ZANI presse

MECHANICAL PRESSES

INDEX

01

HOW TO CHOOSE A PRESS

HANDBOOK OF THE IMPORTANT PARAMETERS FOR CHOOSING CORRECTLY

A good metal sheet stamping result depends on the quality of three basic elements:
- **press**
- **tooling die**
- **metal sheet**

When the customer begins the press selection process, the part to be stamped will affect the specifications and decisional criteria. Taking the right decision since the beginning will lead to a high productivity rate and quality of the part.

Here below are reported the parameters to be defined before the final decision is taken:

- **Modality of use:** single stroke, progressive, transfer.
- **Calculate the significant physical parameters:** force, energy and torque.
- **Defining the main technical features:** speed, bolster dimension, kind of kinematic (eccentric, with levers and slow-down movement or servo).
- **Construction accuracy of the press required from the tooling die and productive process** (deflection, parallelism, perpendicularity, clearances of the slide's guides).
- **Choose the necessary automation:** monitoring and control of the press, auxiliary equipment on board.

02 FORMING PROCESSES

A SINGLE STROKE

In a single stroke operation, the operator or robot places the material on the tooling die.
The press starts and the part is stamped. After this operation, the press is stopped at top dead centre and the operator removes the material from the die.
The sequence is repeated until the number of produced parts is reached.

ADVANTAGES

- MUCH MORE EASIER FORMING PROCESS (IN ONE OPERATION)
- CENTER LOAD IN RELATION TO THE PRESS' PLATE

DISADVANTAGES

- VERY LOW PRODUCTIVITY
- THE MAJOR RISKS RELATED TO THE OPERATOR REQUIRE A HIGHER SECURITY LEVELE

B PROGRESSIVE

In a progressive operation, the stamping steps are combined in a single die. The starting material, in the way of coil, is placed on the decoiler and successively straightened through straightening rolls before being inserted into the progressive tooling die by the feeder.

The carrier strips carry the material in all the die steps until the last one, in which the part is stamped and the carrier strips cutted.

ADVANTAGES

- RATHER SIMPLE PRESSES
- HIGH PRODUCTIVITY RATE

DISADVANTAGES

- AMOUNT OF SCRAPS (MAINLY FOR THE PRODUCTION OF COMPLEX AND ASYMMETRIC SHAPES)
- DIE COMPLEXITY

C TRANSFER

In a transfer operation, the material is separated from a step to another. This separation can take place outside the press o directly in the first step.

