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A practical approach to noise control in the Wire Industry.

INTRODUCTION

The Wire manufacturing industry is inherently noisy with most machinery and plant emitting noise in the 95-105 dB(A) range. The most prolific source of noise is the wire braiding machine which braids or plaits the outer screen on a vast range of cables.

Control of Noise at Source

The main sources of noise in braide Color rs are the motor and its associated gearing, the turntable, the cable bobbins and the braiding head itself. Over the last twenty years most major users have experimented with controlling the noise at source with varying degrees of success. A Carter, 16 spindle, bench top braider produced 95 dB(A) with its original metal bobbins and only 88 dB(A) when they were replaced with plastic equivalents. Although this is clearly a worthwhile reduction the plastic bobbins wore out at an unacceptable rate and most users have now abandoned this type of approach in favour of the total enclosure.

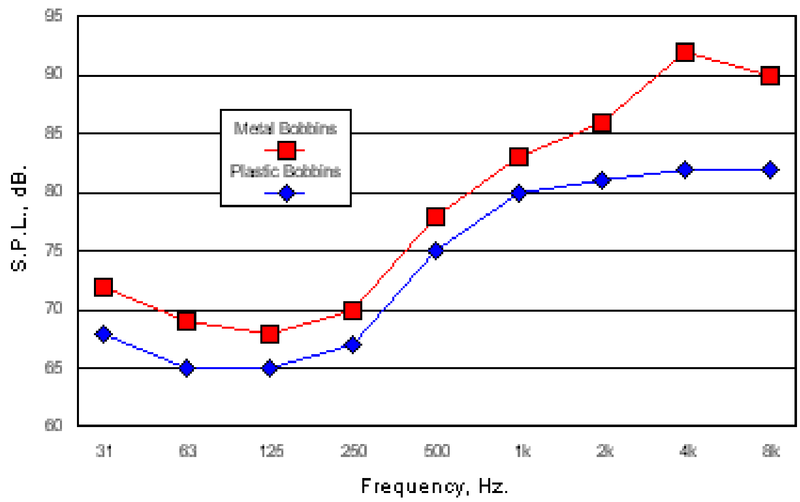

Figure 1, 16 Spindle Carter bench top braider.

Design Criteria

Before designing an enclosure for any machine it is vital to establish a suitable deign target. This will then enable the enclosure to be designed with exactly the right level of performance since extra attenuation is reflected directly as extra cost.

Many companies have already established noise level targets for their entire plants and these vary from 85 to 90 dB(A) depending on the company. Should there be no existing target to work towards then the best guide is to design to the existing background level. It is essential to measure the background level with the braider switched off. In order to ensure that the enclosed braider does not significantly contribute to this measured background level the enclosure must provide enough attenuation to reduce the noise emission to approximately 10 dB below the background level.

Materials and Construction Methods

Armed with the required attenuation the next step is to consider the selection of materials and construction techniques. When a braider is considered to be a totally permanent installation traditional builders materials can be selected. Unfortunately space is precious in most factories and any machine must be considered as semi mobile. In general the most commonly used building material is an acoustic panel system which can be dismantled and moved with the machine.

Realistic Performance

The selection of an acoustic panel for use in an enclosure depends on the required sound reduction. When talking to manufacturers it should be borne in mind that most companies quote the absolute panel performances and do not allow for the effects of windows, doors and joints, all of which degrade the overall performance. Figure 2 shows the realistic installed performance that can be expected of a number of different types of panel systems. It is possible to design an acoustic panel to produce precisely the required attenuation but in general the cost saving over a standard mass produced panel system is not significant.

Panel and Glazing	Typical Installed Performance
30mm thick panel, 6mm single glazed	20-22 dB
50mm thick panel, 6mm and 6mm double glazed	27 dB
50mm thick panel, 6mm and 10mm double glazed	36 dB
100mm thick panel, 6mm and 10mm double glazed	42 dB

Figure 2: Realistic performance figures for various panel systems.

