Press Isolators: Their Function and Effectiveness

Careful Analysis

Since 1965, Vibro/Dynamics has been studying press structures and the interrelationship between the press and the foundation. This study was made along three parallel paths:

- An analytical study of the forces acting upon the press structure and the behavior of the press structure,
- A series of measurements of foundation forces, vibration, and noise on a wide variety of presses,
- Observation of thousands of presses mounted in every conceivable manner.

When the study was started, many people in the stamping industry believed that presses had to be bolted down and that isolators caused more problems than they solved. In many cases this was true.

However, we were convinced that if the isolators were specifically engineered for the press, to control the dynamic forces and to eliminate the foundation twisting forces, it would be possible to achieve significant reductions in vibration and noise without causing harm to the press or tooling.

Our studies have shown this to be true. What we did not expect when we started out was that when the isolators were properly designed and installed, the performance of the presses actually improved -- and very significantly. We also learned that vibration and noise could be reduced by a much greater amount than anyone had thought possible.

In addition, we learned that hard mounting the press to the foundation is harmful to the press, to the foundation, and to personnel. By properly isolating the press, these harmful effects are reduced and the following additional benefits are also derived:

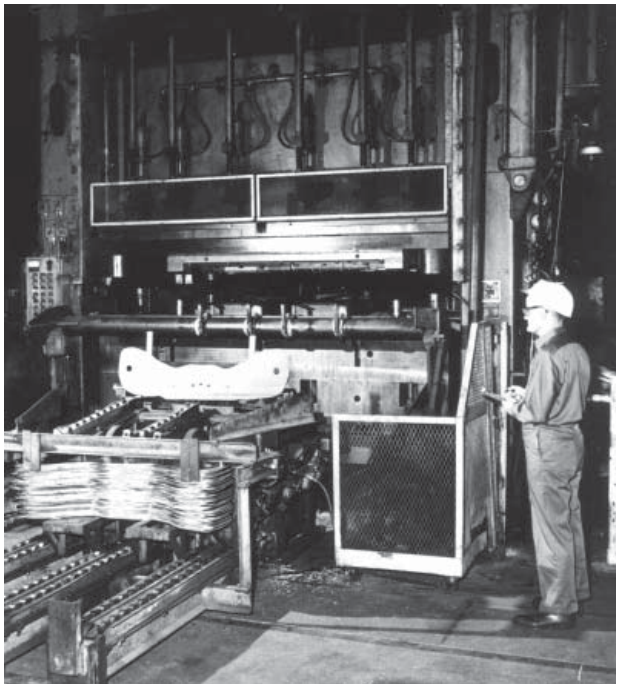

Figure 1- Pumping effect sank foundation of 800-ton press

- Press performance and productivity are improved
- Downtime is decreased
- Repair costs are reduced
- Vibration and noise are decreased
- Die life is increased
- Power consumption is decreased

Solving Foundation Problems

Our first introduction to the isolation of heavy presses was in 1970. The 800-ton press shown in Figure 1 had been bolted to a very heavy and wide foundation due to the wet sandy soil. In 18 months of operation, the foundation had settled six inches. Adjacent building columns had also sunk, requiring six inches of space plates under the building columns so that cranes would not have to run uphill. Cracking of foundation walls resulted in many thousands of dollars of repair work.

