E.T.S. de Ingeniería Industrial,
Informática y de Telecomunicación

Design of frontal access bathroom device for reduced mobility persons

Grado en Ingeniería en Diseño Mecánico

Trabajo Fin de Grado

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El desarrollo del presente TFG supone la última etapa de un camino en el que el esfuerzo es la única vía para llegar al final. Por tanto, es momento de agradecer a las personas que han estado cerca durante este tiempo:

- En primer lugar a mis padres, porque sin su esfuerzo nada de esto no hubiera sido posible.
- En segundo lugar, y no menos importante, a mi hermana. Por ser referente de esfuerzo y fuente de ánimo.
- A los compañeros que aparecen por el camino, a través del cual han surgido amistades. Porque cada uno en su forma y medida, han formado parte del día a día.
- A Ignacio Latorre, por su esfuerzo incansable en ayudar en todo lo posible a sus alumnos.
- En general, a todas las personas que se cruzan por el camino, porque cada una aporta algo en la vida.

"De nuestros miedos nacen nuestros corajes y en nuestras dudas habitan nuestras certezas. Los sueños anuncian otra realidad posible y los delirios otra razón. En los extravíos nos esperan los hallazgos, porque es preciso perderse para volver a encontrarse"

(Eduardo Galeano)

Resumen

La elaboración del presente TFG tiene como objetivo el desarrollo de un dispositivo electromecánico que facilite la acción de transferencia de una persona con movilidad reducida, desde una silla de ruedas hasta la plataforma de higiene personal (baño o ducha). De manera generalizada, el asistente que lleva acabo esta acción realiza un esfuerzo importante al levantar gran parte del peso corporal del minusválido.

El dispositivo a desarrollar pretende reducir sustancialmente el número de intervenciones del asistente, así como el esfuerzo físico de las mismas. Para ello, el dispositivo integrará una plataforma de acceso frontal para sillas de ruedas, pudiendo ser utilizado en platos de ducha y/o bañeras.

Palabras clave: movilidad reducida, higiene personal, acceso frontal, sillas de ruedas, minusválido.

Abstract

The elaboration of this DFW has as its objective the development of an electromechanical device that facilitates the transfer action of a person with reduced mobility, from a wheelchair to a personal hygiene platform (bath or shower). Generally, the assistant that carries out this action performs an important effort to lift a large part of the handicapped's body weight.

The device to develop aims to reduce substantially the number of assistant´s interventions, as well as the physical effort of the same. To do this, the device will integrate a front access platform for wheelchairs, and it can be used in shower trays and/or bath tubs.

Keywords: reduced mobility, personal hygiene, front access, wheelchairs, handicapped.

Índice de contenidos

1.- CONTEXTUALIZACIÓN

En la época actual, el desarrollo de la tecnología permite ofrecer productos capaces de resolver cantidad de problemas que se plantean a diario, de una manera sencilla y cómoda. De esta manera y, a través del diseño, se plantean productos y servicios que tienen como objetivo mejorar la calidad de vida diaria de las personas.

Existe un sector de la población que, por diversas circunstancias, dependen cotidianamente de un familiar o cuidador que le ayude en las acciones que pueda llevar a cabo en el día a día: son las personas con movilidad reducida.

Gracias al desarrollo tecnológico mencionado, existen cantidad de soluciones a problemas concretos del día a día que puedan surgir en la vida de estas personas (levantarse de una silla, coger un objeto, desplazarse, etc.). Muchas de estas acciones pueden llevarlas a cabo de manera autónoma gracias a la diversidad de productos existentes.

Sin embargo, en el ámbito de la higiene personal, es dónde la persona con minusvalía siente mayor nivel de dependencia respecto a un familiar o cuidador. En determinados casos, cuando la movilidad de la persona es muy reducida, estas acciones pueden exigir un esfuerzo físico elevado que puede ocasionar lesiones. Además, emocionalmente, la dependencia sobre alguien puede generar cargas que reduzcan la calidad de vida, tanto del paciente como del cuidador.

Pensando en todos estos factores, surge el presente TFG, en el que la voluntad de mejora de la calidad de vida de estas personas es el objetivo primordial.

2.- OBJETIVO DEL TFG

Mediante la elaboración del presente TFG se pretende mejorar la situación y los esfuerzos de las personas al cargo y cuidado de otras con minusvalías físicas o psíquicas…

En base al objetivo general del TFG se presentan los siguientes objetivos concretos a alcanzar:

Objetivos a alcanzar

- **Acceso frontal:** mayor funcionalidad en espacios reducidos comparado con otros sistemas de acceso lateral (radio de giro silla de ruedas).
- **Versatilidad:** la altura ajustable del conjunto, junto a la rotación y el desplazamiento lateral debe permitir su uso en diferentes situaciones o instalaciones (baño y/o ducha).
- **Eliminación de obras y elementos anclados o fijos al terreno:** reducción de costes de instalación, sin necesidad de crear estructuras o elementos fijos que modifiquen la estética del espacio en el que se utilice el dispositivo.
- **Estética:** el dispositivo está destinado a ser usado con frecuencia por personas en un ámbito muy personal como es la higiene. Además, se pretende adaptar el diseño para que pueda ser empleado en el hogar, por lo que la estética debe de ser neutra, evitando diseños recargados y alejados de una imagen de máquina industrial.

2.1.- Alcances y limitaciones

En relación a los objetivos concretos expuestos en el anterior apartado, se plantean objetivos reales en la consecución del proyecto. De antemano se contempla el desarrollo del proyecto como una fase inicial, en la que marcar una línea futura a seguir.

De tal manera, se prioriza dar soluciones a alguno de los principales problemas que presenta el desarrollo del diseño de concepto. Por tanto, se dejan de antemano ciertos puntos problemáticos sin definir de manera concreta, para los cuales se propondrán en otro apartado ideas sobre soluciones más concretas.

Alcances:

- Diseño 3D:
    - Diseño mecánico del dispositivo de recogida y elevación del usuario
    - Diseño mecánico del dispositivo de recepción

Limitaciones:

- No se desarrolla el diseño eléctrico
- No se diseña la automatización programable
- Usos:
    - Puede no ser válido para determinadas disposiciones de cuartos de baño o dimensiones de bañeras y/o platos de ducha.

- Las dimensiones y funcionamiento pueden no ser las adecuadas para determinado tipo de pacientes según sus lesiones y/o tipo de minusvalía.
- Las dimensiones pueden estar limitadas para personas de determinados tamaños.
- Se plantea el diseño para un usuario con una masa corporal de 100 Kg.

- Antropomorfismo: en los elementos en contacto directo con el cuerpo del paciente, concretamente el asiento, se tratará de acercarse lo más posible a una forma ergonómica adecuada a la morfología del cuerpo humano, siendo consciente de la varianza existente en la misma.

3.- SOLUCIONES ALTERNATIVAS EN EL MERCADO

En este apartado se exponen y comentan posibles alternativas diferentes que puedan contribuir a dar soluciones o ideas en el desarrollo del presente TFG. Se busca principalmente en el sector de las ayudas a personas con minusvalía, pero se exploran también otros sectores industriales que puedan aportar ideas a soluciones concretas.

3.1.- Alternativas comerciales en el sector

Actualmente en el ámbito del aseo e higiene de personas con minusvalía, existen gran cantidad de soluciones en cuanto a movilidad, higiene personal, descanso, transporte, etc. Principalmente se exploran los productos de ayudas en transferencias y movilidad, por ser los más relacionados con el tema del TFG. Se han clasificado en los siguientes grupos:

3.1.1.- Sistemas de transferencia

Ayudan en la transferencia de la persona entre posiciones sentadas, como puede ser de un sofá a la silla de ruedas, o viceversa. Este sistema pretende reducir las tensiones generadas en la espalda del cuidador al evitar que éste sustente el peso corporal de la persona dependiente. Sin embargo, precisa de estabilidad y fuerza muscular suficiente por parte del usuario, por lo que no es válida para cualquier tipo de discapacidad.

Dentro de estos sistemas de transferencia se pueden diferenciar varios tipos de dispositivo.

- **Tablas:** Mediante estas tablas se conecta el espacio entre el asiento de la silla de ruedas hasta la superficie que se desea realizar el traslado, o viceversa. Este tipo de dispositivo permite una cierta autonomía en las transferencias, pero requiere de estabilidad y fuerza muscular en el tronco superior del usuario, puesto que debe ser capaz de levantar el torso con los brazos, para poder colocar la tabla debajo suya y moverse hasta la siguiente superficie con seguridad.

Fig.3.1: tabla de transferencia “Glyder” de la marca Ayudas Dinámicas

- **Plataformas giratorias:** estos dispositivos ayudan a la persona minusválida y su asistente a realizar el proceso de transferencia entre asientos, basándose en el giro de la plataforma, por lo que el espacio necesario para el movimiento es mínimo. Además, estas plataformas también reducen la presión en las articulaciones de las extremidades inferiores del usuario. Dentro de este tipo de sistemas se encuentran dos tipos distintos:

    - **Discos giratorios:** se trata de dos discos superpuestos, con libertad de giro en el disco superior. En este caso, el asistente no minimiza su esfuerzo, puesto que es él quien tiene que ayudar al minusválido a erguirse sobre el disco. Requiere además de fuerza muscular en el tronco inferior por parte de éste, pues necesita mantenerse de pie por unos instantes.

Fig.3.2: disco giratorio "Pediturn" de la marca ETAC

    - **Soportes giratorios:** con ellos el esfuerzo realizado por el cuidador se ve minimizado, gracias al soporte que incorpora la base giratoria. Nuevamente, requiere de cierta estabilidad muscular en piernas, brazos y torso, puesto que la persona minusválida se erguirá sobre la plataforma como se ve en la siguiente figura.

Fig.3.3: soporte de transferencia "Turner" de la marca ETAC

La acción del asistente consiste en hacer de contrapeso, para equilibrar el momento de vuelco que genera el minusválido al levantarse en la plataforma. Tiene la ventaja de que requiere un espacio reducido para la transferencia, puesto que gira sobre su propia base.

- **Cinturones de transferencia:** se trata de un elemento para transferencias de corta distancia que se ajusta alrededor del abdomen del minusválido. Esto permite tener un mejor agarre para mejorar el manejo del peso corporal, puesto que el centro de gravedad humano se sitúa en la cintura. Sin embargo, no se ve minimizado el esfuerzo del asistente puesto que tiene que erguir al minusválido mediante su fuerza Existen variantes que conectan las cinturas de asistente-minusválido, minimizando el riesgo de lesión.

Fig.3.4: cinturón transferencia "Transfer"

3.1.2.- Grúas

Se trata de dispositivos más complejos en los cuales la acción de levantar a la persona asistida se realiza mediante elementos motorizados. Con ello se disminuye el esfuerzo y riesgo de lesión del asistente. Sin embargo, la colocación de los sistemas de arnés requiere de posiciones incómodas y de esfuerzo físico hasta situarlo alrededor del cuerpo del usuario.

- **Grúas de techo:** se trata de dispositivos fijos que requieren de obras para la instalación de las guías verticales por las que discurre la grúa para llevar al usuario desde la silla de ruedas u otra superficie hasta una cama, bañera, etc.

Fig.3.5: grúa de techo RiseBasic Handicare

- **<u>Grúas de elevación y traslado:</u>** de igual manera, elevan al usuario mediante un arnés, con la diferencia de que éstas permiten el libre movimiento del dispositivo.

Fig.3.6: grúa de elevación Sunlift MINI

- **<u>Grúas de bipedestación y traslado:</u>** este tipo de dispositivo permite al usuario una cierta autonomía, pues mediante él es capaz de ponerse en pie y desplazarse hasta donde desee. Requieren de algo de fuerza en el tren inferior, pero sobre todo precisan de fuerza en el tren superior por parte del usuario.

Fig.3.7: grúa de bipedestación Elev Up

3.1.3.- Dispositivos específicos de baño y ducha

- **Asientos giratorios para bañeras:** se trata de dispositivos ligeros y acoplables a la bañera, pero que requieren de total movilidad en el paciente para un uso autónomo. En caso de un usuario con movilidad reducida, el esfuerzo del asistente es muy grande en la maniobra de colocación del usuario.

Fig.3.8: asiento giratorio de aluminio

- **Asiento elevador eléctrico:** en este caso, se trata de un dispositivo portátil basado en un mecanismo de elevación de tijera. Se fija al suelo de la bañera mediante ventosas y permite ajustar la altura, para una entrada cómoda y segura del usuario. Se combina con discos giratorios para un menor esfuerzo. En caso de un usuario con movilidad reducida, nuevamente la maniobra de colocación por parte del asistente requerirá de esfuerzo físico.

Fig.3.9: asiento elevador BathMaster

4.- ELECCIÓN JUSTIFICADA DE SOLUCIONES

En este apartado de describen las razones de elección de los elementos principales que van a componer el diseño del dispositivo en base a los objetivos planteados.

4.1.- Asiento de acceso trasero

Este elemento es el que define principalmente el concepto del dispositivo diseñado, generando otra opción en los sistemas de transferencia de personas con movilidad reducida.

Actualmente, el modo de acceder a cualquier asiento o silla es el mismo: situándose de espaldas a él y flexionando las rodillas. Pero también en ocasiones, muchas personas en una situación de charla distendida utilizan las sillas de una forma distinta pero a la vez cómoda: con las piernas saliendo por la parte del respaldo y el torso o los antebrazos apoyados en el mismo.

Esta idea aplicada en el ámbito de las ayudas a personas con movilidad reducida abre un nuevo camino en la manera de acceder a dispositivos como las sillas de ruedas. Actualmente ya se encuentran algunos modelos y diseños de concepto que emplean este método de acceso.

Fig.4.1 : diseño de concepto premiado el IF Design

Así pues, se pretende aplicar este concepto al ámbito de la transferencia de personas con movilidad reducida, concretamente en el entorno de la higiene y el aseo personal para reducir los esfuerzos físicos de los cuidadores o asistentes.

4.2.- Husillo elevador

En el desarrollo del proyecto, se busca que el asiento parta desde una posición lo más cercana posible al suelo.

Se precisa de un sistema de elevación para el asiento, con la suficiente robustez como para soportar el peso de una persona adulta. Se opta por el uso de este tipo de mecanismo porque permite alcanzar un punto más cercano al suelo que otros mecanismos de elevación como actuadores lineales, los cuales en su longitud mínima ya tienen una medida igual o superior a la carrera del cilindro.

Es por ello que se opta por el uso de un mecanismo de tipo “sinfín”, que permita alcanzar una cota de altura muy cercana al suelo, para posteriormente elevar el asiento hasta la altura deseada, no teniendo limitaciones a la hora del diseño del resto de componentes.

Se realiza un diseño propio para adecuar la altura alcanzable por el asiento a las necesidades propias del proyecto.

Fig.4.2: captura del husillo sinfín diseñado

4.3.- Guías lineales

Se incorpora el uso de este elemento para proporcionar un sistema de posicionamiento mediante la traslación del conjunto de elevación y la rotación del mismo, con el fin de poder situar el asiento en la posición adecuada para realizar la trasferencia al segundo dispositivo.

También son empleadas en el segundo dispositivo, con el objetivo de poder deslizar el bloque de acople hasta una posición segura, que abarque todo el contorno del asiento y permita una correcta trasferencia hacia la bañera o ducha.

Fig. 4.2: guía lineal NSK RA25

4.4.- Sistema de posicionadores de bolas

Mediante el uso de este elemento se ha solucionado la cuestión del giro del sistema de elevación. Previamente se barajó el uso de sistemas de rotación empleados en mesas o asientos de furgonetas como el de la imagen, pero la altura del sistema, elevaba la altura del conjunto final.

