

## Vibration Control, Mounting and Levelling of: **Power Presses**



### **Presses come in various categories including:**

- ▶ Mechanical
- ▶ Hydraulic
- ▶ Friction
- ▶ Extrusion
- ▶ Press Brake

Pressing operations are where components are Blanked, Drawn or Formed into shapes and components by placing the metal between the upper die attached to the moving slide and the lower die attached to the bolster. The press action applies an impact force by the upper die on the metal which is then deformed into the required shape.

Mechanical Presses use reciprocating crank mechanisms controlled by a clutch on a flywheel.

Hydraulic Presses are used mainly in drawing and forming operations where the application of smooth controlled deformation is required. They normally do not produce strong shock forces. However the hydraulic system can produce fluid impulse shocks.

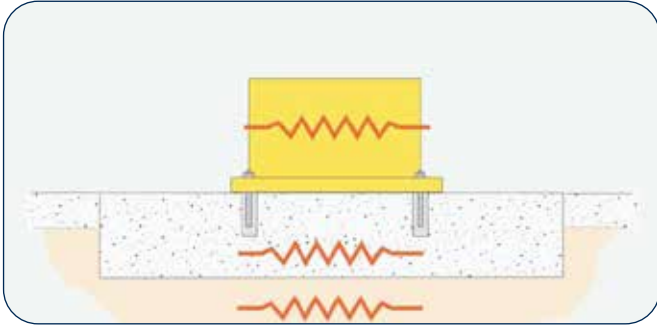


# Design Consideration 01

## Shock and Vibration affecting operating performance, surrounding environment, operators and equipment.

By their very nature impact machinery and Power Presses will generate shock and vibration which can affect the performance of the machine itself as well propagate through the ground to disturb operators, surroundings such as floors and foundations, building structures, offices and neighbouring residents and businesses etc.

Assuming there may be a problem with shock and vibration the first factor to consider is the surrounding ground conditions as different substrates will have different natural frequencies.



Typical natural frequencies of ground and structures	
Steel structures	2-15Hz
Suspended concrete floor	~10-15Hz
Ground floor	~12-34Hz
Soft Clay	~12Hz
Medium Clay	~15Hz
Stiff Clay	~19Hz
Loose Fill	~19Hz
Dense mixed grain sand	~24Hz
Limestone	~30Hz
Hard Sandstone	~34Hz

The second factor to consider is the operating speed of the press.

Low Speed presses operating up to 250 strokes per minute (spm) produce a series of shocks rather than a disturbing frequency. These shocks will, unless attenuated, cause the press foundation and surrounding structures and subsoil to vibrate at their respective natural frequencies  $f_n$ . Measures should be taken to reduce the amplitude and intensity of the shock transmission.

As an indicative guide the degree of shock produced by these operations depends on: the operation type, the metal type and thickness.

	Thickness	1-3mm	4-6mm	7mm+
		Shock Level: 1 = Low - 5=High		
Operation	Metal			
Blanking (cutting or piercing)	Aluminium alloys	1	1	2
	Copper and brass	1	1	2
	Mild steel	2	3	4
	High tensile steel	3	4	5
	Stainless steel	4	5	5
Forming	All metals	1	2	3
Drawing	All metals	1	2	3

## Other factors influencing shock levels include

- ▶ Tool Design
- ▶ Press Balancing
- ▶ Component design
- ▶ Cross sectional area being blanked (cut or pierced)

### Other factors influencing shock levels include;

High Speed presses operating over 250 strokes per minute (spm) produce repetitive shocks which produce a disturbing vibration  $f_e$  (spm/60) repetitive shock impulses. If ground or building structure natural frequencies  $f_n$  coincide with press operating frequencies  $f_e$ , structural resonances will occur which in extreme cases can make the press or the building unusable. These resonances may amplify the source vibration/shock. Also if the surrounding buildings are particularly lightweight they will act like a tuning fork where the shock wave energy will be sufficient to excite the structure at its own resonant frequency.

