PRESENTATION / p 04

TYPES OF SLIDE-WAYS / p 06
  02.1 THIN FLAT SLIDE-WAY
  02.2 FLAT SLIDE-WAY WITH BORES
  02.3 PRISMATIC SLIDE-WAY
  02.4 SLIDE-WAY WITH MULTIPLE SLIDING SURFACES

MAIN CHARACTERISTICS / p 08
  03.1 PARALLELISM
  03.2 SQUARENESS
  03.3 FLATNESS
  03.4 ROUGHNESS

PRECISION AND TOLERANCES / p 12

CENTRE TO CENTRE DISTANCE AND TOLERANCE / p 14

MATERIALS AND HARDNESS / p 16
  06.1 TOOLS STEELS
  06.2 HARDNESS

MATCHING SLIDE WAYS / p 20

TRACEABILITY / p 22

CERTIFICATIONS / p 24
  10.1 QUALITY SYSTEM
  10.2 ENVIRONMENT MANAGEMENT SYSTEM

CONTACT INFORMATION / p 26
At Zorrotz Legazpi S.L.L. we have been producing Machine Tool Slide-Ways for the past few decades.

All Machine Tool is equipped with sliding elements. A specific solution can be adopted with specific designing requirements, for each application.

In all applications, sliding guides are designed to drive with precision the rolling element, in order to guarantee a displacement, as smooth and precise as possible.

In those cases where the “Standard Linear Guides” are not able to satisfy the high requirements of precision and long durability, Special Slide-Ways, are used instead.

Our custom made Slide-Ways, are designed and manufactured in order to achieve better performances.

The Special Slide-Ways manufactured by Zorrotz Legazpi S.L.L., are the ideal solution for those application where long durability, high stability and a strong wear resistance are needed, when standard linear guides, equipped with rollers or bearing, are not sufficient to guarantee the desired quality.

The possibility of manufacturing Slide-Ways according to the customer’s drawing, offers to the engineering department a great flexibility at the time of customizing a product.

The materials and heath treatments used by Zorrotz in the production Slide-Ways, are selected according to the customer requirements: size, tolerances, final application; also taking in count cost saving requirements.

The Alloy Steel used as raw material by Zorrotz, is produced exclusively by the most important European Tool Steel producers.

The quality is guaranteed by industry standard certificates, available to customers upon request.

The experience accumulated by Zorrotz Legazpi S.L.L. performing heating treatments, guarantees the correct implementation of the process and a homogenous hardness all over the Slide-Way’s surfaces. Through hardening treatment is carried out exclusively in our facilities by experienced Zorrotz staff.

Apart from being able to provide a product of excellent quality, we are able to provide a first class customer service to users internationally, thanks to the network of agents available in different countries around the world.

For more information about our company, products and services visit our website at www.zorrotz.com
IN THE CURRENT CHAPTER, ONLY AS A DEMONSTRATIVE PURPOSE, WE ILLUSTRATE SOME COMMON EXAMPLES OF PROFILES AND SHAPES OF SLIDE-WAYS WE CAN PRODUCE. HOWEVER, THIS LIST OF EXAMPLE IS LIMITED IN COMPARISON WITH THE WIDE RANGE OF SLIDE-WAYS WE CAN MANUFACTURE AT ZORROTZ.

BEING ABLE TO MANUFACTURE PRODUCTS, UPON CUSTOMER’S DRAWING, WE ARE ABLE TO SATISFY THE MOST DIFFERENT REQUESTS.

IF AMONG THE FOLLOWING EXAMPLES YOU CANNOT FIND THE EXACT DESIGN OF THE SLIDE-WAY YOU ARE LOOKING FOR, WE INVITE YOU TO GET IN CONTACT WITH US OR ANY OF OUR AGENTS, WHO WILL BE PLEASED TO ASSIST YOU.