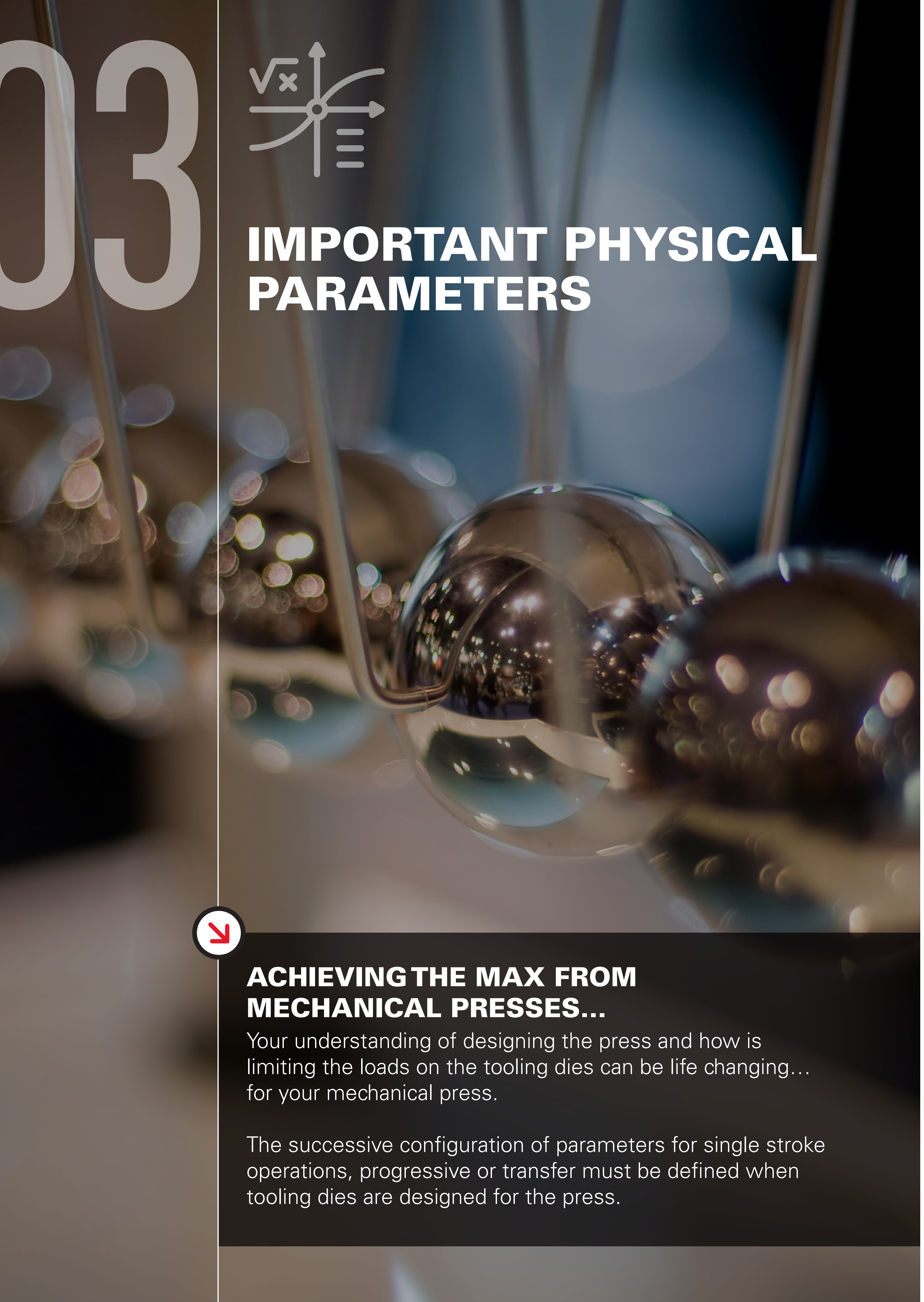
The transfer is normally equipped with two bars and a system of grippers moves the material from a step to the next one until the part is cutted end expelled from the press.

ADVANTAGES

- BETTER USE OF MATERIAL (FEWER SCRAPS)
- POSSIBILITY TO GET COMPLEX SHAPES USING A HIGH NUMBER OF OPERATIONS
- RATHER SIMPLE SINGLE STEP OF TOOLING DIE