Se buscó, por tanto, otro tipo de elemento que aportara sencillez manteniendo la funcionalidad, además de que no aportara demasiado peso ni altura al conjunto. Por ello se optó por la opción de los sistemas de posicionamiento de bolas.

Fig. 4.3: posicionador de bolas NORELEM

4.5.- Motores eléctricos CC

En el desarrollo del dispositivo se precisa motorizar el giro del husillo sinfín, encargado de elevar/descender el asiento con el usuario sentado en él.

Como primera opción se baraja el uso de motores CA, debido a la existencia de una mayor variedad de modelos y la facilidad para encontrar motores de la potencia requerida. No obstante, por cuestión de dimensiones y peso (además de razones estéticas) se descarta el uso de este tipo de motores, ya que implica ocupar un gran espacio y dota al dispositivo de una apariencia muy "industrial", cuando éste se pretende dirigir a un uso personal.

Es por ello que se recurre al uso de motores CC, con la misma versatilidad en un espacio mínimo. Es en el sector del transporte eléctrico donde se encuentran más soluciones adaptadas al uso deseado. En concreto, el sector de las bicicletas eléctricas es el que ofrece modelos de motor CC que concuerdan perfectamente con el objetivo que se busca de reducir el espacio al mínimo.

Fig. 4.4: motor CC Miromax BLT500

5.- SOLUTION DESIGN

This section begins with a general description of the operation of the device, as well as the main parts that compose it, to explain the design of specific components that make up the different subsets of the development in more detail.

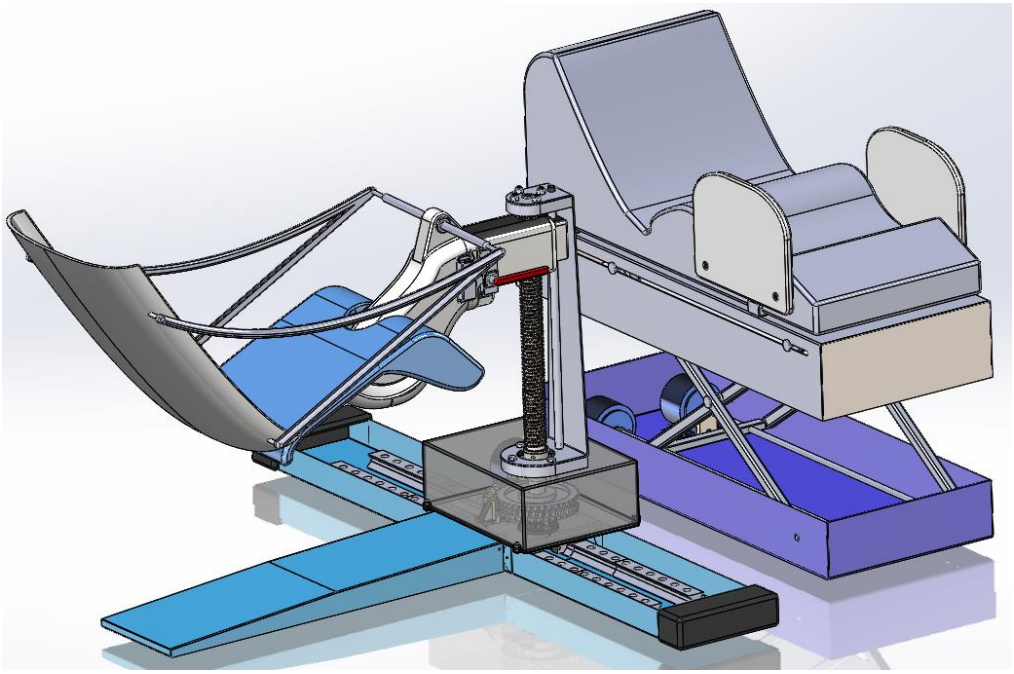


Fig.5.1: Complete assembly of the design in 3D

5.1.- General description of the device

The complete design consists of two complementary devices. The first is responsible for picking up the user from the wheelchair, and to seat the user in the device. It then uses a worm drive positioner with linear guides and a ball joint, allowing the proper positioning for reception in the seat on the second device.

This second device consists of a scissor lift motor using worm drives and a seating receiver for the seating of the user, designed with the correct shape for the reception and safety of the user, to help with the lateral movement that is provided by the linear guides located at the base.

- In the initial position the chair is located in a lowest position of the worm drive, and the back of the seat in the upright position.
- Now the wheelchair and user is moved to the apparatus and the assistant puts the legs of the user on the back of the seat (the top of the backrest touches the back of the user's knees and the user's calves are placed on the backrest of the seat).
- At this point the worm drive begins to lift the user's legs, so that the weight of the user's legs makes the seat pivot. In this way, as the worm drive moves, the seat goes sliding up the back of the thighs of the user (by sliding into the seat of

the wheelchair). Once you reach the position that is currently in the photo, you move the back of the seat to hold the user's body completely (still in the wheelchair).

- This elevating assembly can rotate at its base. In addition, by using linear guides, it can be moved in both directions.
- The next step is to turn and move this whole device, leaving user's legs parallel to the longitudinal axis of the 2nd device, which has a piece shaped like the backrest and seat to which the user is seated on.

  The side panel can be removed laterally so that the 2nd device can be placed completely under the seat. At this point, the seat can be freed with the safety lever and the seat fitted in by sliding it into the shape of the 2nd device. The red locking lever is lifted to free it from the elevating seat assembly.
- The next step is to introduce a plate with two cylindrical parts attached in holes of the second device, to retain the lateral movement of the Chair between the two plates.

5.2.- Device No. 1: Picking up the user and positioning

As explained before, this first device is the first of the transfers: from the wheelchair to the seat. Subsequently, it allows the proper positioning to proceed to the second transfer to the device in the bath or shower tray. Below is a breakdown of the device into the different assemblies of which it is comprised:

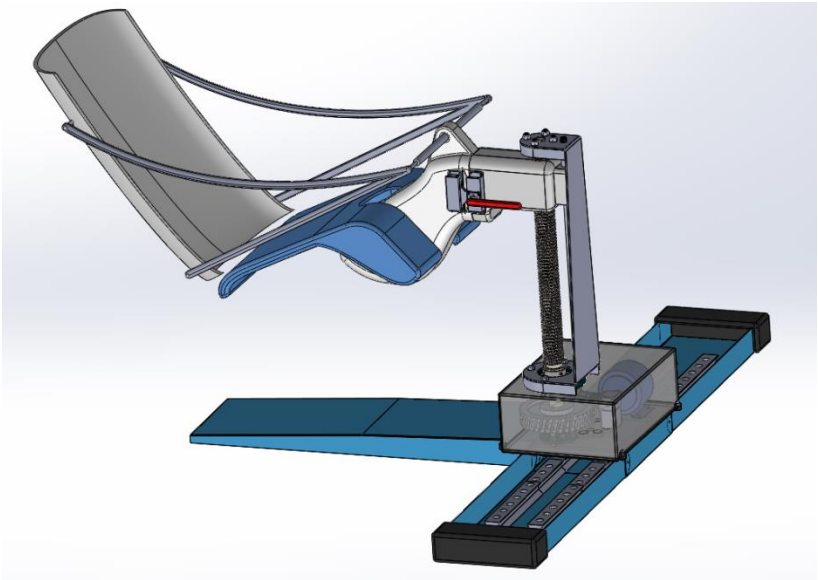


Fig.5.2: Pick up and positioning device

5.2.1.- Elevation Assembly

All the elements for the elevation of the user are in this seat lift device. They are subdivided into the following elements:

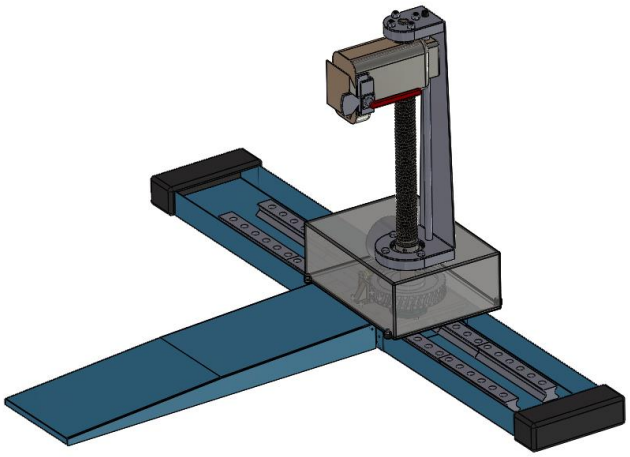


Fig.5.3: pick up and positioning device

5.2.1.a) Sliding assembly:

It includes the base on the floor and the sliding of the elevator device through linear guides.

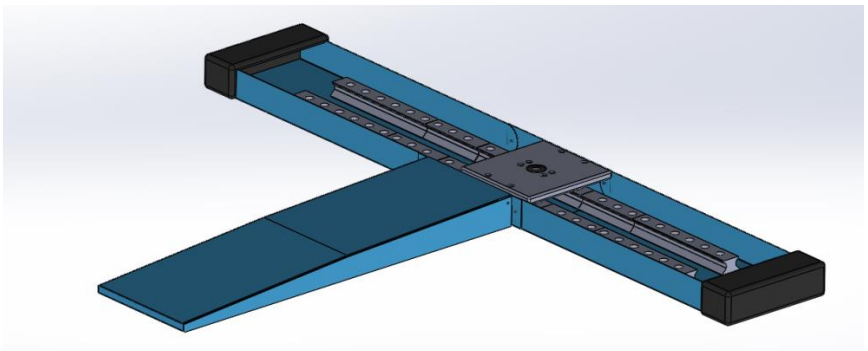


Fig.5.4: Sliding assembly

It is composed of:

- **Subassembly of welding base:** It refers to the base in the form of a T, which houses a linear sliding rail. It is composed of different plates joined together by welding. This type of union is also used to fix the guide to the base. Welded base: refers to the base in the form of a T, which the linear sliding guides are located. This type of union is also used to fix the guides to the base.

  The T wings are joined by a shaft with pin, that to allow the Assembly to be folded for transport. Similarly, part of the Chair, has a lid attached to the same system, in order to give space for the possible subsequent placement of electrical, electronic elements.

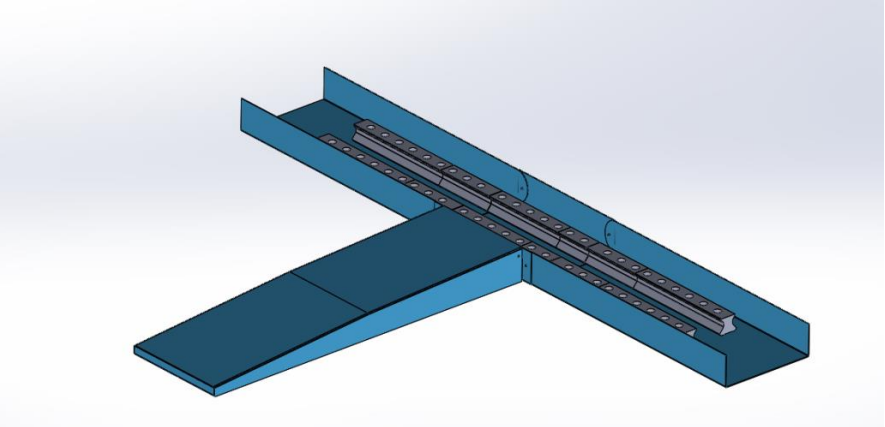


Fig.5.5: Soldered subassembly in 3D.

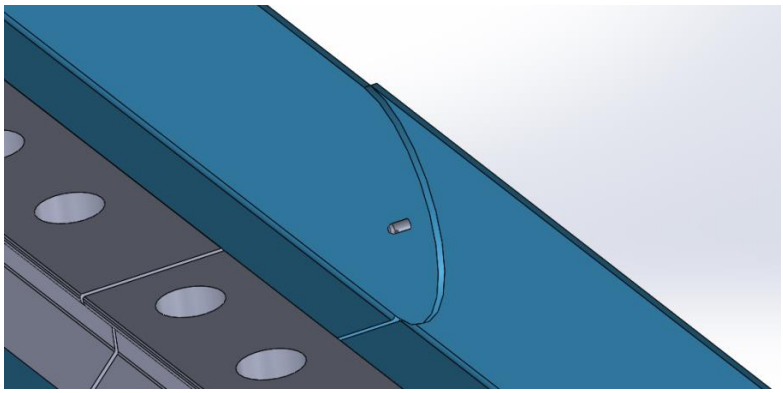


Fig.5.6: Detail of the T shaped support

The T shape form is used for the following reasons:

- Entry point for the wheelchair: minimize the section in this part because it must fit with clearance between the width of wheels on the wheelchair.
- Lateral stability: having a very small area at the entrance area of the wheelchair, is compensated for the possibility of lateral tipping through the wings of the T shape.
- Location of linear guides: the shape of the assembly is defined, in addition to the above, for the need to house the guides in it that allow the parallel movement of the longitudinal axis into the bathtub and/or shower.

The images shown below show screenshots of the 3D design of the individual parts that make up the subassembly of the welded base, all of them made in cold press and laser cutting, from galvanized sheet steel (with the exception of the profile guide which is a commercial item)

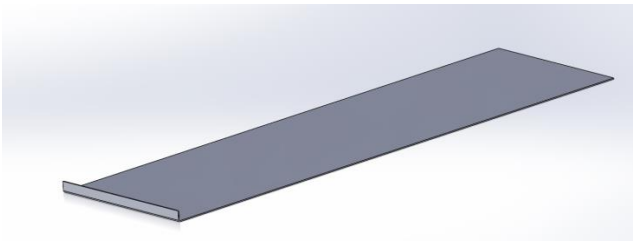


Fig.5.7: Central sheet metal base

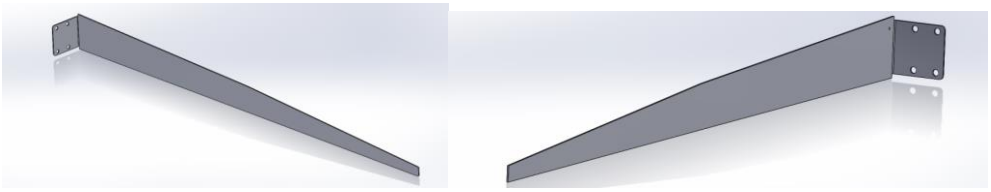


Fig.5.8: Sheet metal left and right sides.