02.1
THIN FLAT SLIDE-WAY

These are Slide-Ways of thickness between 3 and 6 mm approximately. These products are generally used in order to cover pores on the cast- ed iron machine-tool bed or revamping old machine-tool with worn out slides. They are usually glued directly onto the machine-tool bed, and finally re-ground once they are in their final position. Thin Flat Slide-Ways of the same purchase order, are manufactured and ground together, in order to guarantee they all have exactly the same thickness.

02.2
FLAT SLIDE-WAY WITH BORES

These Slide-Ways have the same function as Flat Thin Slide-Ways. The main difference between them is the technique used to secure the Slide-Ways to the machine tool bed, in this case using bolts. Both, countersink or counterbore bores can be provided, depending on customer’s needs. Flat Slide-Ways with bores, of the same order are manufactured and ground together, in order to guarantee they all have exactly the same thickness.

02.3
PRISMATIC SLIDE-WAY

This type of Slide-Ways is generally used in applications where, apart from the sliding movement, a guide, who forces the carriage to an exact centred position, is required. They are generally manufactured with bores that allow securing them to the machines with the help of bolts. We can also manufacture Prismatic Ways in a shape of a circular segment. Used in conjunction with straight segments, they allow the creation of “Non-linear” path. We guarantee that both, linear and circular segments match in size, in order to guarantee the smooth transition throughout the entire path.

02.4
SLIDE-WAY WITH MULTIPLE SLIDING SURFACES

This Slide-Way is the type that requires the highest manufacturing skills. The sliding of the carriage, or the bearings, is performed ensuring its position on two or more surfaces, perpendicular to each other. Strict Parallelism, Flatness and Squareness tolerances are usually required on these products. Both skilful personnel and “Cutting Edge” equipment are employed in order to achieve the best results. We are able to manufacture different profiles according to customer’s requirements.
DEPENDING ON THE TYPES OF THE SLIDE-WAYS, (FORMS, FINAL APPLICATIONS AND DIMENSIONS), WE CAN IDENTIFY A FEW CHARACTERISTICS WHICH DESCRIBES: TOLERANCES, PRECISION, SURFACE CONDITION, AND THEREBY THE QUALITY OF A SLIDE-WAY.

THE MAIN CHARACTERISTICS WHICH WE CAN IDENTIFY IN A SLIDE-WAY ARE:

**03.1**
PARALLELISM

**03.2**
SQUARENESS

By “Parallelism” we identify, the maximum error between two parallel flat surfaces. This characteristic is critical for the Slide-Way, due to the fact that any error of parallelism, is directly transferred to the machine’s X, Y, Z reference planes, having a direct impact on the quality and tolerances the machine can achieve.

**How to measure**
According to the following images, the value of the parallelism is the absolute value of the maximum acceptable difference between dimensions X and Y.

Usually we refer to a virtual ideal plane, or datum, “A”, as the reference surface for the measurement.

It can be shown as an absolute value, over the overall length, or as a value of mm/Mt.

As the parallelism, the squareness is another important characteristic for Slide-Ways.

Any dimensional error in squareness, has a direct influence in the positioning of the headstock or the carrier, therefore in tolerances and quality the machine will eventually achieve.

The squareness, defines the absolute value of the maximum error between two perpendicular surfaces.

Usually we refer to a virtual ideal plane, or datum, “A”, as the reference surface for the measurement.

**How to measure**
Taking as a reference a flat surface (Datum) “A”, the value of squareness, is the maximum allowable error measured between the ideal plane, perpendicular to the reference surface, and the real piece.

It can be shown as an absolute value, over the overall length, or as a value of mm/Mts.
03.3

FLATNESS

The flatness defines the maximum allowable error between an “ideally flat surface” and the real surface we need to measure the flatness of. Flatness can be measured with the Slide-Way in two different positions:

- Free state
- Fastened to the machine tool bed

As shown in the pictures, depending on the measuring method (Free state or Fastened), the flatness of the same Slide-Way can change remarkably.

The flatness of the Slide-Way when “fastened”, can be shown as:

\[
\text{SLIDE-WAY FLATNESS} \leq \text{Bed flatness} + \text{Slide-Way Parallelism}
\]

The importance of the flatness in Slide-Ways and the method of the measurement, depends on the final use and the type of machine.