DISADVANTAGES

- OFF CENTRE LOADS
- BIG DIMENSIONS OF INSTALLATION
- HIGH INVESTMENT LEVEL



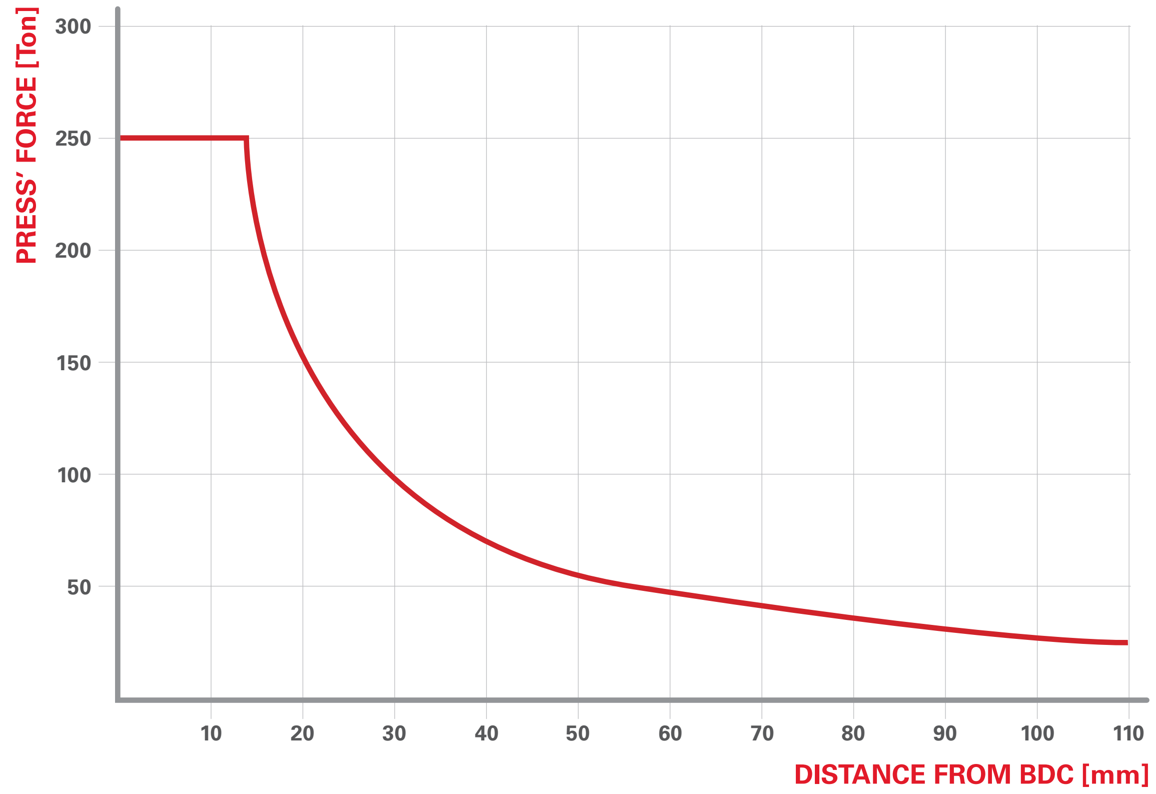
03 IMPORTANT PHYSICAL PARAMETERS

ACHIEVING THE MAX FROM MECHANICAL PRESSES...

Your understanding of designing the press and how is limiting the loads on the tooling dies can be life changing… for your mechanical press.

The successive configuration of parameters for single stroke operations, progressive or transfer must be defined when tooling dies are designed for the press.