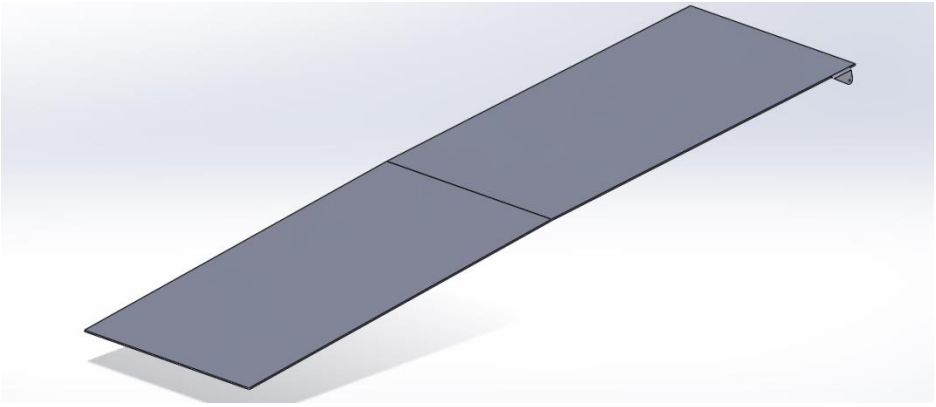


Fig.5.9: Subassembly of sheet metal cover

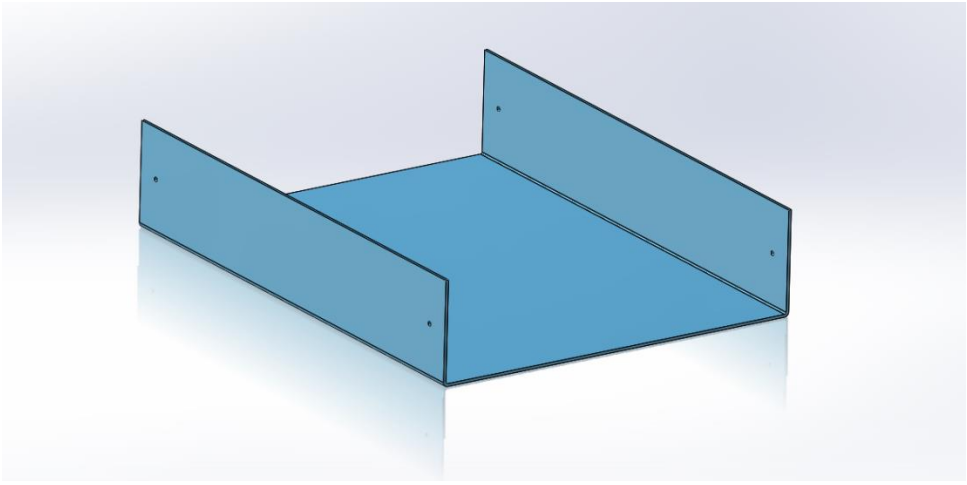


Fig.5.10: Sheet metal central sides

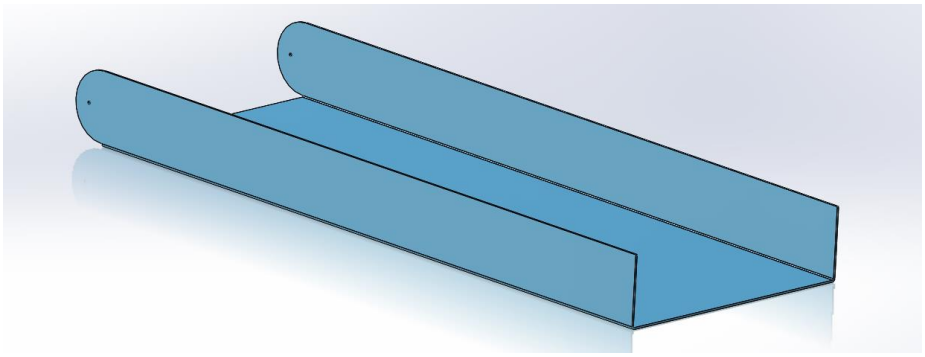


Fig.5.11: Side sheet metal folds

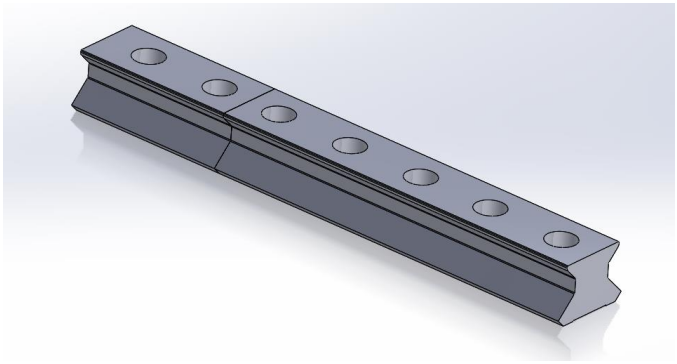


Fig.5.12: Guide rail

- **Side covers:** a lateral U-shaped plate enclosure for the welded guides. Added as an aesthetic element and protection of the sharp edges of the sheet metal. Manufactured using plastic injection.

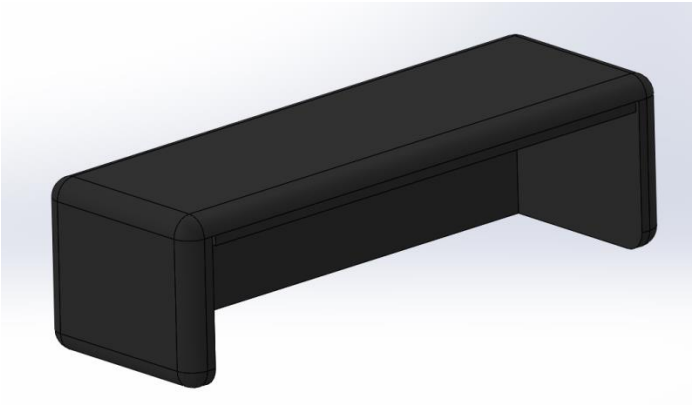


Fig.5.13: Side cover

- **Support plate:** this element is the connecting link between the slide Assembly and assembly comprising the lifting mechanisms. It is linked to the brackets of the guides by means of M10 Allen screws and hex lock nuts. On its surface, the rotational movement of the whole assembly takes place. In addition, its core is houses the bearing which will based on a small shaft on the motor box. Manufactured by laser cutting in Steel AISI 316 and rounded edges.

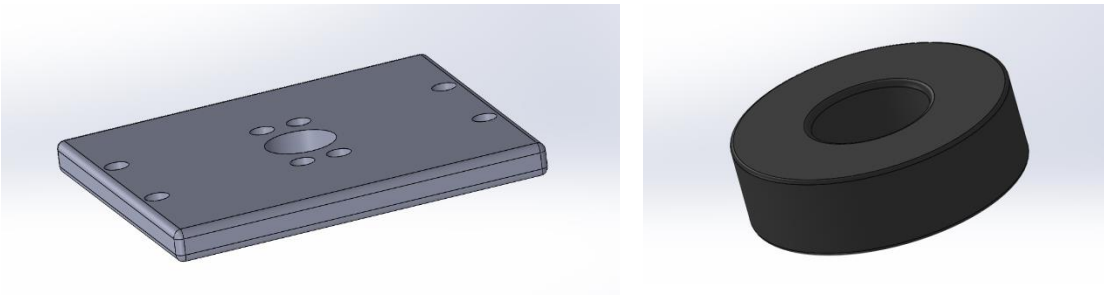


Fig.5.14: NSK204W plate support and bearing

- **Support guide NSK:** this element serves as an anchoring support for the plate, attached to the guides enable sliding. It is part of the NSK-RA 25 commercial element set out in paragraph *"4.- Justified solutions choice"*. Separate guide to perform the welding of the guides to the base more comfortably.

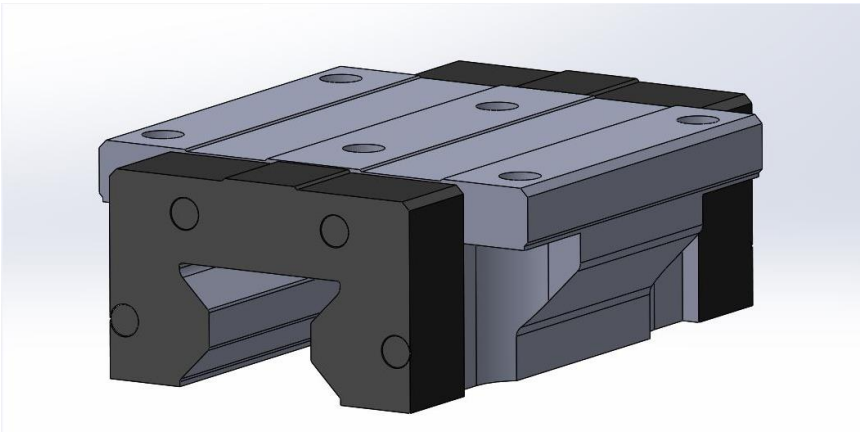


Fig.5.15: Lineal guide support for NSK

5.2.1.b) Elevator block:

This assembly raises the seat and provides rotation to one of the positioning movements.

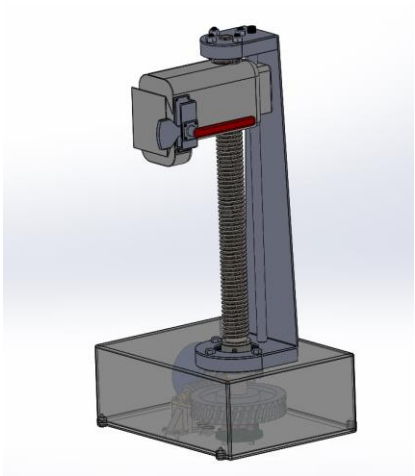


Fig.5.16: Elevator block assembly

This assembly is composed of the following elements:

- **Motor assembly:** to generate the rotation that allows elevation of the seat block, it is housed in this box, manufactured in AISI 316 steel, different components that allow it to turn the worm drive.

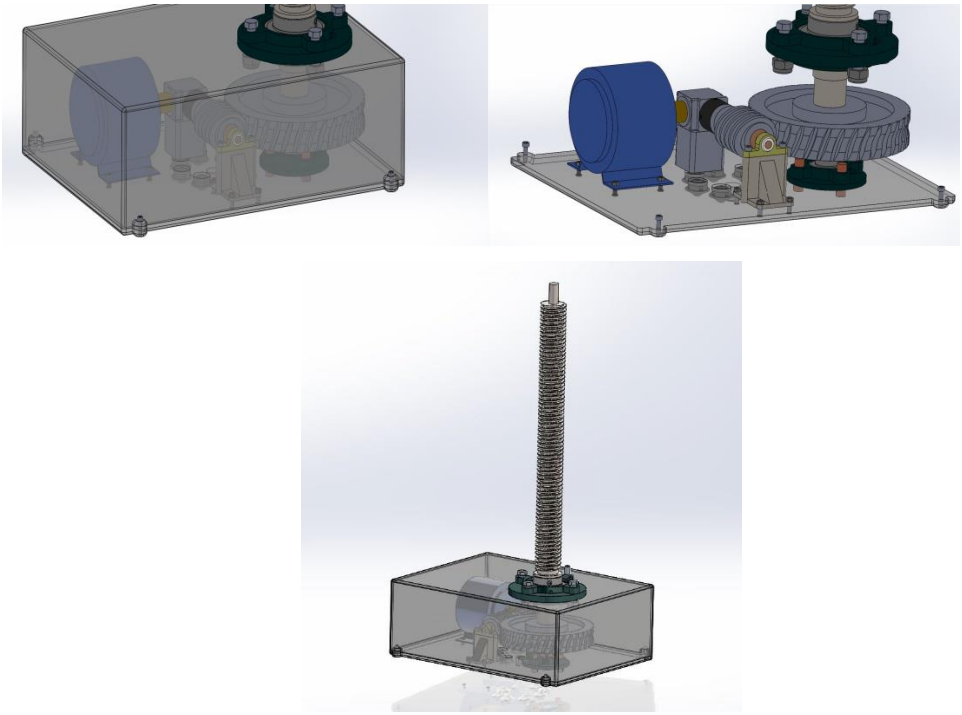


Fig.5.17: View of the motor subassembly and detail of mechanisms

In addition, a total of 8 ball bearing positioners are installed at its base, allowing it to perform the rotation of the full subset on the plate (slide set). On this base is a small mechanized shaft that is inserted into the bearing support plate above, which is the point of rotation of the motor subassembly.

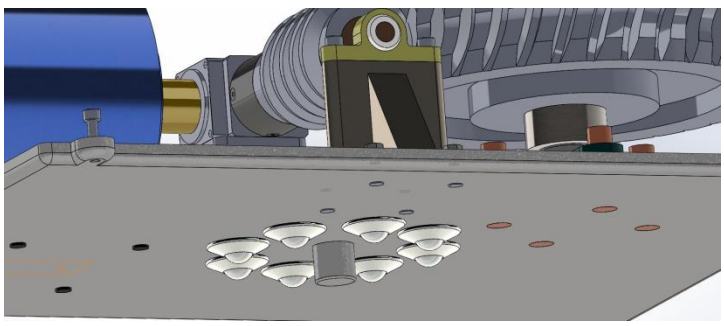


Fig.5.18: Detailed view of the ball positioner and shaft that supports the bearing support plate

- **Elevator attachment**: this item has a threaded hole for the worm drive shaft, so it moves vertically due to this rotation. It also has a dove tail shape at one end which connects to the seat joint through the releasable coupling. By using the safety lever, it is possible to block sliding between the two sides.

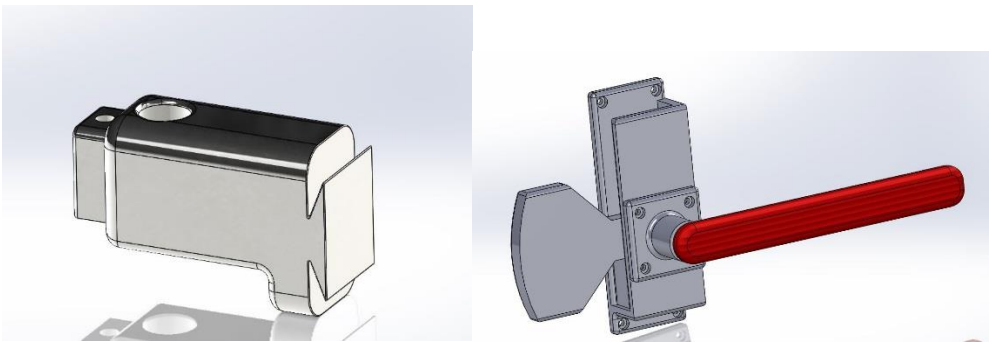


Fig.5.19: elevator attachment and safety lever

On the other part, there is a smooth machined hole, through which it can be joined to a shaft that blocks the rotation.

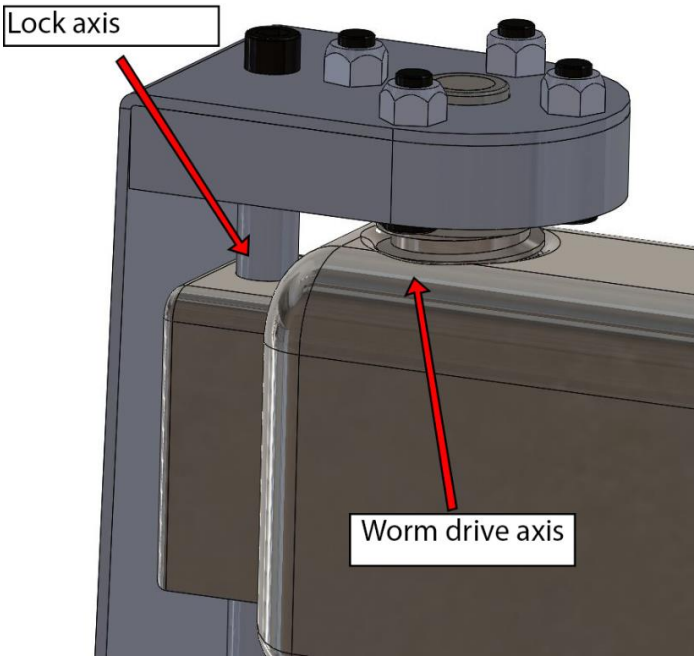


Fig.5.20: Union to the lock axis and the worm drive

- **Worm drive**: a profile of trapezoidal thread is provided as it is one of the most suitable transmissions of movement. It supports the axial loads better due to this type of profile by having a greater thickness at the base. It is machined in 4340 standard steel, to which a surface treatment of zinc-plating is applied for better resistance to corrosion in a humid environment.