Generally, the flatness should be measured always after having fastened the Slide-Way on the machine-tool bed.

This mainly due to the fact that:

- The final flatness will depend mainly on the bed flatness.
- Achieving a restricted flatness of the Slide-Way in a “free state” has a strong impact on the production costs.

Generally, when the sum of the flatness errors, between the tool machine bed and the Slide-Ways, is higher than the required flatness, a final grinding of the whole assembly, might be necessary.

**How to measure**

As mentioned previously, before measuring the flatness of the Slide-Ways, it is important to define whether the measurement should be in a “free-state” or “fastened on the tool machine bed”.

In all cases, the flatness of a surface will be the difference between its highest and lowest points.

All the Zorrotz Legazpi S.L.L. Slide-Ways are produced considering the flatness as measured once the piece is mounted and correctly fastened to the machine.*

In this case, the flatness will always be equal to the maximum parallelism error.

* unless otherwise specified on the drawing
The roughness is the property describing the state of any machined surface. Any tool machining process, create furrows on the machined surface. Depending on the tool type and speed used during the manufacturing process, the size of the resulting furrows changes. The size and shape of these small irregularities, defines the surface roughness.

**How to measure**

The roughness of a surface is measured by a specific instrument called Profilometer, or Surface Roughness Tester. The procedure of defining the roughness, consist in recording the profile of the surface and measuring the amplitude of its peaks. Roughness can be defined according to various scales and units. If not specified otherwise, the unit scale used by Zorrotz for the measurement of the roughness is “Ra.”
THANKS TO THE FLEXIBILITY OF OUR PRODUCTION PROCESSES, WE ARE ABLE TO PRODUCE SLIDE-WAYS OF MULTIPLE PRECISIONS AND FINISHING.

IN THE FOLLOWING TABLE, YOU CAN FIND TWO DIFFERENT QUALITY STANDARDS (STANDARD AND FINE).

“STANDARD”: Dimensional Tolerances which satisfy the majority of the guides produced for the Machine-Tool market.

“PRECISION”: Fine dimensional tolerances, applicable to those products which require a higher precision.

<table>
<thead>
<tr>
<th></th>
<th>STANDARD</th>
<th>PRECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PARALLELISM</td>
<td>&lt; 0,02</td>
<td>&lt; 0,01</td>
</tr>
<tr>
<td>PERPENDICULARITY</td>
<td>&lt; 0,05</td>
<td>&lt; 0,005</td>
</tr>
<tr>
<td>FLATNESS*</td>
<td>&lt; 0,15/Mt</td>
<td>&lt; 0,005/300mm (0.015/Mt)</td>
</tr>
<tr>
<td>ROUGHNESS</td>
<td>Ra 0,8</td>
<td>Ra 0,2</td>
</tr>
</tbody>
</table>

*Flatness measured in “free state”

<table>
<thead>
<tr>
<th></th>
<th>STANDARD</th>
<th>PRECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>THICKNESS</td>
<td>+/- 0,1</td>
<td>+/- 0,005</td>
</tr>
<tr>
<td>LENGTH</td>
<td>+/- 1</td>
<td>+/- 0,1</td>
</tr>
</tbody>
</table>
Unless a bevel is correctly indicated on the customer drawing, all holes will be finished breaking sharp edges.

The positioning of the holes, and the precision of the distance centre to centre between holes, can change depending on the manufacturing processes used.

The main factor which can influence the precision of the distance centre to centre is the contraction or distension of the steel, during the heating treatment.

During designing process, the engineers should keep in mind the following warnings:

1) Drilling parts after “Through Hardening”, is a time-demanding and difficult operation and it requires special costly tools to be performed.

2) During “Through Hardening”, the piece, either shrink or elongate. This makes difficult to control the distance between centres of two holes.

3) Since “Induction Hardening” is a surface treatment of approximately 3 mm depth, it is easier and faster to drill an induction hardened workpiece than a through hardened workpiece.

