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Homologation Officer Muffler 1/8th and 1/10th IC

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Procedure for EFRA Approval of INS-box for 2024+.

Any manufacturer, who wishes to have a new INS-box approved to be used at EFRA events must follow this procedure:

- First send a drawing in pdf or jpg to the muffler homologation officer. The drawing needs to show all the different parts/design with tolerances in the various measurements.
- After examination of the drawing the manufacturer will be notified and needs to send 2 sets of 2 INS-boxes. 1 Set for the homologation officer and 1 set for which the address to be defined (testing).
- The design of the INS-box is free, however is limited due to the space available on the carburetor besides the cooling head.
- The INS-box has 2 functions:
- limitation of the air-flow thru the carburetor
- To take away the inlet noise from the carburetor that is originated by opening the throttle and reving up the motor.

The limitation of the air-flow is small, but is common for each air filter. The volume of the box together with the inlet opening and the internal design is responsible for the total limitation.
An INS-box is designed with a specific foam air filter and should only be used with this foam filter due to its measurements. The total package must be designed in such a way that the air can only enter thru the inlet and only leave by means of the carburetor. Any other possible airflow will cause problems with adjusting the motor and the performance will not be reached.

The principle of the original INS-box
RC cars/motors have 2 main sources of noise, the exhaust system and the inlet system. The performance of the exhaust system and the gearing are responsible for the RPM coming out of an engine when it is well adjusted.
With the use of homologated silencers, the exhaust noise has been reduced. The induction noise however, had no silencing device and with the ever-increasing rpm's, the induction noise has gone up to close to 88-90 dB(A). The 2 noise sources together produce the measured overall noise-level of close to 92-93 dB(A).
It is obvious that reducing the exhaust noise level further would not affect the overall noise level. Only reducing the induction noise would be effective in terms of overall noise reduction. This is what the INS-BOX does. The original box is designed to filter out the 700Hz frequencies and its harmonics. These frequencies are 'weighted' very heavily in the 'A" scale used for measuring the 'industrial noise levels' such as cars, the original INS-BOX was designed using complex acoustic formulae to calculate the volumes and shapes of the 2 chambers and the size and length of the holes (pipes) which connect the 2 chambers.
However, during the years motor manufacturers have adapted their engines a little and also some of the new boxes have a new more simple internal design. A good designed INS-box is capable of reducing the inlet noise with 3-4dB's over the entire frequency spectrum.
When we talk about noise figures than 3 dB's means double or half the noise. So, a noise production of 80 dB's or 83 dB's means the noise is 2 x louder at 83 dB's. Two cars each producing 85 dB's will have a total noise figure of 88 dB's. 4 Of those cars means 91 dB's.
That is one of the reasons noise limitations are difficult to reach and why measuring on the track is also difficult.

TIME SCHEDULE.

The time schedule for EFRA INS-box approval is as follows and these are **deadlines**, so **the sooner the better**: The first drawing proposal must be received by EFRA 1st of November the latest.

Samples must be received by January 1st the latest following November. Please also remember to mark the parcel as **"SAMPLE", with no commercial value.** All costs involved with this procedure must be paid by the manufacturer.

Payment for an INS-box approval must be received February 15th the latest.

The INS-box will be checked and approved between the 1st of December and 28th of February. This process does include a number of tests at a track with a car, that's the reason it takes some time and this time schedule was made.

If approved the EFRA approval number will be sent to the manufacturer 28th of February the latest. Manufactures are requested to pay attention to the engravement and make sure this is good visible.

EFRA will publish their list of registrated mufflers and INS-boxes 1st of March. This list will also be forwarded to IFMAR, to be included in the IFMAR list.

Each approved INS-box must have a unique EFRA number. The EFRA number must be visible at time of technical inspection. If the Homologation Officer suspects that an INS-box has been modified he may anonymously purchase an example of the box for checking. If he finds that the box has been modified it will be immediately removed from the approved lists. If the box is only modified by the driver and does not correspond to the original the technical inspector at an event can disqualify the driver

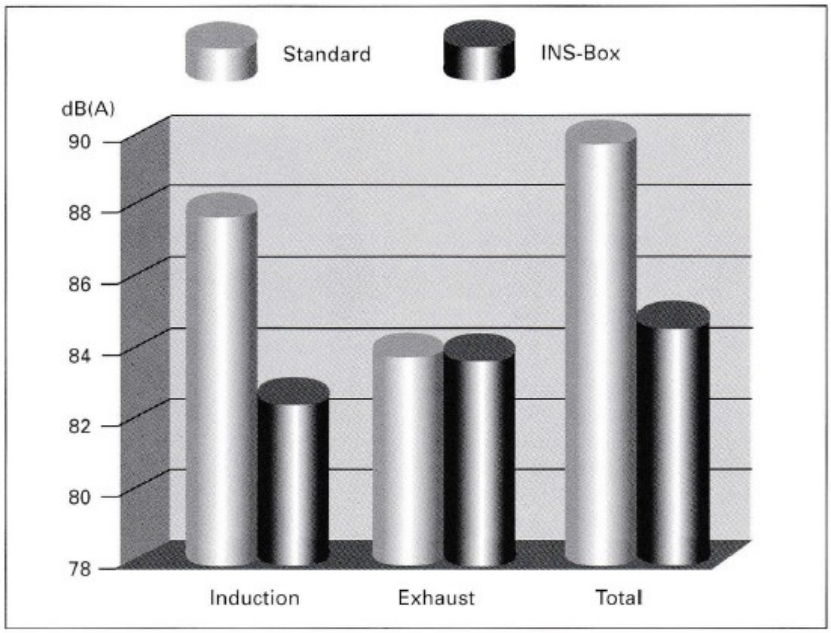
The **Registration will remain valid as long as the rules will remain the same**. However, if the model is amended / changed then it will need to be re- submitted for approval and an extra fee of 50% will apply. The Registration fee is 800 Euros for an INS-box (EFRA handbook fees 2023). EFRA associated members pay 400 Euros per INS-box (50% discount).