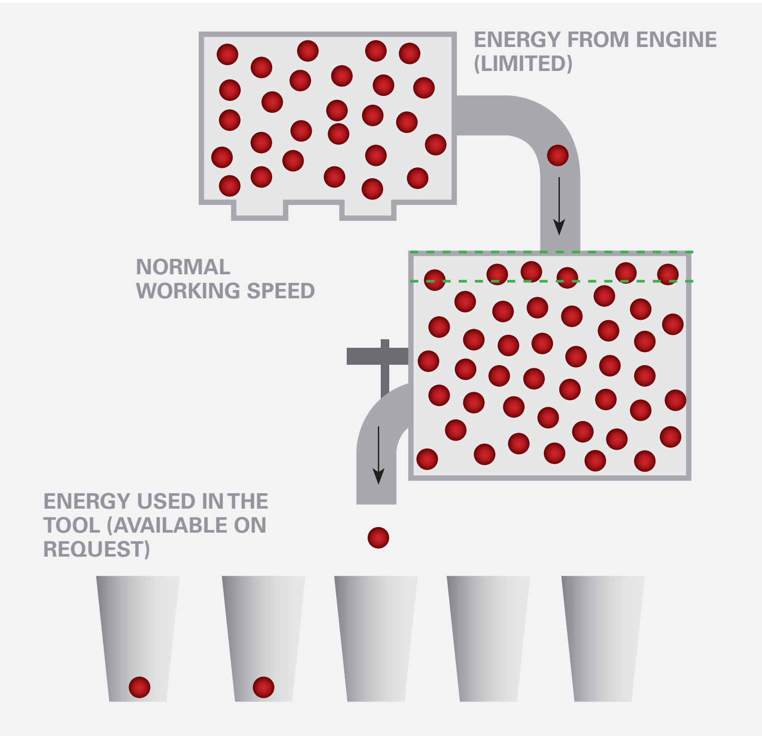
CURVE OF THE FORCE

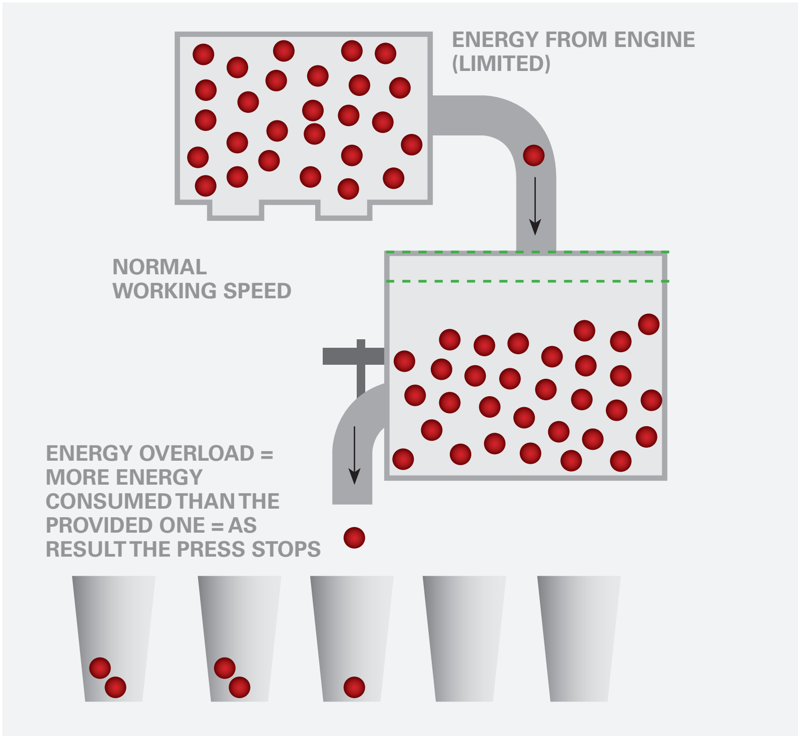


Every mechanical press has a curve of force in its documentation. The graphic here above is a very important instrument to design a press, since shows the relationship between the distance from the bottom dead centre and the force of the press which we are dimensioning. The nominal distance of the press, usually 6,35 mm from BDC for simple reduction-kinematics or 12,7 mm from BDC for double-reduction kinematics, means that the maximum force of the machine exerted on the tooling die is between the nominal distance and the end of the stroke.
The press' producer will determine the maximum torque and keep this value as limitation for every point above the nominal distance.
Since the connections of the press lose mechanical advantage over the nominal distance, the resulting effective allowable force decreases.
The reduction of the force over the nominal distance is less significant for the press with slow-down movement, since the mechanical advantage decreases with a less dramatic rate than a classic conrod-crank kinematic. Every tooling die must keep the load within this curve. Though overloading the press over this point won't overloading the whole structure or signalling an overload on a conrod, the transmission will experience an excessive load on the gears.
This is true because the max torque used for designing the gears and shafts, represents one of design's limit.

ENERGY

A mechanical press is limited in the availability of energy per stroke, with the flywheel providing the energy to form the piece. The main motor provides energy to the flywheel which consume it during the forming's phase. Typically, the press' manufacturer allows a reduction of the energy inside the flywheel of 10-20% per stroke.
This parameter imposes the limitation in energy per stroke to be absorbed from the formed part.
The allowable energy is given by the press' manufacturer and is also included in the press' specifications.
During the planning of the die attention must be paid to the energy per single stroke but also to the speed of forming to which this energy is required. The more the flywheel rotates faster, the more energy is generated; however if the energy utilized to form the part is lower than that provided by the flywheel at the desired speed, the press will tend to slowing down until it stops because it won't be able to recover all the lost energy anymore.