As a consequence, it is also cheaper to achieve restricted tolerances on the dimensions involving distances between the centres of holes.

4) Nitriding is a heat treatment which does not deform the workpiece. Any drilling can be performed before the heating treatment, as the centre to centre holes distance will not change.

Besides, being the nitride surfaces, extremely hard to machine, it is not advisable to drill them after the treatment is applied.

In the following table you will find a summary of the tolerances we can achieve in Slide-Ways, for each of the heating treatments mentioned above.

As we are continuously improving our processes and precisions, feel free to contact us in order to know all our possibilities.

<table>
<thead>
<tr>
<th></th>
<th>STANDARD</th>
<th>PRECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>THROUGH HARDENING*</td>
<td>+/- 0.7 mm/mt</td>
<td>+/- 0.1 mm/mt*</td>
</tr>
<tr>
<td>INDUCTION TEMPERING</td>
<td>+/- 0.7 mm/mt</td>
<td>+/- 0.1 mm/mt*</td>
</tr>
<tr>
<td>NITRIDING</td>
<td>+/- 0.5 mm/mt</td>
<td>+/- 0.5 mm/mt</td>
</tr>
</tbody>
</table>

*Any drilling performed after the “Through hardening” increases the cost of production.
Steel used in the production of Slide-Ways, is generally part of the family of “Tool Steels”. This family of steels include only high alloyed steels. Their chemical composition is specifically thought, in order to allow for heating treatments to be applied, and enhance the steel properties.

All steel used by Zorrotz, is produced by the biggest European tool steel producers. Their quality is guaranteed by their quality management systems and internationally recognised certifications.

The Slide-Ways made by Zorrotz are done with selected steels in order to guarantee:

- Low friction resistance
- High wear resistance
- Long life of the Slide-Way
- Rolling elements resistance
- Surface hardness

Depending on each specific application, technical specifications and dimensional tolerances, we are able to provide different solutions, proposing the proper steel to be used and heating treatment to be applied.

We are able to satisfy the customer’s request, suggest alternative solutions, providing the required technical solution, at the most competitive level.
The hardness is one of the most important characteristics of a Slide-Way. A higher hardness is generally synonymous of a good wear resistance and, in turn, longer durability over the time.

The usual heating treatments offered by Zorrotz are:

Through Hardening:
- The part is fully heated and tempered down to the “core” of the piece
- The Slide-Way will have the same hardness all over
- Allows achieving very high resistance to compression
- Non indicato per guide di grandi spessori
- Not indicated for Slide-Ways with strict tolerances on the distance “centre to centre” of holes

Induction tempering:
- Surface treatment
- The hardness on the piece reaches a maximum depth of 3 mm
- Economically advantageous for Slide-Ways of big thickness

Nitriding:
- Depth of hardness limited to 1 mm.
- Hardness can reach 1000 Vickers (Depending on the steel used).
- Dimensional stability is guaranteed during heating treatment.
- Not indicated for Slide-Ways with high thickness or where high compression resistance is needed.

In the following table we can find a summary of the most common steels used for the production of Slide-Ways, some of the heating treatments we can execute, maximum hardness achievable and finally, the maximum length we are capable of manufacturing in one piece.

If the solution you are looking for is not available on this list, please get in touch with us as we are always finding new solutions for our customers.