  In the section called *"5.4.-sizing calculations"* analysis of the resistance of this element is explained.

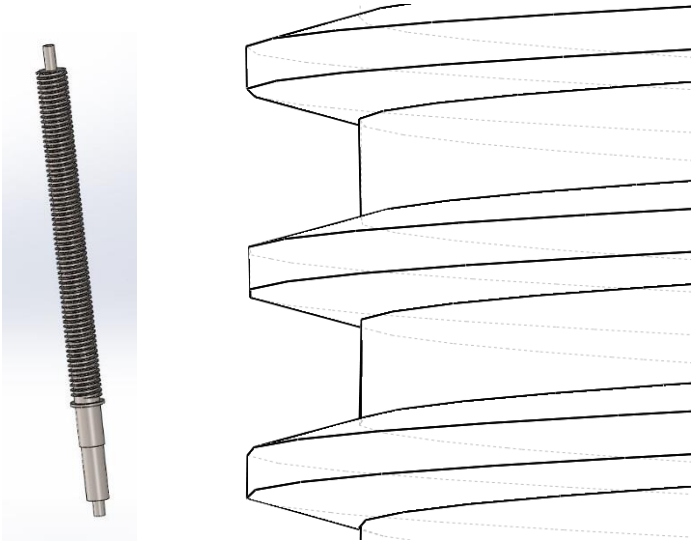


Fig.5.21: worm drive thread and details of trapezoidal thread profile

5.2.1.c) Seat assembly:

It is an assembly which, together with the assemblies defined above, is responsible for the collection of the user of the wheelchair. In particular, it is an element based on the concept of the DFW, since it allows the collection of the user starting from the back of the seat, based on the trajectory of movement it makes through the groove of the coupling part. In addition, it is designed to be completely detachable from the elevating assembly and move it to the receiving device.

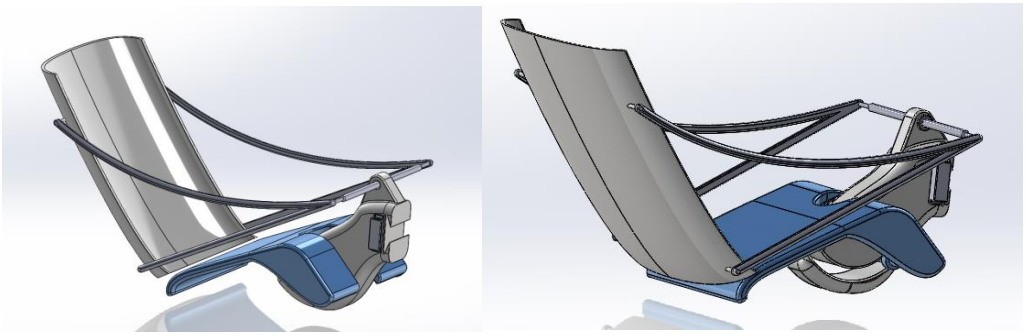


Fig.5.22: illustration of the seat assembly

This system is subdivided into the following components

- **Back Support**: manufactured in plastic injection reinforced with fiberglass to withstand the stresses required when a large part of the weight of the user leans on it in the most reclined position.

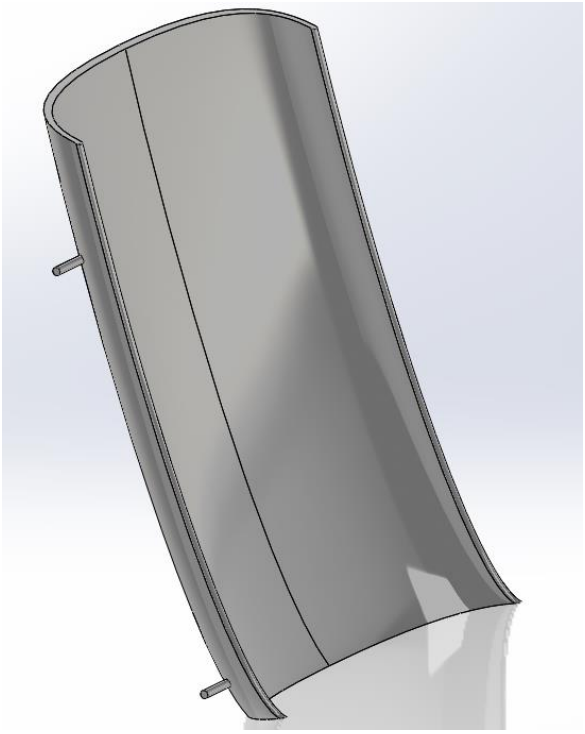


Fig.5.23: seat back made from fiber glass reinforced polymer

- **Seat:** this element is intended to be manufactured in two symmetrical parts by the injection of fiberglass-reinforced plastic, joined by a riveted plate.

  In the design phase of the element, two important issues to comply with were contemplated: a proper morphology that allows a smooth sliding on the thigh of the user, and that it was able to pivot on an axis.

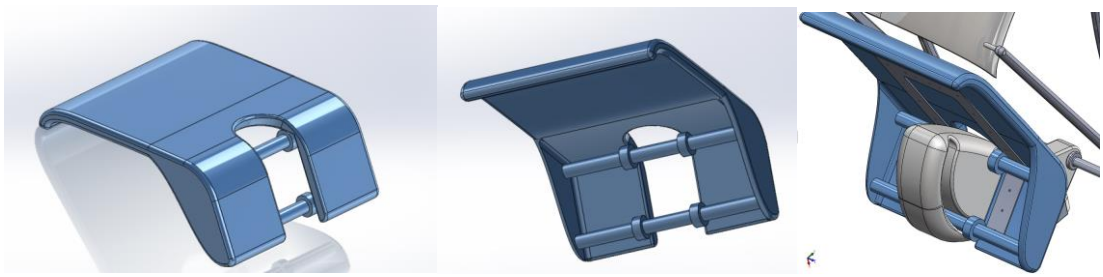


Fig.5.24: complete seat views and riveted plate

To resolve these two issues we propose:

- A curved, rounded shape at the edge of entry to the wheelchair: in the image you can see that the back of the seat has a curved shape, with the idea of keeping the thighs of the user at a tangent during the first moments of the movement of entry to the wheelchair. In addition, being the point that initially contacts the back of the knee, it thus fits perfectly, not generating a knock at the start of the lifting movement.

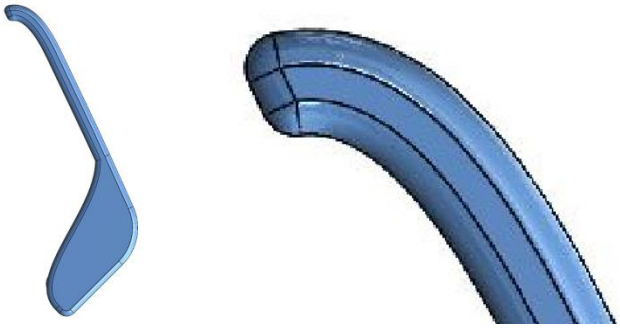


Fig.5.25: section of the seat and details of the entry point

- Axes of rotation: a fixed axle and a pivoting axis are established. The first of them is very close to the surface of the seat in such a way that the weight of the user is transmitted to the axis of the pivot in the form of contact force between this and the final part of the groove, blocking the movement of rotation.

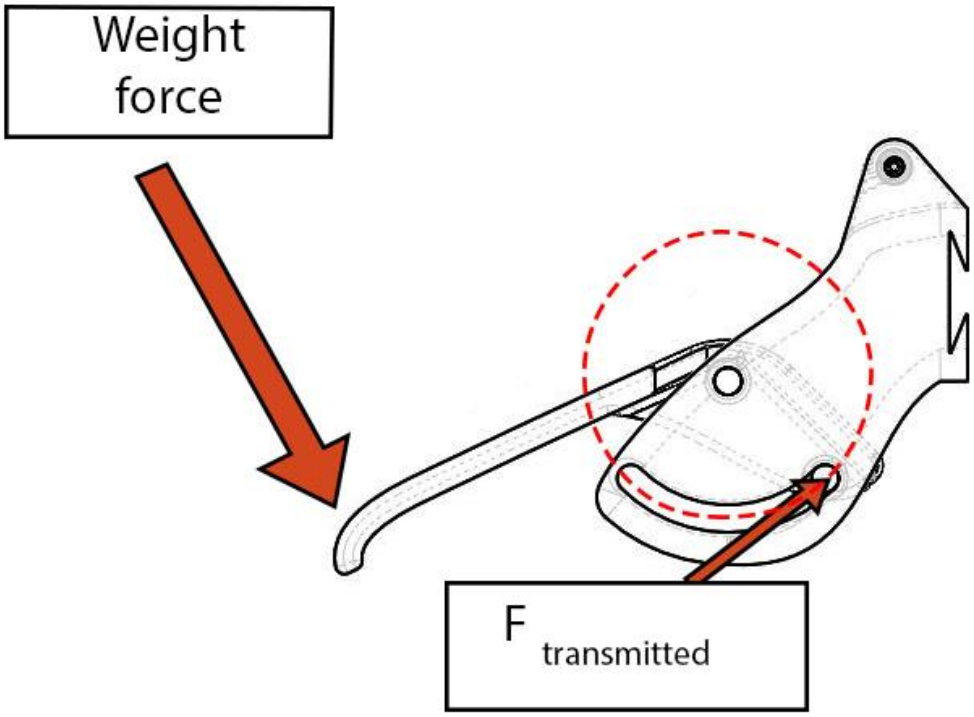


Fig.5.26: blocking from the weight of the user

- **Releasable coupling**: during the design of this component two key functional objectives were raised: allow a rotation of 90° of the seat and be able to disconnect it easily from the elevating Assembly.

  To solve both objectives, there are two solutions:

  - Quarter-circumference slot: the oscillating axis contacts on this slot and absorbs the force of the weight of the user in the position explained above, causing the rotation of the seat lock in a natural way.

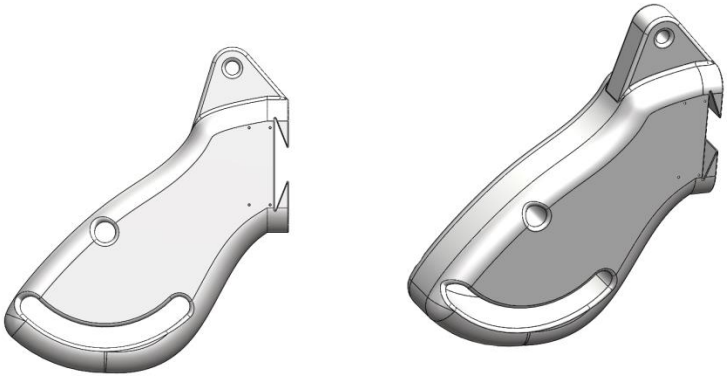


Fig.5.27: image of the releasable coupling

- "Dovetail" type clamp: it allows a quick disconnection from the elevator block by means of sliding between the connecting parts as shown in the image. In addition, the cavity is screwed to the block in which the safety lever latch is located.

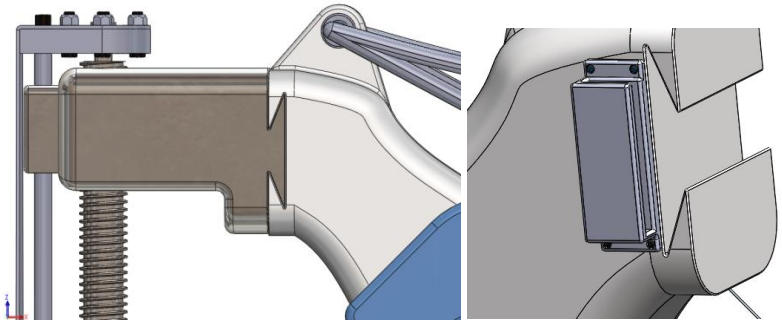


Fig.5.28: connection between the coupling and the lifting block and cavity of the latch

- **Side fastenings:** they are two pieces joined together with a screw to one of the holes in the releasable coupling.

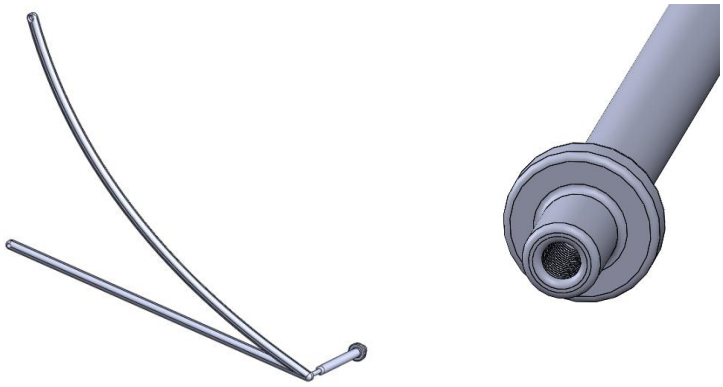


Fig.5.29: lateral fastening with female thread

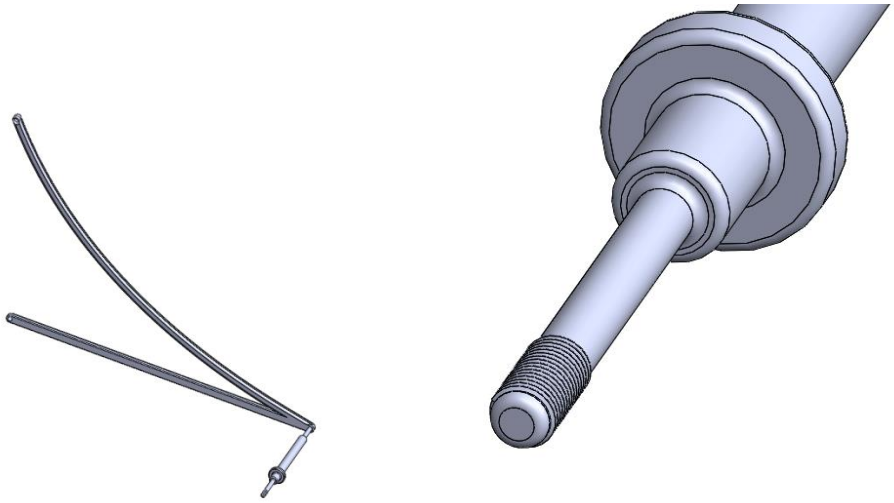


Fig.5.30: lateral fastening with male thread

5.3.- Device nº2: reception of the user

This device is responsible for receiving the seat assembly. It is located on the shower and/or bath tub tray and it will be here where the assistant will shower the disabled person.