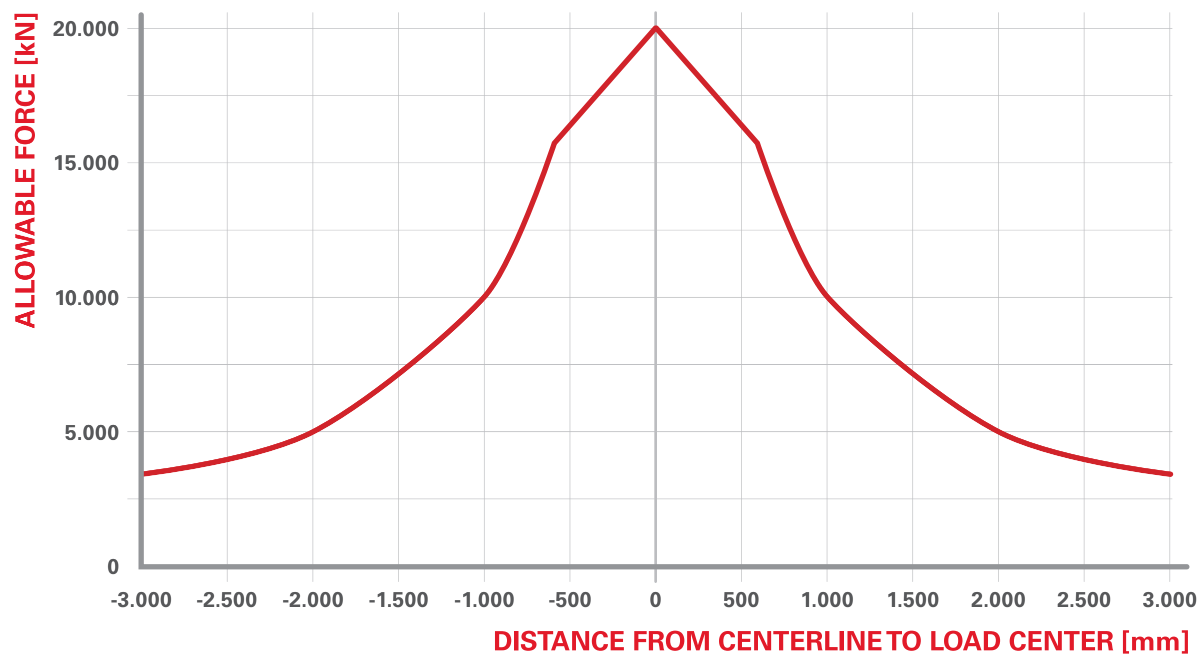


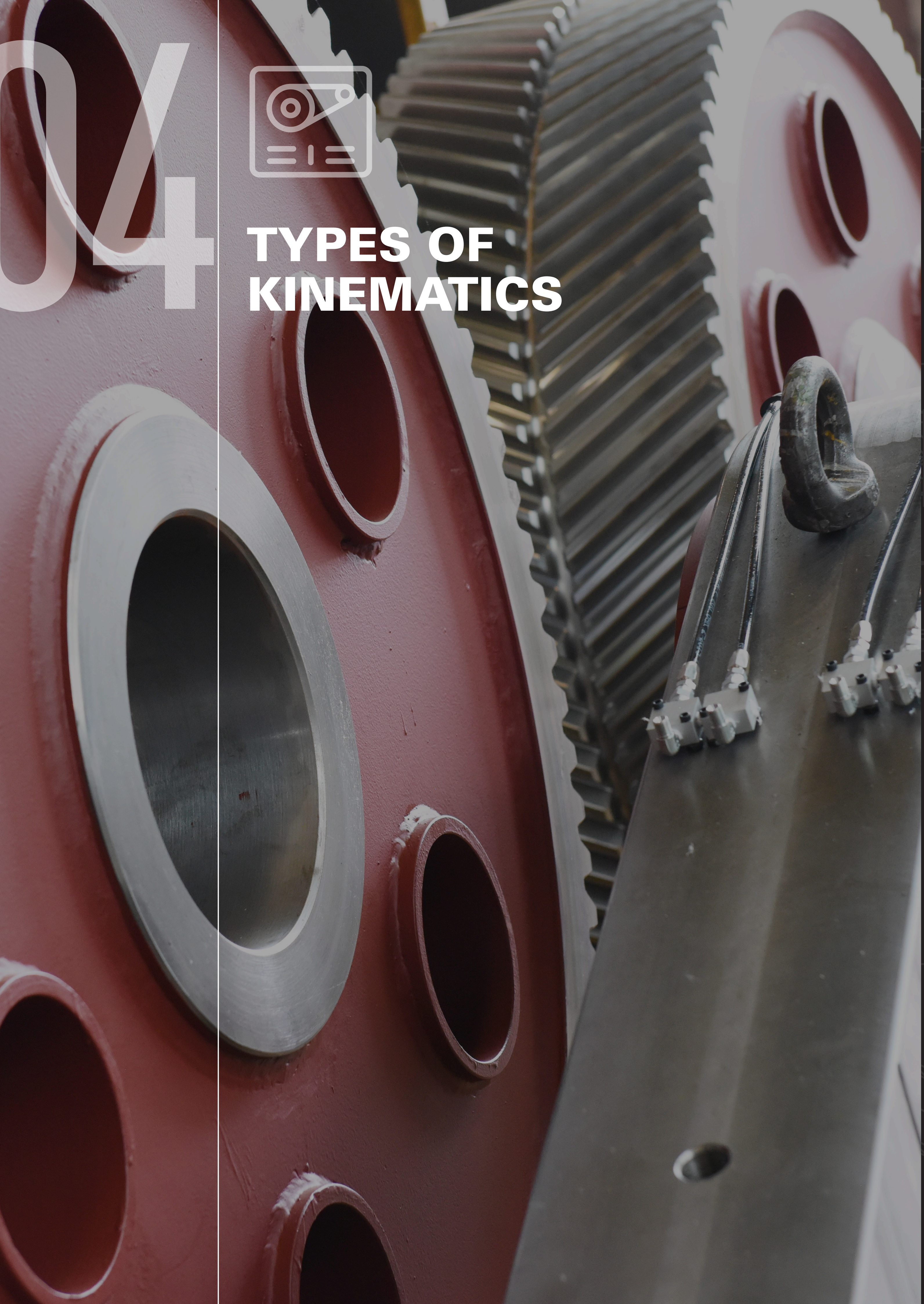


The area below the curve of the force is equivalent to energy. Knowing the force- required values at different distance from BDC is possible to determine the total energy required by summing up all the areas under the curve.

CONSIDERATIONS ABOUT OFF-CENTER LOADS

The quantity of compensation of the loads applied to tooling dies, defines another parameter to be defined.
This becomes a huge problem when comes to progressive or transfer applications. The tooling die is physically much more centred for applications with single tool and usually apply a balanced load to the press. But the loads on the tooling dies can be bigger at the entry than the exit for progressive and transfer applications.
Since in many projects related to presses are based on a uniform capacity all over the area from right to left, the die's load must be designed so that every half of the press has 50% of the capacity.
A good general rule for loads-balancing from left to right: limit the effort max deviation between the connecting rods to 10% max load.
This implies that if the 50% of the force is applied to the entrance of the press, but only the 15% is applied to the exit, the compensation's rule is violated. A common approach to solve this scenario is to add nitrogen springs to the low-loaded side so to take the compensation to a uniform load. Using a mechanical press with a big off-center load condition leads to increase the wear of guides on the slide and on the guide post of the tooling die.
Using a 2000 Ton press for example, the rule of the 10% can control the loads compensation. If the entry side of the press works at the max capacity of 1000 Ton., then the right side should have a load of at least 800 Ton. This load will have a total value of 1800 Ton.
If this condition might be not feasible in any case, it is also be possible to design the press in order to guarantee major off-center load values equal to 20% or also 30% of the max load.