The natural frequency response of the surrounding floor, building structures, and subsoil  $f_n$  may be estimated by a structural engineer using finite element analysis

Generally Mechanical Presses are used to produce a wide variety of work which indicates that when specifying a press shock isolation system the worst case should be considered.

The following table provides a guide to typical operating characteristics of certain press types.

Press Type	Static Mass (Tonnes)	Pressing capacity		Applications	Operating Speed	
		(kN)	(Tonnes)		SPM	Hz
Open fronted	1 to 25	300 to 1500	30 to 150	Smaller components	350	5.8
Open fronted inclinable	1 to 25	300 to 1500	30 to 150	Smaller components	350	5.8
High Speed Blanking	1 to 25	300 to 1000	30 to 100	Smaller components	800	13
Double Sided	30 to 600	1000 to 10,000	100 to 1000	Large components Multiple small components Vehicle Body Panels	350	5.8
Transfer	30 to 200	1000 to 5000	100 to 500	Multiple small components	350	5.8
Hydraulic	5 to 1000	1000 to 10,000	100 to 1000	All components	10 to 100	1.66

If the press is installed and it is not viable to reinstall it with vibration mitigation measures then the only option may be to isolate the surrounding machines, buildings and floors etc. Farrat have significant experience in such scenarios and have successfully isolated;

- ▶ Nearby sensitive machines such as CMMs and Laser Welding Machines
- ▶ Office buildings within press shops
- ▶ Neighbouring residential properties

# Design Consideration 02

## Small to medium size presses (1-30 tonnes mass)

If the floor construction is strong enough (i.e. 300+mm of reinforced concrete) anti vibration pads or mounts can be used to allow installation without bolting down and levelled using height adjustable mounts. Unless the press is top heavy and in need of fixing down to the floor then it is best to install power presses on freestanding or bolt on mounts to fully decouple the press from the floor.

Levelling and correct static load distribution on the press supports is an important factor in achieving optimum press performance. Farrat Machine Mounts such as Isomounts, Isoblocs,



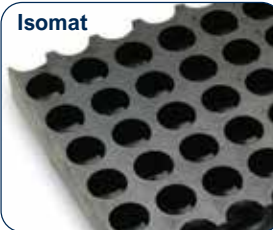
Isomounts



Isoblocs



Isomat



Wedgemounts



### Wedgemounts and Isomat Pads have been used extensively to support and isolate power presses and are used to:

- ▶ Reduce airborne noise
- ▶ Reduce shock transmission to floor
- ▶ Prolong tool life
- ▶ Increase accuracy due to reduced press vibration
- ▶ Reduce impact damage to floor and surrounding structures
- ▶ Create a better working environment
- ▶ Provide easy and accurate installation and levelling
- ▶ Ensure the machine has a stable and uniform support to maximise machine accuracy and performance and to reduce the risk of degradation from machine bed misalignments, internal stresses and flex
- ▶ Overcome irregularities in floor slabs or foundations
- ▶ Increase vibration damping of the machine
- ▶ Provide layout flexibility





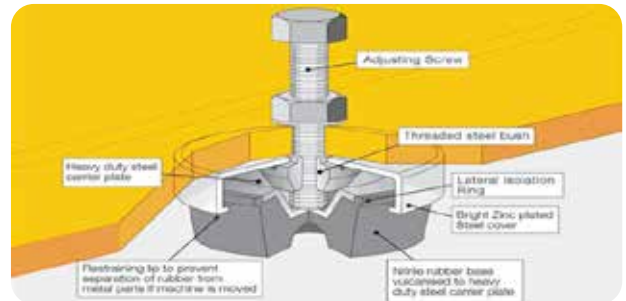
## Solution 2.1

### ISOMOUNTS 150-12,000kg / mount

Isomounts have been designed to provide effective vertical and horizontal shock absorption, vibration isolation and damping as well as easy and precise levelling for a wide variety of machinery and equipment.