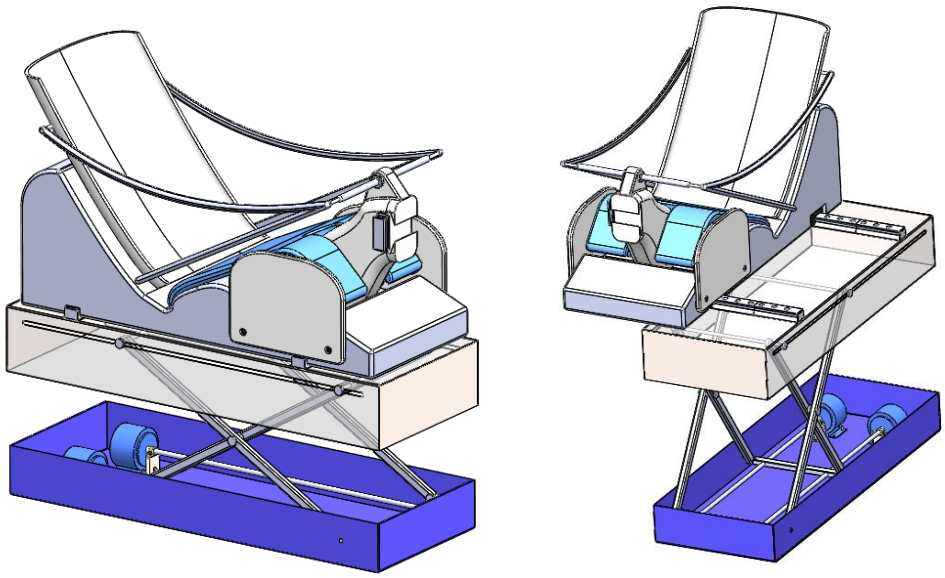


Fig.5.31: image of the reception device

With regard to its function, as mentioned in paragraph "5.1.-general description of the device", on this, the transfer of seat assembly to the shower and/or bath tub tray is carried out safely. For this, it has a block where the seat assembly, having the same shape to fit it perfectly. It can also be moved laterally with rails as you can see in the image above.

This block is supported on a scissor lift platform, which transforms the linear displacement generated by a worm drive, in a raising/lowering movement. This movement will allow the operator to adapt the height of the assembly to a more comfortable position for the assistant.

Below is a breakdown of its main components and subassemblies:

- **Welded lower tray assembly:** it consists of a part in U-shape, to which are attached two welded side covers. These parts are made with galvanized sheet steel on a laser cutting and folding machine. An anti-rust paint treatment is applied to this tray.

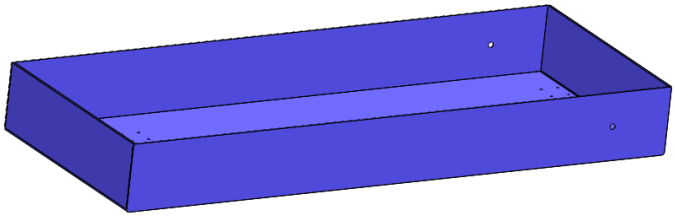


Fig.5.32: welded assembly and the parts of which it is composed.

As you can be seen in the following image, this tray houses the mechanical parts responsible for producing the linear motion of the raising device. The same motor is used in the elevation of the seat. In this case two motors of less power would be installed, which transmits the spinning motion to worm drive, that are connected to raising device, which is engaged to scissor action struts.

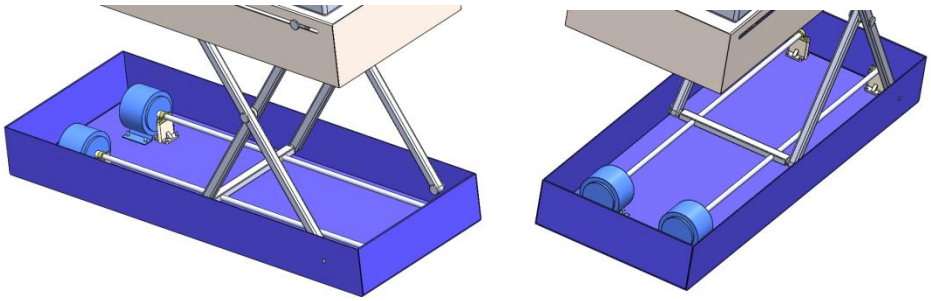


Fig. 5.33: component layout

- **Welded upper tray assembly:** using the same process of manufacture as the lower tray, this set comprising of a U-shaped pieces and two front covers. On the sides it has a slot that the shafts of the profiles of the scissors slide along.

  As with the lower tray, an anti-rust paint treatment is applied to this tray.

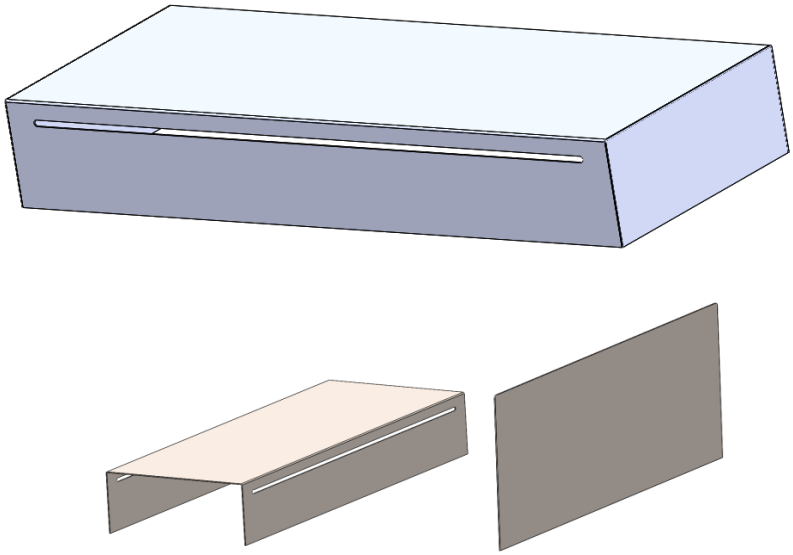


Fig.5.34: welded assembly and the parts it is composed of.

Two rails are welded on its surface of the same model used in the elevating assembly:

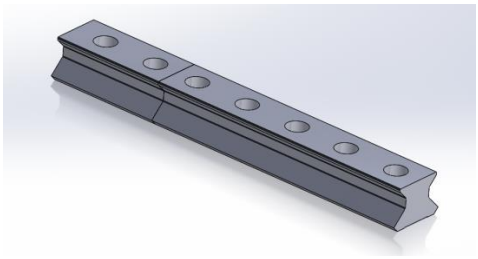


Fig.5.35: NSK linear guide rail used

- **Scissor action struts:** a total of 4 equal struts make up the scissor mechanism that connects the top tray to the bottom tray. Manufactured in standard zinc-plated steel AISI 4340

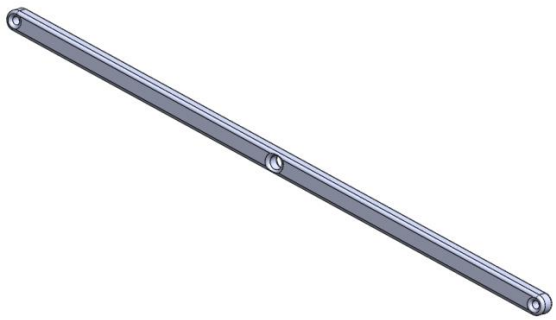


Fig.5.36: scissor action struts

These struts are joined on their axes of rotation with a coupling machined with a threaded hole into which two machined plugs with an external thread are screwed, as shown in the image.

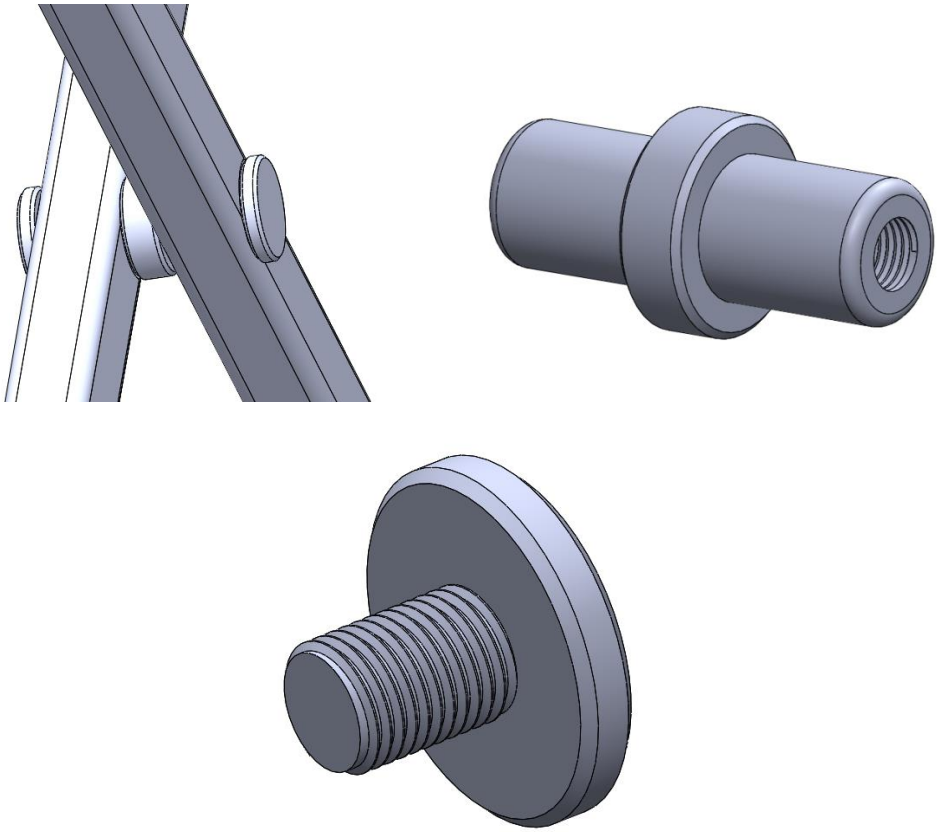
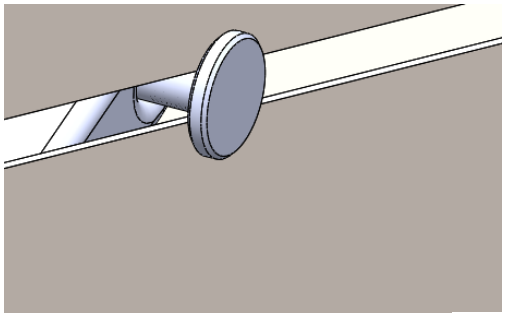


Fig.5.37: details of the union between struts and its components.

Likewise, as you can see in the following image, the same caps are used on the shaft that connects both struts for holding them to the slots in the tray.



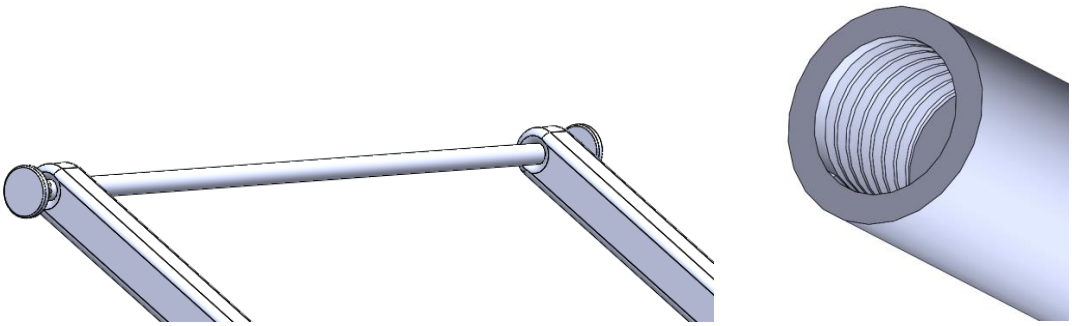


Fig.5.38: details of fixture and threaded shaft.

As for the fixture of the scissor mechanism to the slots, the same caps are used for the coupling bushing.

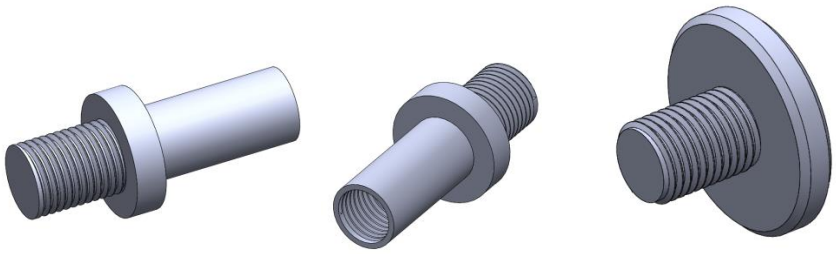


Fig.5.39: coupling bushing and screw plug .

The union is performed in the following way:

- The coupling bushing is threaded to the slot hole.
- The strut is fitted.
- It is fastened by screwing the cap into the threaded hole of the coupling bushing.

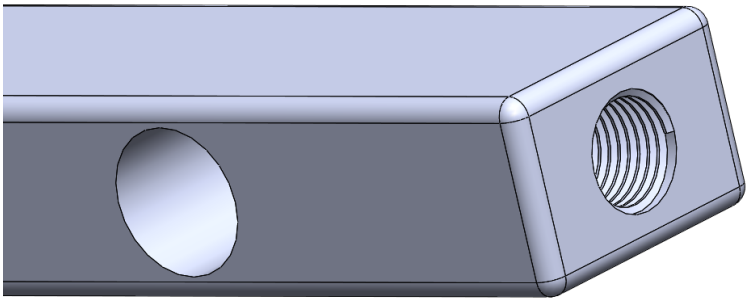


Fig.5.40: threaded hole

So, the union would be assembled as shown in the image:

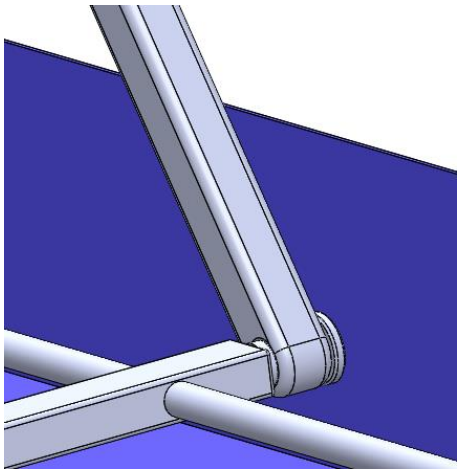


Fig.5.41: union of strut and slider

- **Reception block:** the design of the mechanical development of this piece has not been studied thoroughly. In the section "6.-future lines" ideas are contributed in the development of this piece. A proper morphology that provides the functionality that is required will be established.

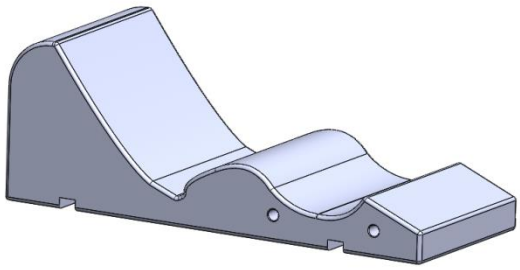


Fig.5.42: morphology of the reception block

As for the aforementioned functionality, the block should allow an adequate slide rail under the seat for the movement of reception, and that it can be perfectly coupled to it. For this reason, it is has the same shape as the seat assembly.

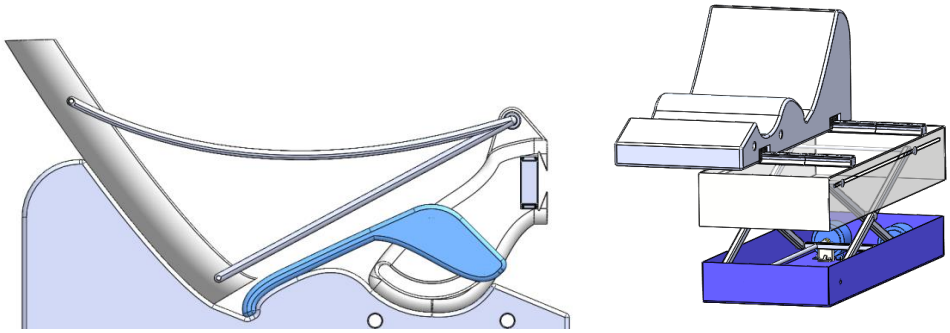


Fig.5.43: link between seat and block and its lateral displacement

As a security measure, to block the sideways displacement, a simple solution has been used. Small plates of hot dip galvanised steel have been welded at the beginning and end of each rail.

