	0
Ductwork, grille plenum & grille*		-4	-5	-6	-8	-9	-9	-7	-8
SWL leaving system		43	44	44	41	37	29	29	23
Percentage leaving outlet	100%	0	0	0	0	0	0	0	0
Distance from outlet	1.5m	-14	-14	-14	-14	-14	-14	-14	-14
Directivity		*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*
Direct Sound Pressure Level (SPL)		38	39	39	36	32	24	24	18
Percentage reaching room	100%	0	0	0	0	0	0	0	0
Room volume	60 m^3	-4	-4	-4	-4	-4	-4	-4	-4
Reverberation time*	<0.7sec	-2	-2	-2	-2	-2	-2	-2	-2
Reverberant SPL		37	38	38	35	31	23	23	17
Combined direct & reverberant SPL		41	42	42	39	35	27	27	21
Combined Case + Inlet SWL		46	50	52	52	**46**	40	32	25
Ceiling Tile Loss*		-6	-4	-7	-10	-12	-12	-13	-8
Room Volume	60 m^3	-4	-4	-4	-4	-4	-4	-4	-4
Reverberation time*	<0.7sec	-2	-2	-2	-2	-2	-2	-2	-2
Combined Case & Inlet SPL		34	40	39	36	28	22	13	11
Combined Discharge + Case & Inlet SPL #		41	44	43	40	**35**	28	27	21
Octave Band NR		7.5	25.1	33.8	36.6	35.4	30.9	32.0	28.2
Guide Noise Rating of #	**NR37**								
A weighting dB of #	**41 dB(A)**								

* Typical acoustic assumptions.

Tip. For a quick analysis, compare the dB numbers at 1kHz instead of looking at all the spectrum.
dB(A) is approximately NR + 6 dB.

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Typical FCU acoustic calculation (omitting all other noise sources)

Exposed FCU in Cat A office application.

		Octave centre frequency							
	Hz	63	125	250	500	1k	2k	4k	8k
Discharge SWL leaving FCU [in-duct]	dB	61	58	54	50	**46**	38	36	31
End Reflection correction	250 dia	-14	-9	-4	-1	0	0	0	0
Ductwork, grille plenum & grille*		-4	-5	-6	-8	-9	-9	-7	-8
SWL leaving system		43	44	44	41	37	29	29	23
Percentage leaving outlet	100%	0	0	0	0	0	0	0	0
Distance from outlet	1.5m	-14	-14	-14	-14	-14	-14	-14	-14
Directivity		*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*
Direct Sound Pressure Level (SPL)		38	39	39	36	32	24	24	18
Percentage reaching room	100%	0	0	0	0	0	0	0	0
Room volume	60 m^3	-4	-4	-4	-4	-4	-4	-4	-4
Reverberation time*	<0.7sec	-2	-2	-2	-2	-2	-2	-2	-2
Reverberant SPL		37	38	38	35	31	23	23	17
Combined direct & reverberant SPL		41	42	42	39	35	27	27	21
Combined Case + Inlet SWL		46	50	52	52	**46**	40	32	25
Percentage leaving outlet		0	0	0	0	0	0	0	0
Distance from outlet		-14	-14	-14	-14	-14	-14	-14	-14
Directivity		9	9	9	9	9	9	9	9
Direct SPL		**41**	**45**	**47**	**47**	**41**	**35**	**27**	**20**
Room Volume	60 m^3	-4	-4	-4	-4	-4	-4	-4	-4
Reverberation time*	<0.7sec	-2	-2	-2	-2	-2	-2	-2	-2
Reverberant SPL		**40**	**44**	**46**	**46**	**40**	**34**	**26**	**19**
Combined direct & reverberant SPL		**44**	**48**	**50**	**50**	**44**	**38**	**30**	**23**
Combined Discharge + Case & Inlet SPL #		**45**	**49**	**51**	**51**	**45**	**39**	**31**	**24**
Octave Band NR		12.6	31.6	42.4	47.9	45.5	42.3	36.6	31.5
Guide Noise Rating of #		**NR48**							
A weighting dB of #		**51 dB(A)**							

As can be seen, removing the ceiling increases the NR & dB(A) figures. Potential solutions to meet the required levels include increasing FCU size (running at lower speed), fitting FCU inlet attenuators, additional plenum treatments and acoustically absorptive rafts / baffles.