04

TYPES OF KINEMATICS

1

KINEMATIC WITH ECCENTRIC

It is the common one. The law of movement of the slide is sinusoidal. It has no specific application field. It is possible to have mechanical stroke change application.

2

KINEMATIC WITH TRADITIONAL KNUCKLE JOINT

It is typical for coining operations. The law of movement of the slide shows a decisive slow down stage but only near the BDC. During the approaching and moving away phases, speeds are quite high. It is not possible to have mechanical stroke change application.

3

KINEMATIC WITH DOUBLE KNUCKLE JOINT

Also known as modified knuckle joint this is an adaptable kinematic recommended for blanking, but also drawing operations.
The law of movement of the slide shows a slow down stage before BDC up to 70-80% and is also possible to have in a certain stage a constant speed.
It is possible to have linear stroke change application.

4

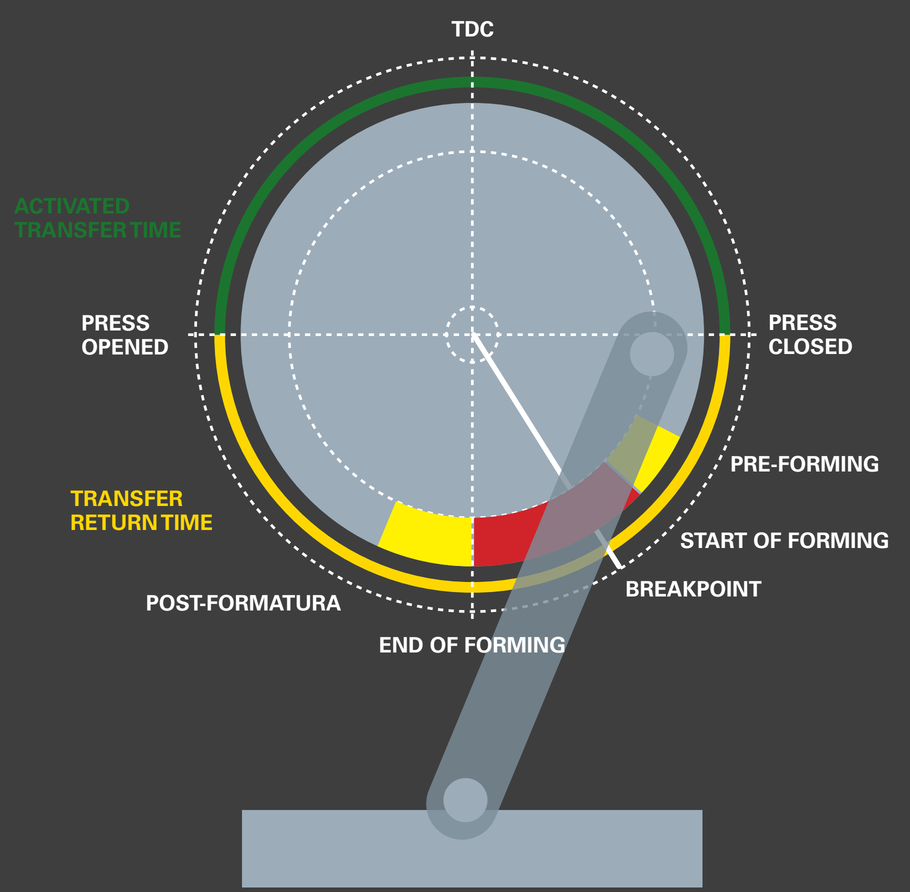
KINEMATIC WITH LINK MOTION

It is a kinematic that has been designed by the ingenuity and creativity of Zani's engineers. The solidity of the system allows a reduction of the head-structure dimensions and as consequence increases the rigidity of the whole system. This is a kinematic that allows a slow down movement up to 40% ÷50% but thanks to the symmetry of its curve of movement is also appropriate to high speed stamping as well as for applications on last generation presses controlled by Servo motor.