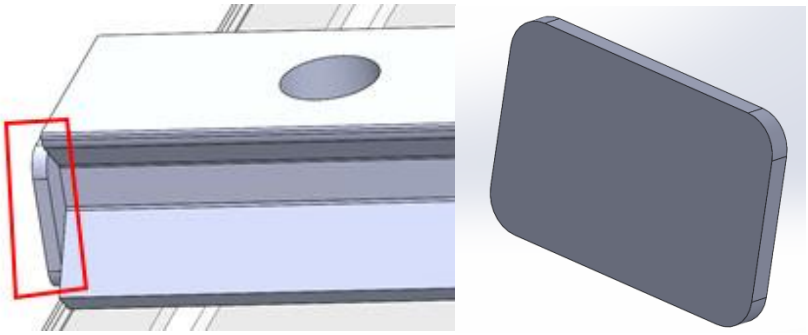


Fig.5.44: Welded tab

- **Retention plate of the seat:** it is a small assembly that the user attaches to the reception block, in order to block the lateral displacement of the seat. One of

them is fixed, to block possible displacement of the seat at the reception. Another plate, as mentioned, is added by the assistant once the seat has been fitted.

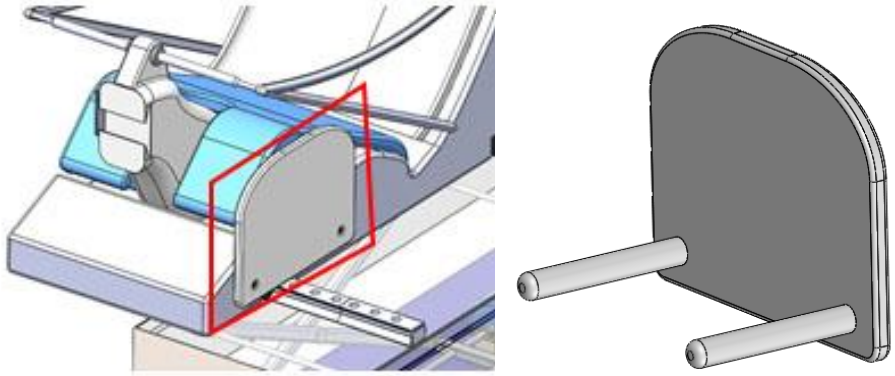


Fig.5.45: fixed retainer plate

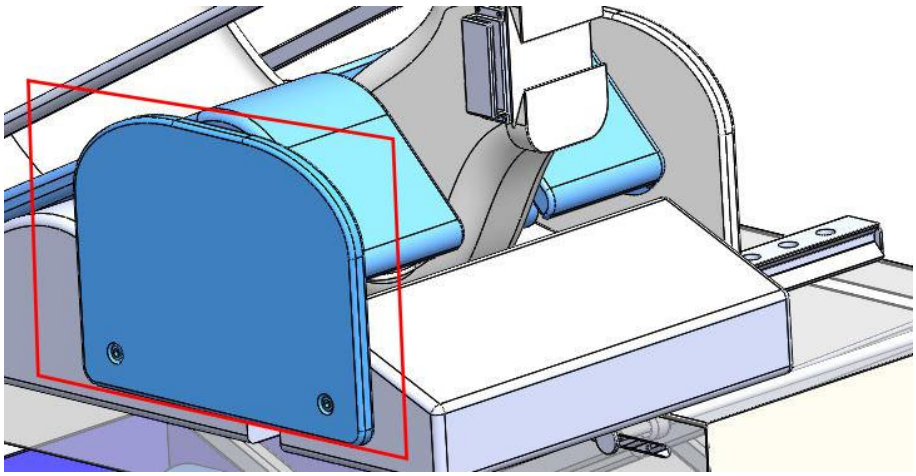


Fig.5.46: (in blue) attachable retainer plate

5.4.- Calculations

The calculations made in the design of the lifting device are grouped in this section.

5.4.1.- Theoretical calculations of the worm drive dimensions

The following are the calculations made for the dimensions of the worm drive sizing that is used in the elevation of the seat, making calculations based on the diameter of the 45 mm thread.

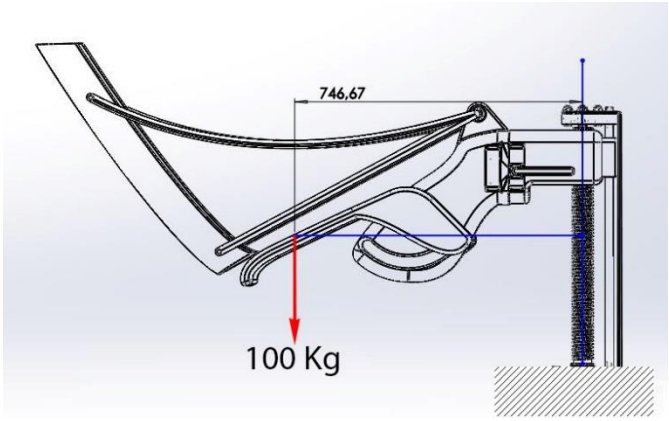


Fig.5.47: calculation of the bending momentum.

As you can be seen in the image, the approximate distance to the axis to which the centre of gravity of the user is calculated is established to be 750 mm. The calculation is for a maximum weight of 100 Kg.

According to the formula for the calculation of the bending momentum produced is:

$$M = F \cdot d = 1000(N) \cdot 0.75(m) = 750\ N{\cdot}m$$

Taking into account this and the length from the fixture to the shaft at the furthest position, which is 617mm, the equivalent force at the end of the shaft is calculated to produce the same bending momentum on the fixture:

$$F = \frac{M}{d} = \frac{750\ (N \cdot m)}{0{,}617\ (m)} = 1215.56\ N$$

For simplification of the calculations, the union between the worm drive and the motor drive is considered as a fixture. However, taking into account that this is an unreal approximation, the result is that shaft will be well within the tolerance limits.

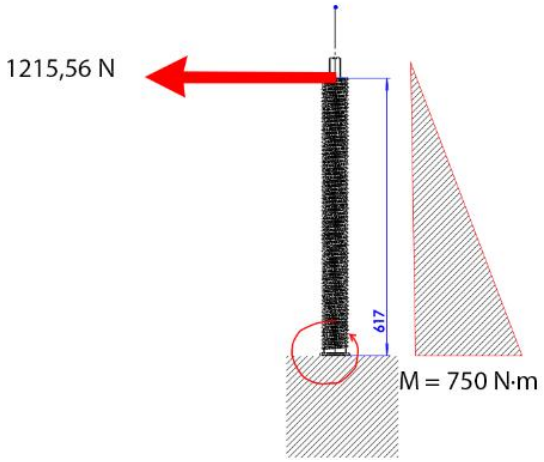
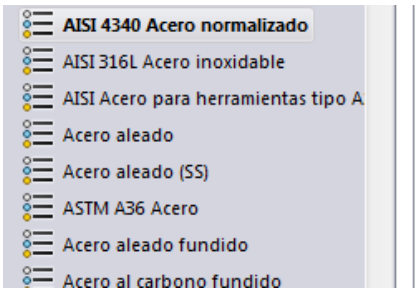


Fig.5.48: the equivalent force to produce the same bending momentum at the base.

We then proceeded to calculate the maximum force that occurs in the worm drive, which is compared to the elastic limit of the assigned material (normalized steel AISI 4340).

According to the table of materials in SolidWorks software, the selected steel has an yield strength of 710 MPa.



Propiedad	Valor	Unidades
Módulo elástico	205000	N/mm^2
Coeficiente de Poisson	0.32	N/D
Módulo cortante	80000	N/mm^2
Densidad de masa	7850	kg/m^3
Límite de tracción	1110	N/mm^2
Límite de compresión		N/mm^2
Límite elástico	710	N/mm^2

Fig: 5.49: properties of the selected steel shown by SolidWorks

With this in mind, according to the law of Navier, the stress produced by a bending momentum is:

$$\sigma = \frac{M \cdot y}{I}$$

Being:

- M: bending momentum
- y: distance from the centre of gravity of the section to the point where you calculate the force.
- I: inertia momentum of the section

In the case studied, in a circular section the maximum stresses occurs at the peripheral, so the *y* parameter will be equal to the radius of the section.

In terms of inertia, for a circular cross-section with a diameter of 45 mm, it is:

$$I = \frac{\pi \cdot R^4}{4} = \frac{\pi \cdot 22.5^4}{4} = 201288.96\, mm^4$$

Knowing this, with the calculated parameters and according to the law of Navier, the estimated maximum stress produced on the axis of the worm drive is:

$$\boldsymbol{\sigma} = \frac{M \cdot y}{I} = \frac{750 \cdot 10^3 (N \cdot mm) \cdot 22.5(mm)}{201288{,}96\ (mm^4)} = \mathbf{83.83\ MPa}$$

We compare the result with the yield strength of the steel:

$$\frac{\sigma_{ys}}{\sigma} = \frac{710}{83.83} = 8.46$$

The result is that the worm drive is well within the limits to resolve the requirements of the fixture and the union of the worm drive.

5.4.2.- FEM Analysis

Virtual testing of finite elements is carried out to verify the theoretical calculations made in the sizing of the worm drive elevator. This trial is conducted through the simulation module that is incorporated the SolidWorks design software 2016.

Considerations of the analysis:

- **Worm drive union**: as in the theoretical calculations we contemplate a union at the base.
- **Forces:** applies to the resulting force calculated in the previous section, in the worst position (the furthest from the recess).
- **Material:** we assign steel AISI 4340.

With these considerations, the conditions of the test would be as shown in the image:

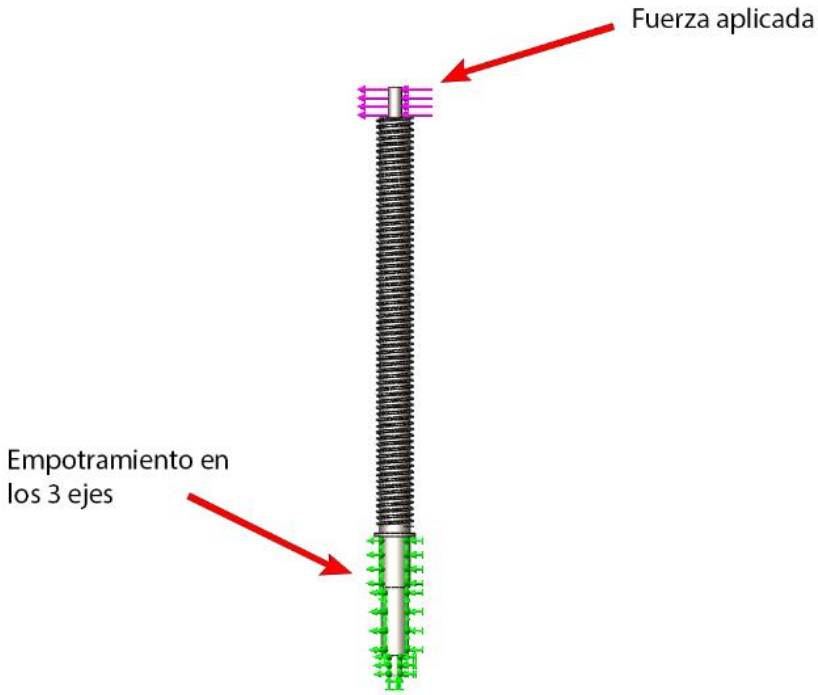


Fig.5.50: the virtual testing environment conditions

- **Resulting Von Mises stresses:** The following presents the results of the analysis of stress according to the criteria of Von Mises security:

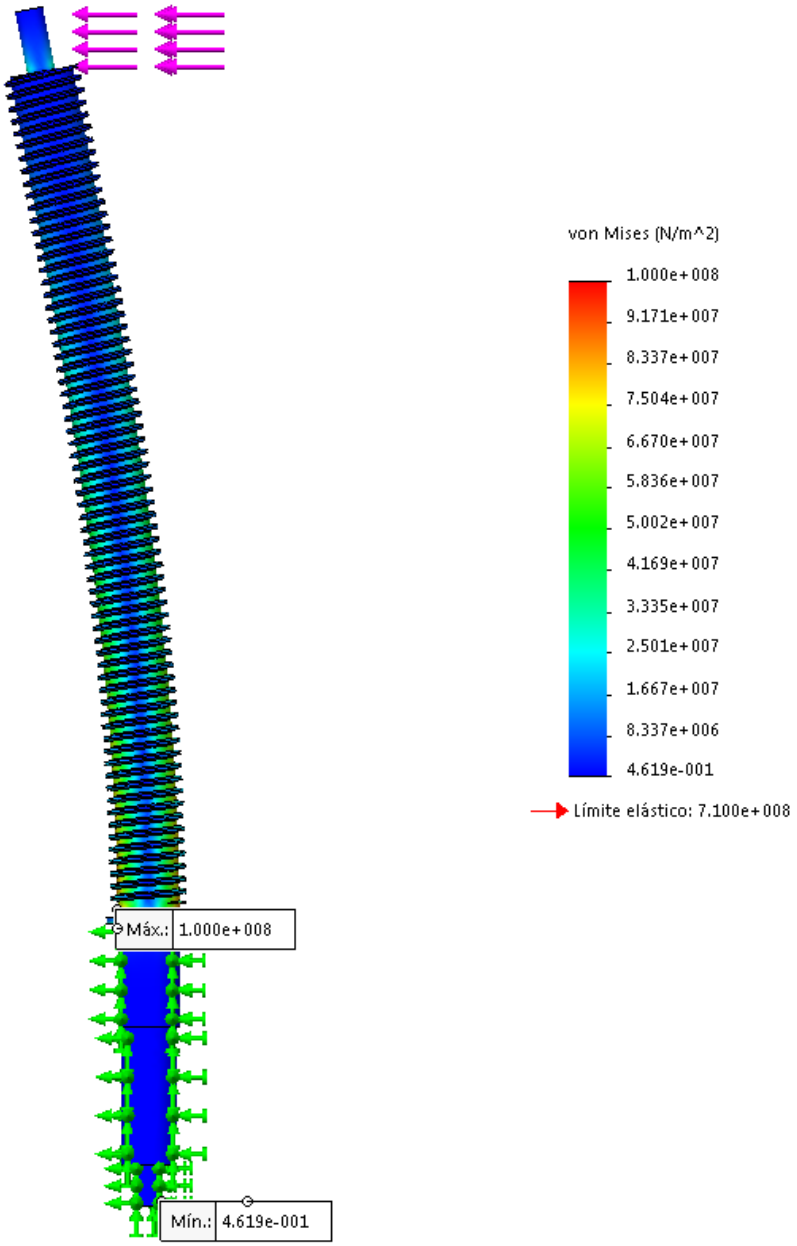


Fig.5.51: results of the analysis of stresses

As can be seen in the image, the maximum stress produced is given at the junction between the worm drive and the base, as it is estimated the theoretical calculations of the previous paragraph.

This maximum voltage value is 100 MPa, relatively close to the theoretical value calculated as 83.83 Mpa. The difference is mainly due to, by simplification of trial, the resulting force has been applied in the upper part of the drive, thus generating a momentum slightly higher in the virtual test.

- **<u>Resulting displacement:</u>** the maximum value of observed displacement is 2.51 mm, produced at the end furthest from the base.