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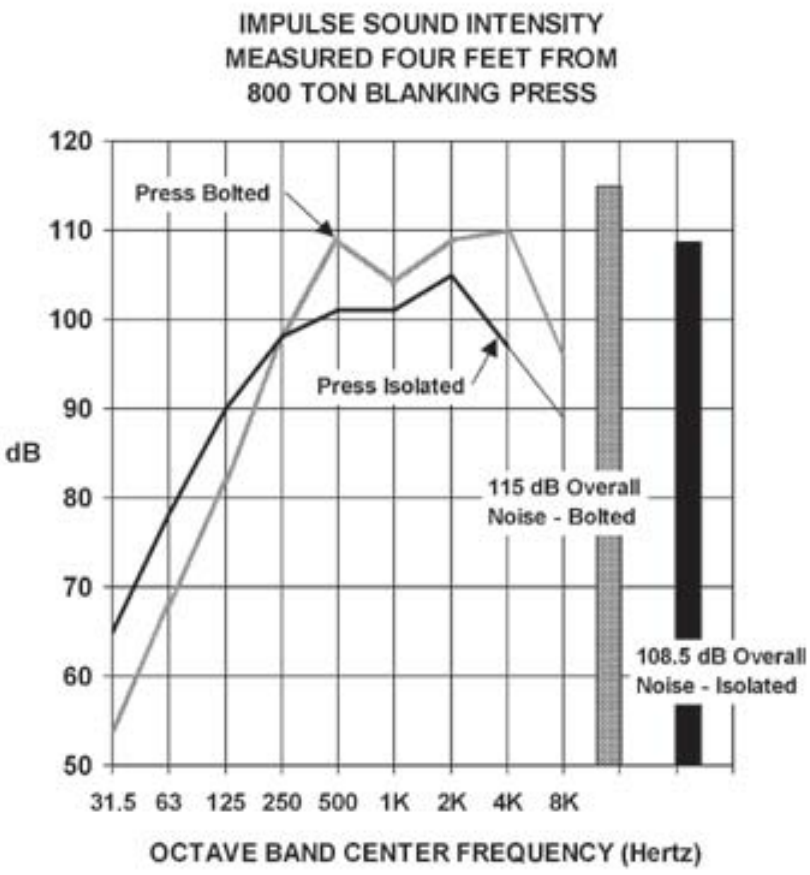

Figure 2 - Noise measurements showed a 6.5 dB reduction

We were asked if isolators could be designed to isolate their new 800-ton press in a way that would prevent similar problems.

After a thorough study of the stamping forces and the behavior of the press structure, we concluded that it was not so much compressive or downward forces exerted by the press feet on the foundation that caused the foundation to settle.

Immediately upon snap through, the springback of the tie rods pulled up on the bed of the press and exerted a tensile force on the anchor bolts. These lifting forces were so great that they raised the foundation, causing water in the soil to be sucked into the area under the foundation. The subsequent pumping action as the foundation vibrated caused sand and silt to wash out from under the foundation.

We concluded that one of the primary design objectives of these isolators was to prevent the press from exerting an upward force on the foundation. A second design objective was to reduce the downward impact force on the foundation. A third objective was to provide a simple means for leveling the press with a higher degree of accuracy than could otherwise be attained. A fourth objective was to design the isolators to have a long life without deterioration.

Both presses were installed on these isolators. In the following ten years, neither foundation had settled, no further damage had occurred and the presses remained level.

Additional benefits were also observed. Noise measurements at the operator's station showed a 6.5 dB reduction (Figure 2). In the frequency ranges that are most damaging to the human ear, reductions up to 121 dB were measured. Vibration in the floor was also reduced.

Increasing Productivity

Another example involves a press (see Figure 3) bolted to a foundation. It experienced a great deal of downtime and could not be operated at full design speed of 300 SPM. It was then reinstalled on press isolators along with eight similar presses.

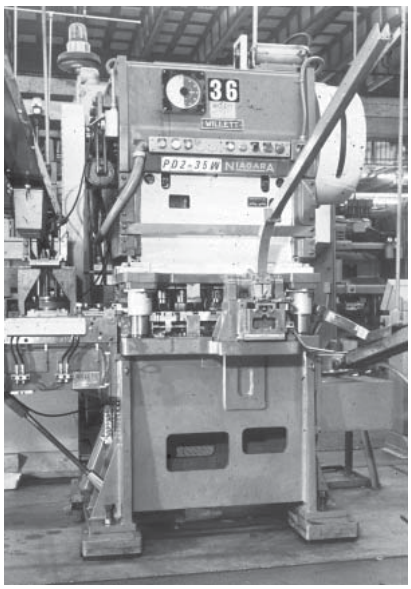

Figure 3 - Installing this press on Vibro/Dynamics' Isolators increased die life up to 800%

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The Results:

- Increased die life 600 to 800%
- Increased operating speed from 270 to 300 SPM
- Decreased vibration and noise very effectively
- Decreased press downtime

It is significant to note that no one knew the cause of the problem was the manner in which the presses had been installed until the problem was solved by the use of isolators. Until that time, there had been a series of confrontations between the press user, the press builder, and the builder of the transfer feed and die system.