<table>
<thead>
<tr>
<th>HEATING TREATMENT</th>
<th>DIN STANDARDS</th>
<th>WERKSTOFF STANDARD</th>
<th>HARDNESS</th>
<th>HARDNESS DEPTH</th>
<th>HARDNESS AT THE CORE</th>
<th>MAX LENGTH (<em>mm</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THROUGH HARDENING</td>
<td>90MnCrV8</td>
<td>1.2842</td>
<td>Up To 58/60 HRC</td>
<td></td>
<td></td>
<td>3.8 Mt</td>
</tr>
<tr>
<td></td>
<td>X15CrVMo121</td>
<td>1.2379</td>
<td>Up To 60/62 HRC</td>
<td></td>
<td></td>
<td>3.8 Mt</td>
</tr>
<tr>
<td></td>
<td>X210CrV12</td>
<td>1.2080</td>
<td>Up To 60/62 HRC</td>
<td></td>
<td></td>
<td>3.8 Mt</td>
</tr>
<tr>
<td>TEMPERING INDUCTION</td>
<td>C60</td>
<td></td>
<td>Up To 60/62 HRC</td>
<td>Up To 3 mm</td>
<td></td>
<td>4 Mt</td>
</tr>
<tr>
<td></td>
<td>C45</td>
<td></td>
<td>Up To 58/60 HRC</td>
<td>Up To 3 mm</td>
<td></td>
<td>4 Mt</td>
</tr>
<tr>
<td></td>
<td>40CrMnMo7</td>
<td>1.2311</td>
<td>Up To 58/60 HRC</td>
<td>Up To 3 mm</td>
<td>100 Kg/mm²</td>
<td>4 Mt</td>
</tr>
<tr>
<td></td>
<td>40CrMnMo58.6</td>
<td>1.2312</td>
<td>Up To 58/60 HRC</td>
<td>Up To 3 mm</td>
<td>100 Kg/mm²</td>
<td>4 Mt</td>
</tr>
<tr>
<td></td>
<td>90MnCrV8</td>
<td>1.2842</td>
<td>Up To 58/60 HRC</td>
<td>Up To 3 mm</td>
<td></td>
<td>4 Mt</td>
</tr>
<tr>
<td>NITRIDING</td>
<td>HARDOX 500 (UNI)</td>
<td>URSSA 500</td>
<td>Up To 1000 Vickers</td>
<td>0,1 mm – 1mm</td>
<td>500 Vickers</td>
<td>7 Mt</td>
</tr>
<tr>
<td></td>
<td>HARDOX 400 (UNI)</td>
<td>URSSA 400</td>
<td>Up To 1000 Vickers</td>
<td>0,1 mm – 1mm</td>
<td>400 Vickers</td>
<td>7 Mt</td>
</tr>
</tbody>
</table>
The line of union between two Slide-Ways, is a very critical area. Any difference, even if small, can affect the correct sliding or rolling of the moving elements.

Any error can lead to an early wear of the sliding element, and generate unexpected vibrations.

To limit any critical situation to a minimum, at Zorrotz, we are able to produce Slide-Ways perfectly joined between them.

In case the use requires perfectly joined Slide-Ways, it should be clearly indicated on the drawing with a note (i.e. “Grind all ways together”, “All ways at the same exact thickness”)

The joint between the Slide-Ways can be done in different forms according to their final application.

Below some examples:

<table>
<thead>
<tr>
<th>TYPE OF JOINTS</th>
<th>APPLICATION</th>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRAIGHT</td>
<td>General</td>
<td>Standard manufacturing process</td>
<td>Possible skipping</td>
</tr>
<tr>
<td>TILTED</td>
<td>Special for tool machine high precision</td>
<td>Smooth and progressive transition of the rolling elements</td>
<td>Not standard manufacturing process</td>
</tr>
<tr>
<td>SQUARE</td>
<td>Special application</td>
<td>For special applications (assembling and alignment)</td>
<td>Complex execution</td>
</tr>
</tbody>
</table>
All our products are produced according to the “highest workmanship standards”. We execute production and project management processes, according to the specifications specified by our Quality Management.

The data of all relevant production processes is recorded for future traceability.

All our Slide-Ways are identified and etched with the Zorrotz logo, and the internal “Manufacturing Order Identification Number”. This number allows us to identify and trace back to the production data of the Slide-Way, even years after the manufacturing date.

Zorrotz Legazpi is committed to the highest quality standards. Our internal Quality Management System covers all Management, Manufacturing and Quality Check processes.

The certification of our Quality Management System is made according to the ISO 9001 standard which guarantees its correct application. (Since 1999)

The Zorrotz’s strong compromise with a clean environment and a correct waste management, has brought Zorrotz Legazpi S.L.L. to obtain the ISO 14001 certification (year 2002).