#### Farrat Isomounts offers the following features and benefits;

- ▶ Load range from 150kg up to 12,000kg per mount
- ▶ Vertical and horizontal shock and vibration isolation performance
- ▶ Improve performance, reduce wear and lower noise levels of machines
- ▶ Simple and economical machine installation
- ▶ High friction grip so machines don't move
- ▶ Factory layout flexibility (no bolting down or grouting)
- ▶ Heavy duty and durable design
- ▶ Manufactured from the highest quality materials
- ▶ Oil and chemical resistant
- ▶ Thousands of worldwide industrial applications



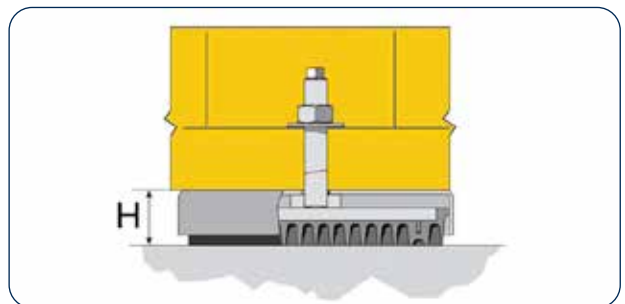
## Solution 2.2

### ISOBLOCS 7,500 - 50,000kg / mount

Isoblocs have been developed specifically for, although their use is not limited to, power presses to provide effective vertical and horizontal shock absorption, vibration isolation and damping as well as easy and precise levelling on a much larger scale than Isomounts.

#### Farrat Isoblocs offers the following features and benefits;

- ▶ Load range from 7,500kg up to 50,000kg per mount
- ▶ Precision fine screw thread height adjustment
- ▶ Vertical and horizontal shock and vibration isolation performance
- ▶ Simple and economical machine installation
- ▶ Factory layout flexibility (no bolting down or grouting)
- ▶ Heavy duty and durable design
- ▶ Manufactured from the highest quality materials
- ▶ Oil and chemical resistant
- ▶ Hundreds of worldwide industrial applications



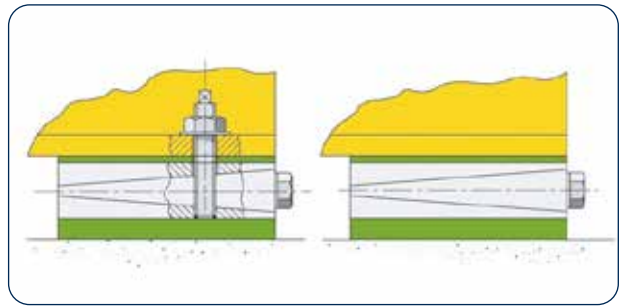
## Solution 2.3

### Wedgemounts

Wedgemounts are often used to provide a level and secure fixing together with a high degree of vibration damping and offer the following features and benefits;

- ▶ Accurate, efficient and economical machine installations
- ▶ Precision vertical levelling adjustment with no horizontal forces applied when adjusting
- ▶ High ratio of lifting force to adjustment torque to ensure accurate and smooth levelling
- ▶ Enhanced machine stability (the machine is not sitting on the screw thread)
- ▶ Vibration Damping (in some variants)
- ▶ Allow factory layout flexibility through easy installation and relocation

For Power Presses Farrat recommends either WLF (Freestanding) or WLB (Bolt on) types with damping grades: A or D. We are happy to discuss exact requirements and specifications to find the ideal match