By working closely with all three parties, we were able to design isolators which provided optimum performance for these specific presses.

When a press has been properly installed and fine-tuned on custom-engineered isolators, we have seen the same benefits time and again. Precisely engineered and properly applied isolators can mimic the set up at the press builder's plant and help keep the press level and aligned.

Stamping Near Sensitive Equipment

The importance of optimizing the design of isolators is illustrated by a 400 ton cold forging press installation. The plant was laid out for maximum efficiency of material handling with the heat treating furnace located about 20 feet from the press.

Realizing that vibration might be transmitted to the furnace unless something was done to prevent it, the press was mounted on a heavy foundation that was "isolated" from the surrounding floor by a resilient separator; and a pad of resilient material was placed under each of the press feet to isolate the press from the foundation.

The main item of concern was the sensitivity of the mercury switches that control the heat treating furnace. These switches had been tested to determine that vibration in excess of .0015 inch would affect their reliability.

When the press was operated, the heat treating furnace could not be operated. Vibration measurements showed that the mercury switches vibrated with an amplitude of up to .014 inch (9.3 times as much as the switches could tolerate).

The resilient pads were removed and a set of Vibro/Dynamics' Isolators were installed. Vibration of the switches was reduced to .0015 inches.

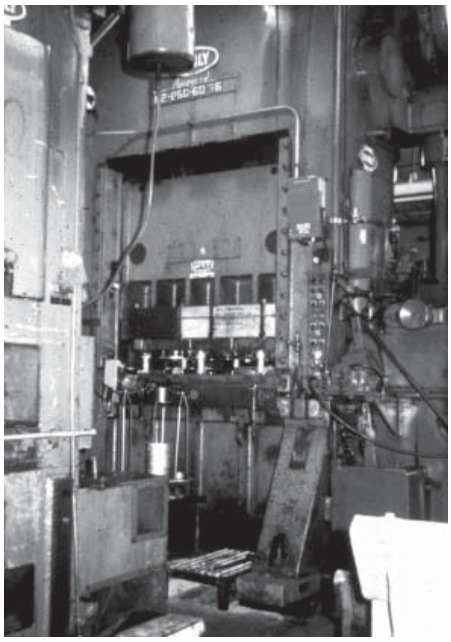

Figure 4

Inasmuch as this was still a marginal condition, a second set of isolators were installed. These isolators were designed to provide optimum reduction of the foundation impact forces and to eliminate the foundation twisting forces. As a result, vibration of the mercury switches was reduced to .0007 inch.

With the resilient pads supporting the press, the vibration transmitted to the mercury switches was 20 times as great as it was when the press was installed on the optimum isolators.

Other effects were observed. When the press was first mounted on resilient pads, excessive vibration was transmitted through the soil to other parts of the building and to other buildings. Quality control work had to be scheduled between shifts. Vibration and noise in an office building 150 feet from the press were intolerable.

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With the press installed and fine tuned on the optimum isolators, quality control functions were unaffected by the operation of the press. In the office building it was not possible to detect when the press was operating and when it was not.

Controlling Impact Forces = Decreased Vibration

In our study we felt that it was important to determine more precisely how effective isolators can be in controlling the foundation forces and the reduction in vibration and noise that results from the control of these forces.