On behalf of EFRA.
Sander de Graaf / EFRA Muffler Homologation Officer.

Noise issues/explanations.
Noise is an issue in almost any country, and if it is not yet today, it will be tomorrow.
Race tracks have already closed down, or are under threat because of noise problems. In 1995 IFMAR, the World organization for RC racing, asked the manufacturers to come up with solutions to reduce the noise-level of 1/8 scale gas powered racing cars. Serpent took up the challenge and in close co-operation with the University of Delft, developed the universal Induction Noise Silencing Box, the INS-BOX. In combination with an effective (*) exhaust silencer.
the INS-BOX is able to reduce the overall sound level with up to 4 decibels.
If 10 cars would be using the INS-BOX at the same time, like in a race, the overall noise-level would drop with 5 to 6 decibels

Decibels
Noise is measured in decibels. The decibel scale is not linear but logarithmic. For instance, total silence would be 0 dB, a silent room 45 dB, a person speaking 60-65 dB, a car 80-85 dB, an airplane 90-95 dB. From a silent room to an airplane is only doubling the number of decibels, but what you hear is much more than double the noise.
There are different scales used with decibels. This depends on the type of sound and the environment it is produced in. For noise-level measurements used to set acceptable standards for the human ear, the "A scale" is used.
The noise level depends on the distance between the noise source and the point of measuring. The closer by, the higher the noise level. The standard distance for measuring noise levels of cars and machines is 10 mtrs. The universal norm for industrial noise levels has been set at 80dB(A) at 10 mtrs. A noise level of 83dB(A) compared to 80 dB(A) is experienced as double the noise by the human ear. Above 80 dB's it is advised to use some kind of protection, depending on the time you are facing this level.

Noise levels
Current '1/8 scale gas powered cars, using EFRA/IFMAR homologated exhaust pipes are measured at 90-92 dB(A). This high noise level depends very much on the engine rpm. With the ever-increasing rpm's, the noise level went up from 84-85 dB(A) in the early 80-ties, till 90-92 dB(A) at this moment as engines are now capable of running well in excess of 40.000 RPM.

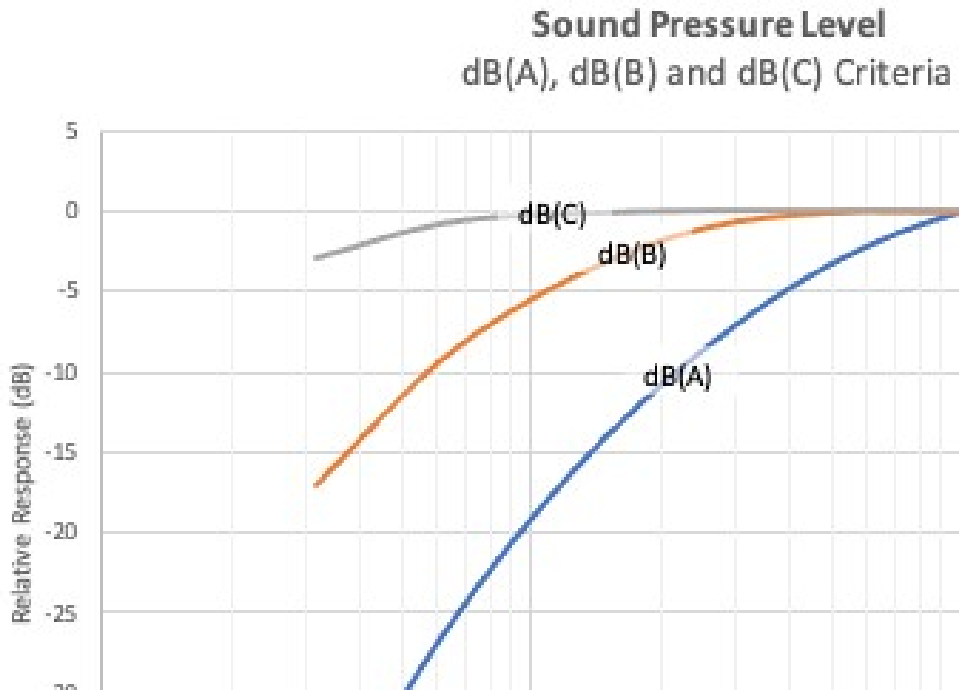


However, one thing is difficult to stop and that is motor development. We know that the noise production is linear with the number of RPM's.

The human ear is more sensitive to sound in the *1 to 4 kHz* frequency range than to sound at very low or very high frequencies. Regarding noise - higher sound pressures are therefore more acceptable at lower and higher frequencies than in the mid-range.

Knowledge about the human ear is important in acoustic design and sound measurement. To compensate for the human hearing sound meters are normally fitted with filters that adapts the measured sound response to the human sense of sound. Common filters are

- *dB(A)*
- *dB(B)*
- *dB(C)*



- **dB(A)**

The decibel A filter is widely used. dB(A) roughly corresponds to the inverse of the *40 dB* (at *1 kHz*) equal-loudness curve for the human ear.

With the dB(A) filter the sound level meter is less sensitive to very high and very low frequencies. Measurements made with this scale are expressed as dB(A).

Anyway - dBA (or dB(A)) is commonly used.

- **dB(B) and dB(C)**

The decibel C filter is practically linear over several octaves and is suitable for subjective measurements at very high sound pressure levels. The decibel B filter is between C and A. The B and C filters are seldom used.