05

THE SERVO PRESS

The Servo presses are the latest evolution in the world of metal sheet mechanical presses. They are equipped with one or more servo motors specifically designed for presses: they have a high torque at lower rotations per minute.
A conventional mechanical press cannot have enough work energy for forming the material till reaching the nominal speed.
The Servo press instead, has a complete opposite behaviour and has the max energetic content from the minimum speed.
Servo motors don't need any maintenance and also without the clutch and flywheel you have a simplification of the kinematic chain that brings to a lower environmental impact in terms of noise and consumptions.
The consumption – reduction is achieved thanks to an energetic management system through capacitors and/or flywheel motors.
Energy is stored during the free movement of the slide and returned during the forming phase.
The movement modalities of the slide are infinite programmable, and this allows the realisation of forming processes otherwise not feasible with conventional presses. The servo technology in the end is extremely flexible and permits the optimization of every kind of process with resulting increased productivity and efficiency.



06

GEOMETRIC ACCURACY

OVERALL CLEARANCE

To check overall bearing clearance, set air counterbalance pressure to "0". Install a hydraulic jack and dial indicator between the bolster and slide.
Zero the dial indicator and pressurize the jack to 10% of press' capacity: wait a couple of minutes so lube is squeezed from bearings then check the dial indicator to determine overall clearance. For two-point presses use jacks and dial indicators under each connection point.

PARALLELISM

Parallelism should be checked with the counterbalance pressure set high enough to lift the slide.
"0" is set at the first corner measured and then the dial indicator and base is moved to the other three corners.
Check the press manuals to determine if the parallelism meets the manufacturers recommendations. If not, then adjustments must be made.
During any adjustments, close attention must be paid to slide guide clearance to ensure that damage does not occur once press operation is resumed.

PERPENDICULARITY

Perpendicularity should be checked in the right to left and front to back directions. This can be accomplished using a precision angle plate and a dial indicator with a magnetic base.
The combination of perpendicularity and parallelism is limited by the accuracy of the components involved.

SOLUTIONS FOR QUICK DIE CHANGE

SELECT YOUR APPROPRIATE DIE CHANGE SYSTEM ACCORDING TO YOUR NEEDS

To have a major availability of your press and consequently to obtain a whole better efficiency of your OEE installation (acronym of Overall Equipment Effectiveness), the choice of the die change system typology is very important. The higher the frequency of die-change is required, the quickest and automatized the solution you might choose will be.

MANUAL WITH BRACKETS

The first step to change the die as quick as possible is to provide the press a system of hydraulic die lifters on the lower bolster but also support brackets on the exit side of the die. The operator in this way is able to manually pushing the die inside the press with a force that varies from 1 to 3% of max die's weight.

TROLLEY

Tool change system by means of one motorized table, mounted on frame and equipped with guides. The movement of the table is supported on the front through legs with wheels sliding on rails positioned on the floor level. The exit of the table is only on the press front side whereas the locking is automatic once it has reached the working position.

MOVING BOLSTERS

For heavy tools, the press can be equipped with one or two moving bolsters sliding on ground rails, front/rear direction or with T-Track movement. The best solution depends on the layout of the factory and the accessibility to the dies through crane.
The bolster is automatic clamped once has reached its working position under the press.

bcentric.it

ZANI SPA
Via Centro Industriale Europeo, 32
22078 Turate (CO) - Italia
t. +39 02 96 68 17 1
f. +39 02 96 48 03 52

info@zani.net
www.zani.net

MECHANICAL PRESSES

Via Centro Industriale Europeo, 32
22078 Turate (CO) - Italia
t. +39 02 96 68 17 1
f. +39 02 96 48 03 52

info@zani.net
www.zani.net