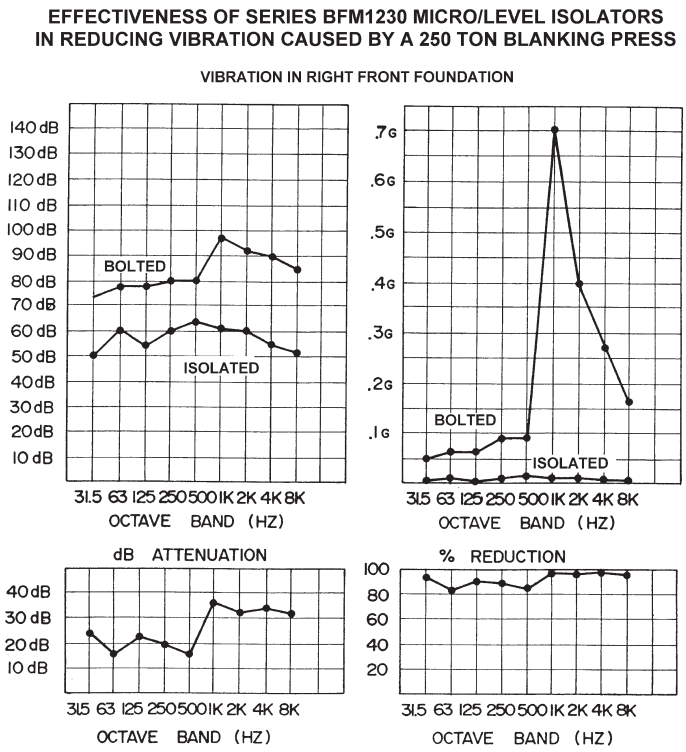

Figure 5

Our analytical study showed that for most presses it is possible to design isolators that reduce foundation impact forces and foundation vibration by 95 to 98%.

These computed values of effectiveness were substantiated by actual measurements in the field. The 250 ton press in Figure 4 was bolted to a foundation but it was decided to reinstall it on press isolators because of the harmful vibration which was being transmitted to other equipment.

Prior to reinstallation, a series of vibration measurements were made on the press structure, on the foundation, on the floor, and on the building column. Similar measurements were made after reinstallation of the press on isolators that were designed for optimum control of dynamic and static foundation forces.

Overall vibration of the foundation was reduced by 31 dB as indicated by the vibration meter. This is equivalent to a reduction of 97.2%. Figure 5 shows a typical set of measurements. Both halves of the figure are identical. The left hand side shows the vibration as measured in dB. The right hand side shows the same vibration defined in G's.

Both sides show that the isolators reduced vibration by 97.2%, which is another way of saying 31 dB attenuation. The left side shows something else that is very significant; that when the press was installed on the isolators, the noise radiating from the foundation surface was attenuated by 31 dB.

Putting it the other way around, when the press was bolted down, the vibration in the foundation was 36 times greater than it needed to be, and the noise radiating from the foundation was 31 dB higher than it needed to be; that the isolators prevented this excess vibration and noise radiation.

Similar measurements showed that the press leg vibrated 7 times greater when the press was bolted down than when it was properly isolated, and the the equivalent noise radiation from the leg was 17 dB higher with the press bolted than with it isolated.

Vibration of the floor was 10 times greater and radiated noise from the floor was 20 dB greater with the press bolted down.

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Vibration of the building column was 6 times greater and radiated noise from the building column was 16 dB higher.

One very personal side benefit of this improvement showed up when the press operator expressed his appreciation to the plant manager inasmuch as he no longer went home fatigued.

As a noise control measure, properly designed press isolators are unique. While most other noise control measures tend to interfere with productivity, and increase costs, isolators increase productivity and decrease costs.

Compensating For Floor Irregularities

If we look at a press resting on its foundation, we see that it tends to be supported under three feet due to irregularities in the surface of the foundation (Figure 6). You will notice that the shape of this floor is such that the left front foot is unsupported. Most of the press weight is supported on the left-rear right-front diagonally opposite feet.

