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KTI Schwingungstechnik

KTI Technical Report No. 1

SPRING BEARINGS MINIMISE VIBRATION IN AUTOMATIC PUNCHING PRESSES

Machines intended for the fields of metal shaping and cutting often generate significant vibrations during operation. Spring bearings allow disturbances to be reduced. This allows presses and automatic punching presses to be operated even in the direct vicinity of residential areas without disturbing or inadmissible vibrations.

In the metal processing industries, punches and presses with maximum press forces of between 100 and 5000 kN and with machine weights of between 10 and 100 t are often used for metal forming and cutting. When in operation, such machines generate considerable vibrations and annoying noise. This has in turn led to strict official regulations limiting the level of admissible vibrations. The criterion used for assessing such emissions is vibration strength (or perception strength) KBFmax. The maximum values to be observed are specified in DIN 4150-2. This indicates that with neighbouring residential areas a level of KBFmax = 0.15 during the day and KBFmax = 0.1 at night may not be exceeded. If residents make a complaint and it is found that these thresholds were not observed, the company's operating licence may be withdrawn. Vibrations can, however, also spread through the entire building and generate local resonance in the building structure. Even office rooms far removed from the source of the disturbance can thus suffer from vibrations.

Spring bearing of the KP series manufactured by KTI with integrated viscous safety damping, Bearing capacity 120 kN. To protect operators, the steel springs are clad in protective metal sheets.

Spring bearings provide the perfect solution

For the above reasons, presses, punches and other machines causing vibrations are today placed on spring bearings. These are compact elements comprising steel springs and an integrated safety damping (Fig. 1). The machine-spring bearing system is designed for a natural frequency in the range 2 to 7 Hz and with damping in the range 0.1 to 0.25. With an installation height between 150 and 600 mm, these spring bearings will, with a static sinking of only a few millimetres, cause a reduction of more than 90% in all generated vibrations.

Spring bearing of the PWG series manufactured by KTI for sub-surface installation with integrated viscous safety damping and a bearing capacity of 2,500 kN

KTI – latest generation of high-tech spring bearings

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The centrepiece of KTI spring bearings are the high-quality steel springs, which bear the static and dynamic loads of the machine. The strongest springs can bear a load of over 100 kN. For higher loads, the bearings are strengthened with more springs. The durability corresponds to the service life of the machine.

Spring suspension of a 1,600-kN automatic punching and forming machine with spring bearings of the KP series manufactured by KTI

Customer-specific adjustment of bearings

To keep any machine reverberations as low as possible even when caused by single thrusts, spring bearings are now provided with a maintenance-free and no-wear viscous safety damping. This involves a stamp system dipping into a viscous mass. The movement of the stamp in the mass generates a damping effect proportional to the speed of up to D = 0.25. Non-slip holding plates are used for screwless fixing of the spring bearings, which are placed above and below the spring bearings and effectively prevent any shifting of the machine. For precise alignment of the machine after it has been fully installed, the spring bearing bases can be raised hydraulically and steel sheets laid underneath.

Spring bearings are manufactured by KTI in various versions precisely according to customer requirements up to a bearing strength of 400 tonnes per spring bearing (Fig. 2). The spring bearings are designed separately for each machine; this means vibration insulation can be optimised and all movements of the machine resulting from the spring suspension can be kept below a predefined threshold. Such spring bearings were used insulate successfully presses of the company Haulick + Roos GmbH in Pforzheim, Germany with a press force of, for example, 1,600 kN and a stroke rate of up to 300 min-1 (Fig. 3). The vibrations generated by this machine were reduced by more than 90%. Projects involving larger presses with a press force up to 4, 000 kN were also successfully executed with Haulick + Roos.

Spring bearings with clear advantages and wide applicability

Machines positioned on spring bearings provide a wide range of advantages: as the dynamic forces are for the most part absorbed by the spring bearings, a stronger and more expensive foundation is not required. Staff and service building are also protected from excessive vibrations; the transmission of structure-borne noise is prevented and any changes to the machine can be simply compensated by means of the spring bearings. KTI-Schwingungstechnik has been operating in the area of vibration insulation for over 20 years. We develop and sell spring bearings for machines with net weights from approx. 10 to 3,000 tonnes. Numerous presses and punches have already been installed and insulated with KTI spring bearings at various locations around the world.

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