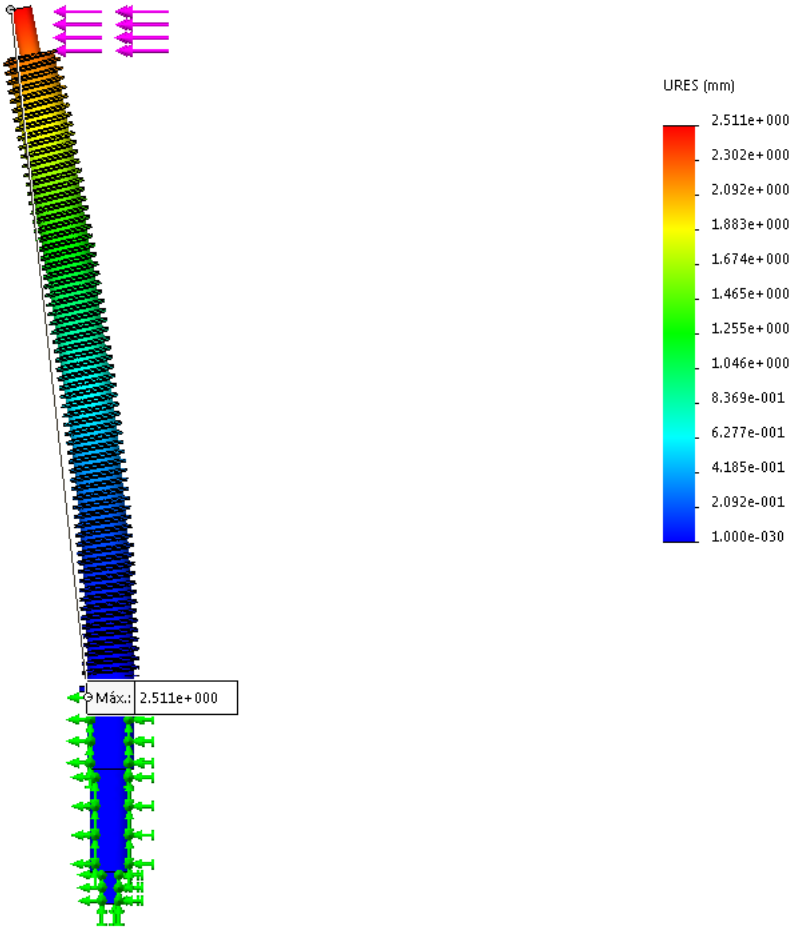


Fig.5.52: resulting displacement

6.- BUDGET

This section is an approximate budget of the cost of developing the product. However, it should be taken into account that the present DFW has tried to develop a design of operating concept that solves a problem, rather than a fully functional and mechanically developable design.

It is therefore the first phase of a project design: from an idea to the definition of the main lines of future development on which the rest of the project depend to become a fully functional and feasible project.

With this in mind, the development of a first test prototype, in which manufacturing costs have not been a limiting factor, may be considered. On this basis, the idea of making the prototype could be aimed at large public and/or private institutions or sectors in which the economic aspect is not as important as the functionality and service provided by the product. An example of this would be the high cost involved in the development of machinery for health, such as scanners, TAG´s, surgical robots, etc.

In this situation, an approximate budget can be calculated, based on products that serve a similar function, but with a distinct operating methodology.

6.1.- Similar Products to device No.1 (pick-up and positioning)

We have analysed the Recommended Retail Price (RRP) of various devices that perform the function of collection of the user from the wheelchair and placement on another platform of reception, analogous to Device No. 1 presented here.

- **Sunlift MINI:** A lifting and transportation crane with a RRP of €918

Fig.6.1: Lifting Crane and transfer Sunlift MINI

- **RiseBasic Handicare:** this product is a ceiling crane, which allows the lifting/lowering of the user and positioning using guides installed on the ceiling, with a RRP of €1430.

Fig.6.2: Rise Basic Handicare ceiling crane

- **Hygiene Crane HB Sling harness:** this is an item that is sold separately but is necessary for both ceiling cranes and X lifting and transfer cranes. Therefore, for the use of any of the above, you must add to the price of the product, the cost of this harness (€186)

Fig.6.3: Hygiene HB Sling Crane harness

Elev Up: This is a standing crane to place the user in an upright position and take them to desired place. It has a RRP of €1190

Fig.6.4: Bipedestation Crane Elev Up

In view of the issues raised, it sets an indicative budget for the proposed device:

Product	RRP (€)
SunLift MINI + harness	1104
RiseBasic Handicare	1616
Elev Up	1190
RRP average (€)	**1303.3**

Table 6.1: Approximate budget of Device No. 1

An approximate budget of €1303.30 is therefore established for the development of the first device. It must be taken into account that the analyzed products are on the market, so that production costs are significantly reduced with respect to the hypothetical production of a functional prototype.

6.2.- Products similar to device No. 2 (reception of the user)

Just as in the previous section, an analysis of commercial products available that have a similar role to the Device Nº 2 designed in the present DFW.

- **BathMaster:** is a Chair without side safety protection, but it works with the same scissor lift mechanism that has been incorporated into the reception device designed. It has a RRP of €528.

Fig.6.5: BathMaster elevating seat

After analysing the above product, an approximate budget for the design of the second device would be €528.

6.3.- Summary of the budget

This budget estimate is an approximation, the comparison between the first functional prototype manufacturing cost and the market price of a fully marketed product, is unrealistic.

Device	Approx price in €
Nº1	1303.30
Nº2	528
Approximate total price	**1831.30**

Table 6.2: Total approximate budget.

However, it provides an idea of the high price that an assistant mechanism for the bathroom will have. That said, it will fully compensate the costs in exchange for a functionality that allows a more comfortable standard of living, both for the user and their assistant.

7.- CONCLUSIONS

In this section a comparison point by point is carried out between the objectives set at the beginning of the DFW and the results once completed it. Thus, it begins with a review of the objectives of paragraph *"2.-Objectives of the DFW"* and an analysis of the degree of compliance with them

- *"**Front access:** improved functionality in confined spaces compared to other systems of lateral access (wheelchair turning radius)"*
    - **Degree of compliance:** with respect to the concept of operation for the device No.1, the requirement of a front access to the wheelchair, can be considered a fulfilled objective.

      However, it must be considered that, without a first functional prototype, it is difficult to check the feasibility of the idea, as well as the failures of design in this concept. There are future points to analyze / resolve through testing a first real assembly:
        - Safety in the movement of the seat: movement and the path of entry of the seat may not be optimal. There may be the possibility that seat slides abruptly under the thighs of the user, and may cause pinching. **For this reason, a point to resolve would be coordination between the worm drive elevation movement and progressive rotation of the seat until it is completely under the user.**
- *"**Versatility:** adjustable height of the system, along with the rotation and lateral displacement must permit their use in facilities (bath or shower) or different situations."*
    - **Degree of compliance:** based on the solutions raised for this purpose, each of them is individually analyzed:
        - ***Height adjustable:*** using the spindle worm in the first device, and the scissor mechanism in the second, it can be adapted to the height of the system, for convenience of the assistant when it comes to showering the user.
        - **Rotation:** there is a solution to this requirement through ball positioners. In general terms, it provides a simple and economical solution that solves the problems of rotating.

          However, the concept of rotation, but not in a way completely safe nor controlled, is resolved because there is no safe lock positions. This would create the possibility that turns dangerous and unwanted den on the set of the seat. **With this in mind, the goal has been resolved, but security methods used are not specified so that the rotational movement to ensure there is no physical danger to the user or the Assistant.**

- **<u>Lateral displacement:</u>** thanks to the installation of linear guides, this movement can be performed both on the pickup device and the reception.

  However, in security matters, this movement not is conducted in a safe manner as there are no locking mechanisms for the brackets of the guides. With the user seated on the seat, the side of the elevating assembly displacement could be very difficult to control safely by the assistant. **Therefore, there is a possible physical solution, but which has not been resolved with respect to security.**

- *"**Elimination of obstacles and elements fixed or anchored to the ground:** reduction of installation, no need to create structures or fixed elements that alter the aesthetics of the space in which the device is used."*

  - **Degree of compliance:** both the T-base of the first device, and the bottom drawer on the second device, is provided as a solution for the solution of both. **Therefore, there is no need for fixed elements that alter the environment in it which the devices will be installed.**

- ***Aesthetics:** the device is intended to be used frequently by people in a very personal area such as hygiene." "In addition, to adapting the design so that it can be used in the home, so the aesthetics should be neutral, avoiding fancy designs and distancing it away from an industrial machine image."*

  - **Degree of compliance:** we have tried to provide better morphology to the seat to adapt it to the shape of the human body. This contribution of functionality also gives as a result, a agreeable object to look at.

    On the aspect of the "image of the machine", it may not have been resolved entirely, because many mechanical elements as the worm drive, are in sight. **Therefore, this objective is not fully resolved.**

8.- FUTURE LINES FOR THE FUNCTIONAL DEVELOPMENT

In section *"6.- Budget"*, we refer to the idea of the design of the concept *"it is therefore the first phase of a project design: from the mental idea to the definition of the main lines of future development over which run the rest of the project to become fully functional and feasible."* We should be aware that, in the business world, there are many people who are part of a group of R&D that make new projects. Therefore, the idea of completely developing the design of the devices raised in DFW, is not feasible for just one person.

In this way, in this section is intended to suggest a path to follow in the development of devices, with the aim of achieving a system with much more real functionality. In addition, we also outlined objective solutions where compliance is not high or at least satisfactory after its analysis in the section *"7.- Conclusions* ".

For this, we analysed specific points that the idea must be analyzed and developed more thoroughly, most of them relating to matters of security.

- **Locking of the elevating assembly:** there are no positions or controls over the locking of this movement in which the whole rotates 90 degrees onto the spindle axis.

  As line to follow for a concrete solution to this problem, there is the use of electromagnets in the positions of collection (front to the wheelchair) and positioning (parallel to the longitudinal axis of the 2nd device), in such a way that the assembly is blocked respect to the T-base for these two movements.

  Using these electromagnets provides the possibility of freeing the movement at the time desired, and therefore having control over it.

Fig.8.1: electromagnetic retention for emergency doors

- **Lock and control of lateral displacement:** as with the 90 degree movement, the elevating assembly is not equipped with blocking mechanisms or control of sliding on the linear guides. For the solution of this problem, we propose the use

of a motorized rack attached to the brackets of the linear guides, in such a way that the displacement for the positioning is done in a totally controlled manner.

The intention is to use this same mechanism to control the displacement of the receiving device.

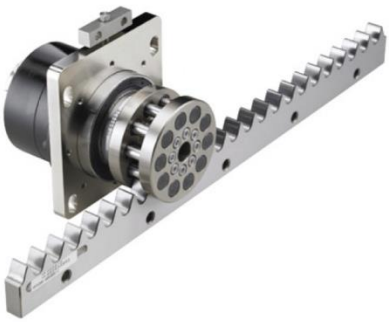


Fig.8.2: sprocket cog rail for precise linear positioning

- **<u>Pivoting seat movement:</u>** as has been raised in the section "*7-conclusions*", coordination between the elevation of the spindle and the rotation of the seat to collect the user must be fully coordinated. If not, it is likely that using the proposed method, the introduction of the seat on the chair cannot occur abruptly, hindering its operation.

  Therefore we propose the integration of a linear actuator in the releasable block, fixed at one end and attached to the pivot axis of the seat. In this way, the angle factor giro-time angle can be controlled and coordinated with the elevation of the spindle.

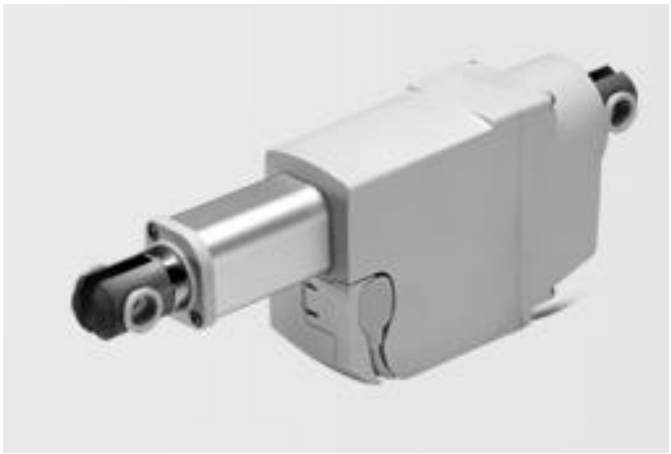


Fig.8.3: LINAK electric actuator

So, with these solutions raised, we describe future lines to improve the functional development of the two devices.

At the beginning of the DFW, the design was proposed as a solution to reduce the number of actions and efforts of the assistant. Therefore, to improve this aspect, we propose centralized automation of the solutions that have been raised in this section. The idea is to unify all the control functions of displacements and movements in a handset device, from which the assistant can perform all the necessary movements without effort.

Below there are some points that have not yet been decided, whose possible solutions are contemplated by the automation of the system as has been done with the previous points.

- **Backrest locking:** in the case of the seat assembly, a reclining backrest, whose centre of rotation is incorporated in the releasable attachment. With the user´s back resting on it, the possibility that it can rotate freely has been raised, resulting in a very unsafe situation for the user.

  On this basis, it is necessary to analyze a solution of anchor point between the backrest and the seat, which can be carried out in a comfortable and safe way. As a simple measure, a releasable blocking mechanism installed on it is proposed. The idea is to place a pin inserted by hand.

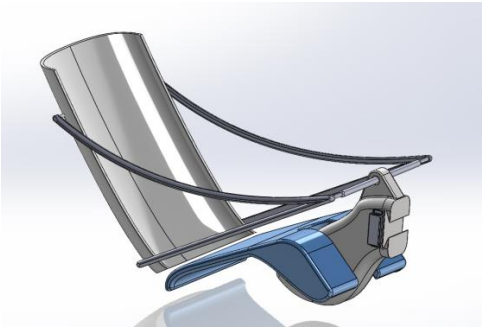


Fig.8.4: reclining backrest and seat

- **Blocking the lateral movement of the seat:** in the image you can see the seat fits loosely in the receiving device.

  This gap between seat and retaining plates can cause lateral displacement resulting in danger or pinching on the skin of the user.

  A proposed solution is the integration of rubber plates, type EPDM, which pad the gap of the seat securely. Eliminating this gap minimizes the risk of pinching in the skin.

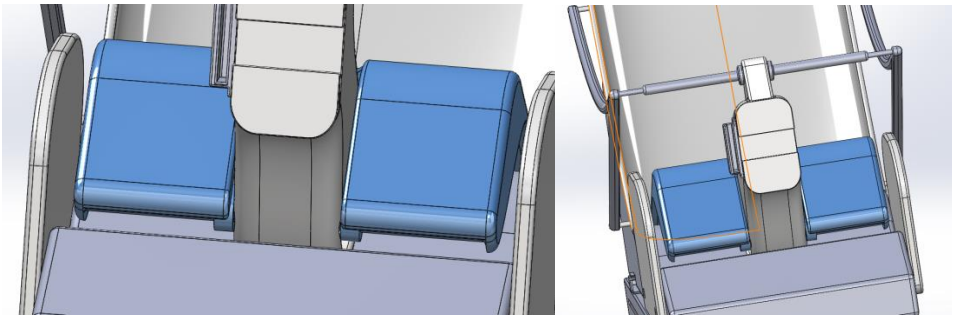


Fig.8.5: detail of the clearance between seat and retaining plates.

In relation to the above retention plates, previously explained that one of them is fixed and the other is inserted. To avoid the unexpected removal of the attachable retaining plate, a proposed restraint system using a PIN to block the rotation of the support.

Fig.8.6: restraint system for blocking

- **<u>Receiving platform re-design</u>**: During this project development, the morphology and movements done by this component have been defined. However, the manufacturing process hasn´t be consistently defined, considering this piece as a mono-block piece.