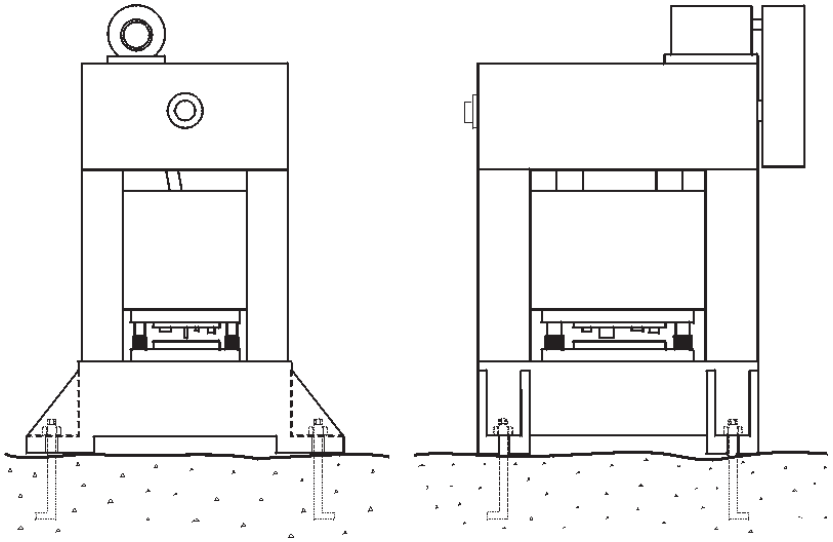

Figure 6 - Bolted down installation. Left front foot is unsupported.

As a result, the press bed is subjected to twisting forces. These twisting forces cause the bed to warp into the shape of a saddle and the entire press structure to twist about a vertical axis. Columns and tie rods are caused to bend and twist.

Press isolators that are properly designed to reduce the foundation impact forces and to eliminate the twisting static forces incorporate a very precise adjustment means for compensating for the variations in the elevation of the foundation under the four feet (Figure 7).

The press is leveled by turning the precision adjusting screws in the four isolators until the press is both level and flat.

This is called fine tuning. The adjusting screws are turned to transfer the excessive load supported by the left rear and right front isolators to the left front and right rear isolators until 50% of the weight is supported by each of the two diagonal pairs of isolators.

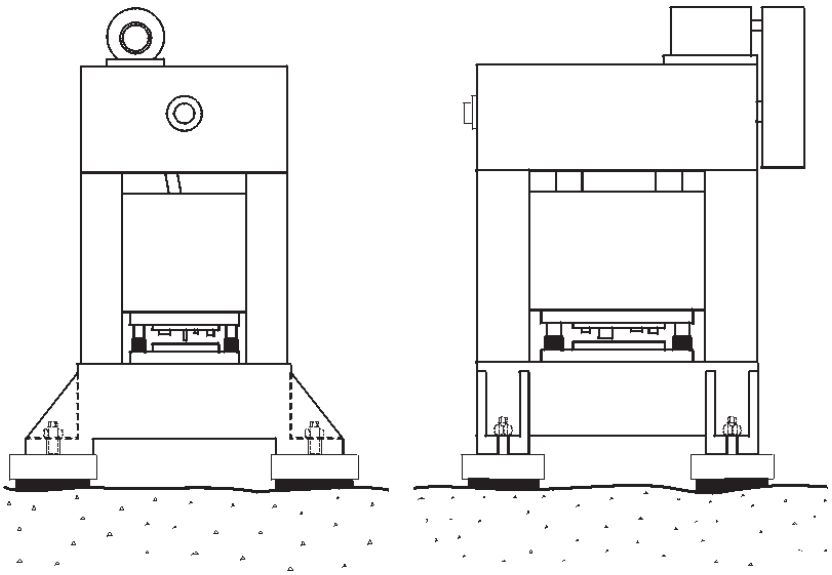

Figure 7 - Press now on isolators which compensate for unevenness.

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The press shown in Figure 8 was leveled and fine tuned in 15 minutes resulting in a reduction in power consumption. Reductions in power consumption of high speed presses of 5 to 25% are not uncommon.

Perhaps the best way to summarize the function of press isolators is this:

They permit the press to perform to its full capabilities by preventing the foundation from exerting harmful influences:

- on the press
- on the foundation
- on the surroundings

and in so doing, they also improve the environment for personnel and for other equipment.

Figure 8 - Fine-tuning this press took only 15 minutes.

Vibro/Dynamics makes a full range of machinery mounting systems for hundreds of industrial applications. Our products are designed to make machine installation faster and easier, and to increase uptime and profitability by maintaining proper machine alignment, extending die and mold life, and keeping machines level.

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