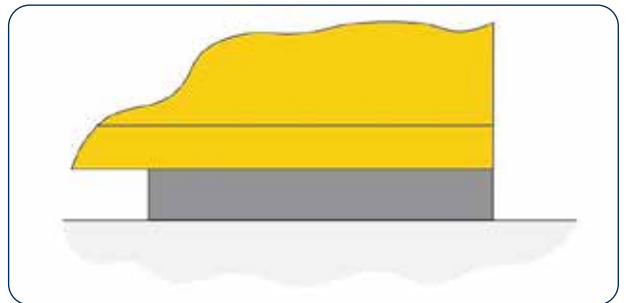
## Solution 2.4

### Isomat Nitrile IMBR Pads

Isomat Nitrile (IMBR) is an excellent low pressure anti vibration and shock absorption material used predominantly in industrial applications for its excellent vibration damping, shock absorption and chemical resistance characteristics.

#### Farrat Isomat Nitrile offers the following features and benefits;

- ▶ Its unique form is perfect for shock absorption and vibration isolation
- ▶ Nitrile has excellent damping characteristics
- ▶ Excellent oil and chemical resistance properties
- ▶ Used extensively in Farrat machine mounts
- ▶ Produced in the UK by Farrat using high quality compounds
- ▶ Available in a range of hardness grades and thicknesses
- ▶ Easy to use and economical elastomeric anti vibration material
- ▶ Low level of creep
- ▶ Long lifetime
- ▶ Can be supplied as sheets or bespoke pads and strips



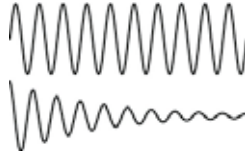
# Design Consideration 03

## Large Presses (30+ Tonnes Mass)

### Solution 3.1

#### Isolated Foundations

An Isolated Foundation system offers excellent shock absorption and vibration control performance by connecting the press to an elastically supported concrete mass which has the beneficial effect of increasing the press mass by the mass of the foundation.



#### Mass damping effect

Press Mass:  $M_p$

Foundation Mass:  $M_f$

The foundation block has the effect of reducing press oscillation (vibration) in ratio:

$$M_p / (M_p + M_f)$$

When designing an isolated foundation we suggest a foundation mass 2-3 x press static mass to obtain a good Mass Damping Effect.

#### Example

Press Static Mass: 15 tonnes (15,000 kg)

Foundation Dimensions: Length: 3m x Width: 3m x Depth: 1.5m

Foundation Mass: 33000kg

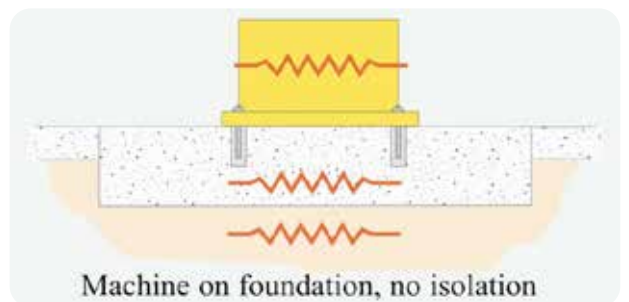
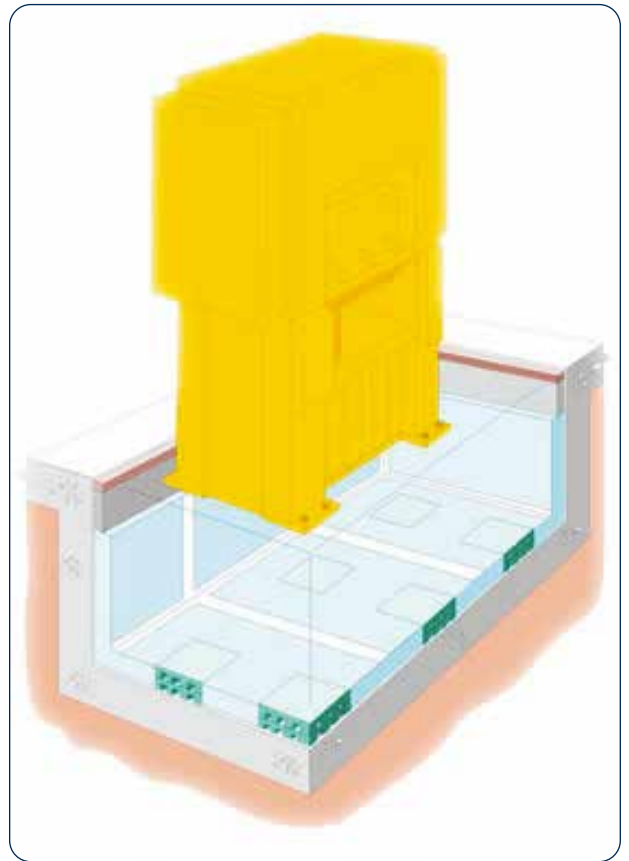
Mass damping ratio  $15000 / (15000 + 33000) = 15000 / 48000 = 0.31 = 69\%$  reduction in press movement