Physical Problems

The design of a braider enclosure now becomes one of coping adequately with the physical problems associated with the machine. The raw cable must be fed in without degrading the overall performance of the enclosure. This is generally achieved by feeding it via a duct in the floor of the factory and up into the centre of the enclosure or alternatively a noise tunnel can be used.

The finished cable is wound around a capstan before being collected onto a large drum outside the enclosure. Figure 3 shows a cable exit consisting of a roller bearing and a small hole in the enclosure wall. Alternatively, Figure 4, shows how the whole capstan can be contained in a noise trap on the roof of the enclosure. The approach adopted to getting the finished cable out of the enclosure depends on the size of the braider, the size to cost ratio of the enclosure and the available funds.

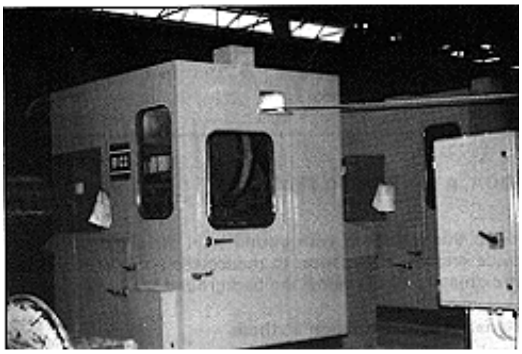
Figure 3.

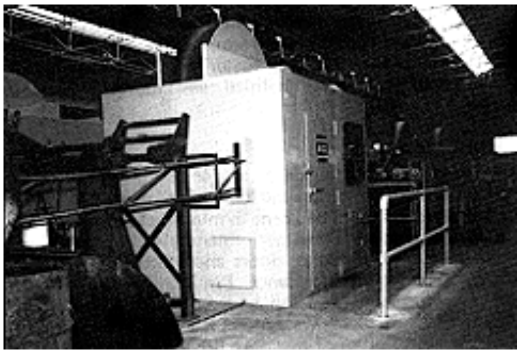
Figure 4.

In most braider configurations the collection drum is chain driven directly from the braider itself. Figure 4 shows how the chain drive can be effectively silenced by a small noise tunnel.

Ventilation

The enclosed braider will be generating heat and in order to avoid unacceptably high working temperatures the enclosure must be fitted with a suitable ventilation system. Figure 5 shows a noise trap low down on the right hand wall through which air is drawn into the enclosure. Figure 3 shows an acoustic cowl on the roof of the enclosure into which is built a small axial fan. This simple system is more than adequate for most situations.

Figure 5.

Services

Services such as power supply and control cables can be fed through ducts in the floor or through suitable holes in the panels. When a cable conduit is run through a panel it must be sealed with a mastic compound and arranged so that the panel can be removed without disturbing the cable should maintenance make this necessary.

Access

To ensure the smooth running of the braider the operator requires doors to get at the braider head and the gear change mechanism. (See Figure 5.) In addition routine maintenance may dictate that additional doors are provided. The design of acoustic doors is a specialised job and where a problem is not straightforward a consultant should be approached. Figure 6 shows purpose designed doors to accommodate the special problems of Stranders. In order to avoid creating new hazards it is good working practice to fit all doors with an interlock to switch the machine off before an operator enters the enclosure.

Figure 6.

Visibility

Lack of visibility is often a major failing in otherwise perfect enclosures. The operator needs to be able to see, from all his usual working positions, when a bobbin is empty or a strand has snapped. It is essential to fit large well positioned windows and it is usually necessary to fit lighting inside the enclosure to ensure that all the key items can be clearly seen.

Control Panel

The Spirka Braider shown in Figures 3 and 5 has an integral control panel to which the operator needs constant access and the maintenance staff regular access. It would obviously have been costly to re-site the control panel outside the enclosure. Fortunately the panel's construction offered slightly better attenuation than the panel system used to build the enclosure and consequently the enclosure walls were built around it. As a result of this measure the enclosure was made more compact without reducing its performance.

Erection

Having taken the time necessary to give the design of the enclosure, careful thought and attention to detail, it would be tragic to ruin the performance with poor erection procedures. There is no substitute for having the erection done by a company whose staff are skilled in this type of work and who do acoustic installations on a regular basis.