An Isolated Foundation System allows the foundation to absorb the shock energy created by the press by oscillation (in example above being only 31% of the oscillation without a foundation). The energy is dissipated by doing work against the ISOMAT isolators and therefore minimising any transmission to the surroundings.

Like any standard isolation system some shock and vibration will be transmitted to the surroundings at the natural frequency of the Isolators although because of the mass damping effect this will generally be at a very low level.

#### Avoiding resonances

In some ways it is just as important to avoid transmission of shock and vibration at a frequency near to or at any important natural frequency of the supporting floor, subsoil or neighbouring structures. Resonance can result in transmitted vibration being amplified many times. ISOMAT Foundation Isolators can be tuned (i.e. designed) to avoid transmitting any vibration at resonant frequencies (if they can be ascertained by design analysis or measurement).



If vibration isolation does need to be incorporated into the design then an Isomat Isolated foundation system designed to isolate the lowest operating frequency of the press has proved to be an ideal solution.

### **Farrat Isolated Foundations offer the following features and benefits;**

- ▶ An Isolated Foundation is generally the most effective way of protecting high value machines and their operating performance from shock and vibration. Systems can be designed to isolate;
  - Active Isolation (vibration created by the Press operation affecting surrounding structures)
  - Passive isolation (externally induced vibrations affecting press operation. Maximum levels at different frequencies which the press can accept tend to be provided by the manufacturer)
- ▶ Effective isolation of vertical disturbing frequencies above 12Hz
- ▶ Effective isolation of horizontal disturbing frequencies above 4Hz
- ▶ Can be designed to avoid resonance with any disturbing frequencies
- ▶ An ideal blend of vibration isolation and damping
- ▶ Often used as a precautionary measure in case of unexpected shocks and future facility alterations
- ▶ Isomat has a proven track record in a very wide range of industrial applications since 1977
- ▶ An economical solution
- ▶ Simplified foundation design
- ▶ Easy to install
- ▶ Long performance lifetime
- ▶ Maintenance free

## **Solution 3.2**

### **Fixing to beams or concrete pillars**

If a trench is required under the presses as part of the manufacturing operations then large presses can be installed on large beams or concrete pillars. In such cases Farrat NBR or ISOMAT pads combined with special AWS anti vibration washers provide a very high level of vibration damping.

Farrat NBR and ISOMAT anti vibration materials are used predominantly in industrial applications for their excellent vibration damping, shock absorption and chemical resistance characteristics. NBR would be used when static loading pressure exceeds the maximum for ISOMAT.

### **Farrat Nitrile Elastomers offer the following features and benefits;**

- ▶ High performance vibration and shock damping
- ▶ Excellent oil and chemical resistance properties
- ▶ Used extensively in Farrat machine mounts
- ▶ Produced in the UK by Farrat using high quality compounds
- ▶ Available in a range of hardness grades and thicknesses
- ▶ Easy to use and economical elastomeric anti vibration material
- ▶ Low level of creep
- ▶ Long lifetime