Performance Check

Having completed the erection of the enclosure the final step is to check its performance against the design criteria. Most noise control companies do this free of charge as a matter of routine. As an example we will look at the performance of the enclosure of the new Spirka High Speed Braider shown in Figures 3 and 5.

The unenclosed Spirka Braider produced a noise level of 100 dB(A), (see Figure 7) and a design target level of 80 dB(A) was considered reasonable for this area. In order to achieve the target of 80 dB(A) the noise emission of the enclosed machine had to be reduced to approximately 70 dB(A). Hence an average Sound Reduction Index of approximately 30 dB was require.

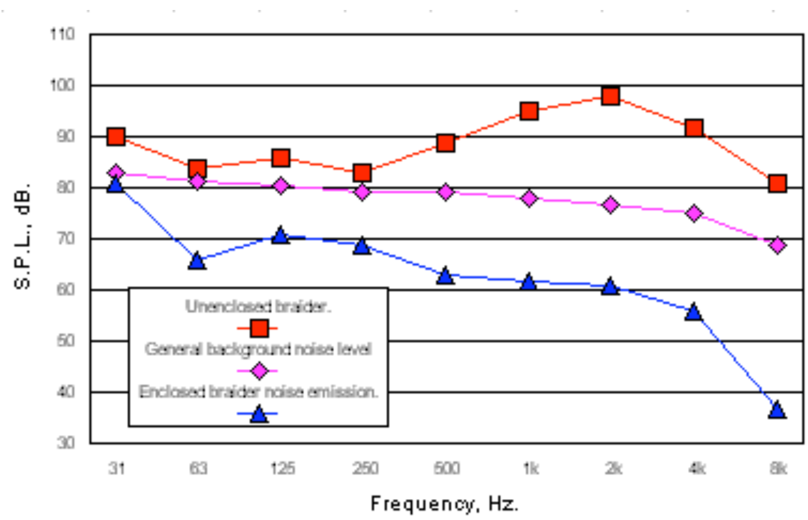

Figure 7, Spirka Braiders.

The noise spectrum of the braider showed relatively small quantities of low frequency noise and predominant peak in the 2 kHz octave band. Consequently it was possible to use a lighter panel construction than would otherwise have been required.

Frequency, Hz	31	63	125	250	500	1K	2K	4K	8K
SRI, dB	9	18	15	13	26	33	37	35	43

Figure 8: Octave band performance of the braider enclosure shown in Figs 4 and 5.

A 50mm thick panel was selected consisting of an outer skin of 18 swg galvanised sheet steel, an infil of mineral wool with a density of 100kg/m3 and an inner skin of 22 swg perforated galvanized sheet steel having an open area of 34%. The double glazed windows consisted of two sheets of 6mm thick toughened safety glass and the reveals were lined with acoustic foam to prevent cavity resonances.

Absolute Performance

The absolute performance of the enclosure was measured during a plant shutdown. The background noise level was 43 dB(A) and the noise emission of the enclosed braider was 68 dB(A). (See Figure 7.) The performance achieved was an average Sound Reduction Index of 32 dB. The table in Figure 8 shows the octave band analysis of the enclosure’s performance. It is worth noting that the enclosure offers low attenuation at low frequencies but has a peak in its attenuation in the 2 kHz octave band where it is required.

Actual Performance

When the plant is running at full capacity several unenclosed machines near the enclosure produce a background noise level of 84 dB(A). The actual performance of the enclosure is a reduction of 16 dB from 100 dB(A) to 84 dB(A). As the surrounding machines are systematically treated the noise level in this area will drop from 84 dB(A) towards the ultimate target of 80 dB(A).

CONCLUSIONS

Although controlling noise at source has proved to have inherent problems for the wire industry, good levels of noise control can be achieved using total enclosures. Acoustic enclosures can be designed that are operator friendly, allowing easy maintenance and are cost effective. All that is required is careful thought, attention to detail and above all, the consideration of all the personnel who will work on, or with the enclosed machine.

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