  Taking into account, the elevate price of machining this component as a unique block, a future development way are described in order to

  This re-design development idea, consist in decrease the assembly weight, doing the same with the manufacturing costs. First, an empty body piece are manufactured with the same shape and exterior dimensions as the actual receiving platform.

  In this gap, a reinforcement structure made by 5 mm steel sheets are assembled.

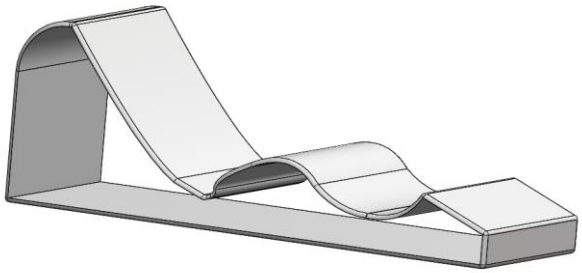


Fig.8.6: receiving platform re-design concept

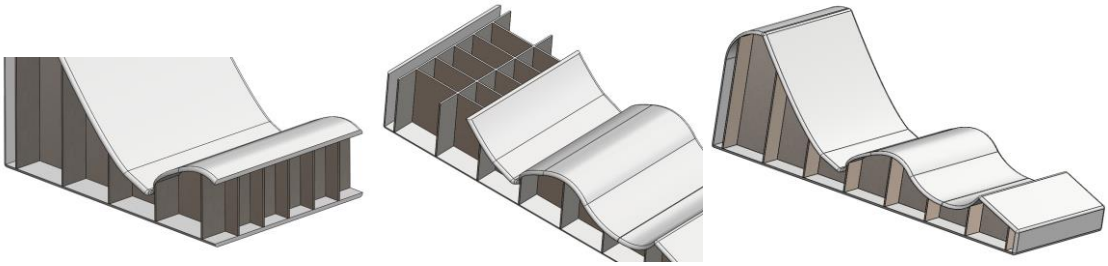


Fig.8.7: inner reinforcement panels

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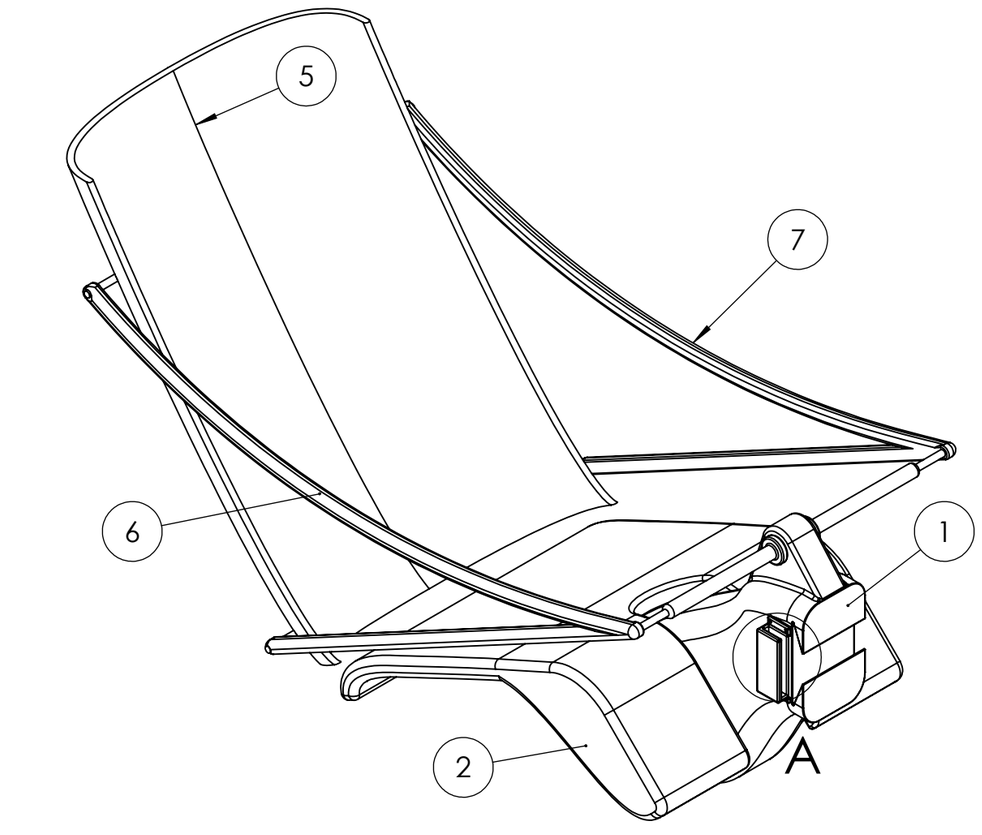
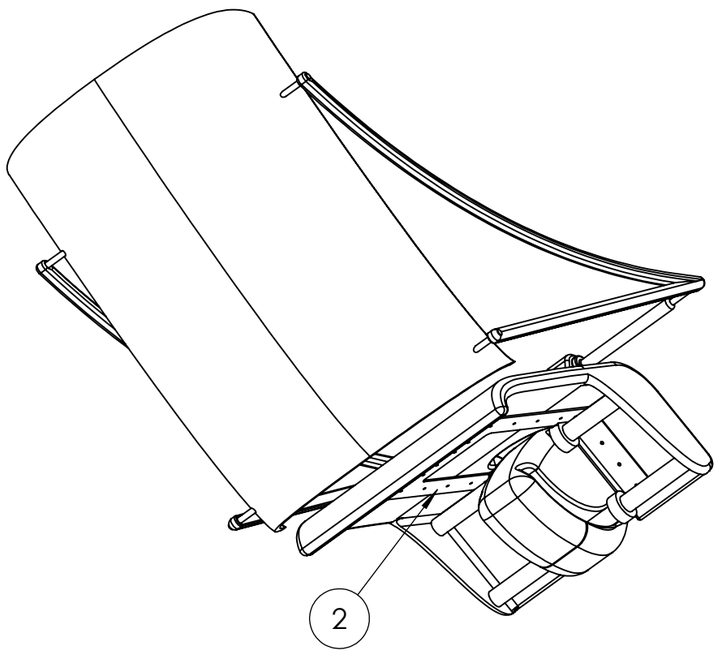
10.- ANEXOS

ANEXO 1: Planos
ANEXO 2: Documentación comercial

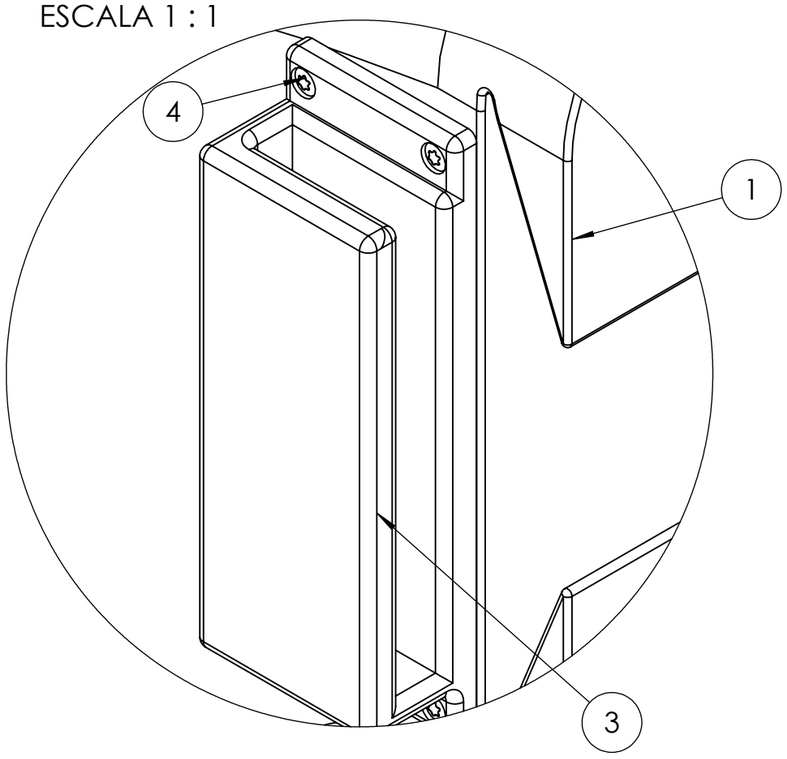
ANEXO 1: PLANOS





N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Acople liberable	1
2	Asiento	1
3	Cierre palanca	1
4	Tornillo Allen DIN912 M3x20	4
5	Respaldo	1
6	Sujeción lateral derecha	1
7	Sujeción lateral izquierda	1
8	Pletina unión asiento	1

DETALLE A
ESCALA 1 : 1



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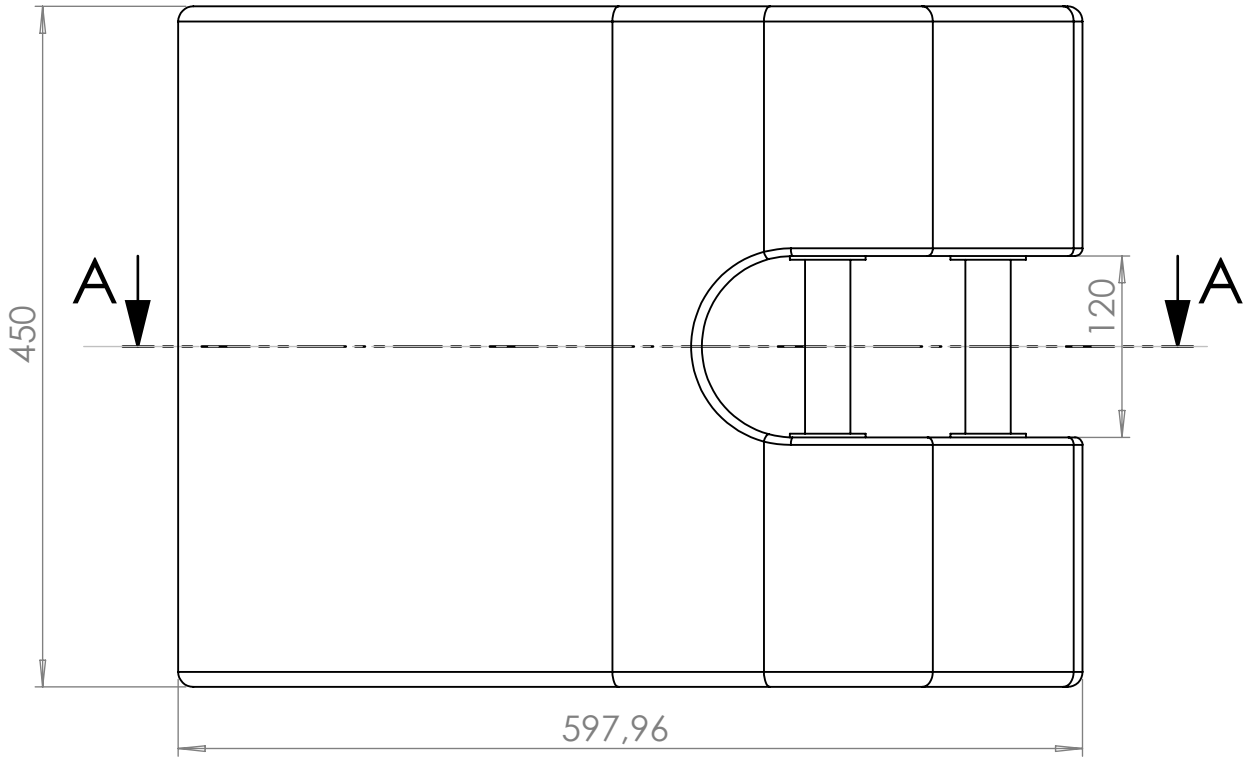
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO	A3
						Conjunto asiento	
				PESO:		ESCALA:1:5	HOJA 1 DE 1



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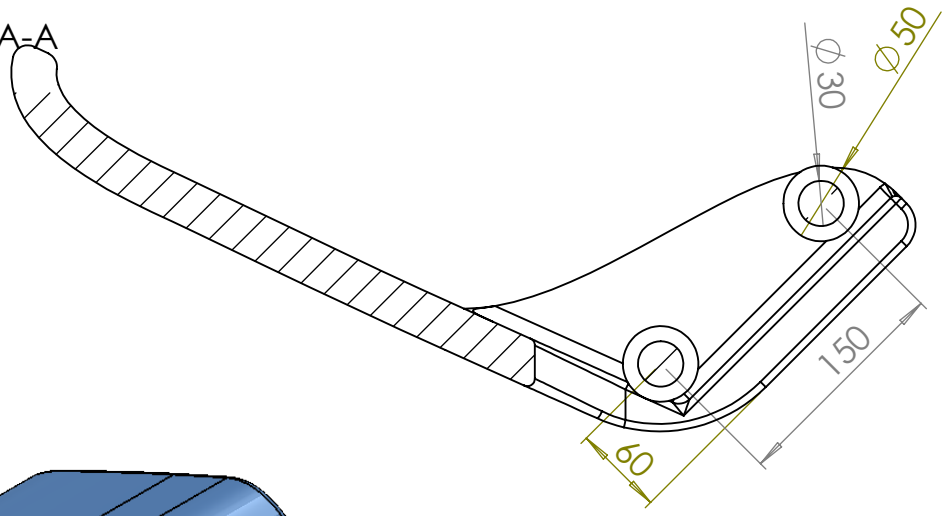

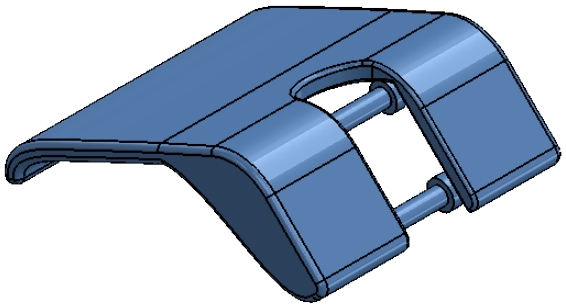

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	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Policarbonato reforzado con fibra de vidrio

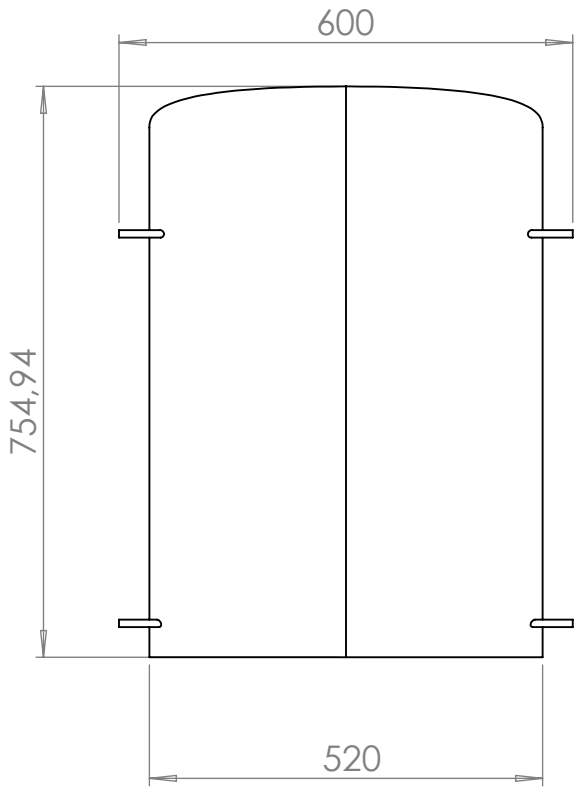
N.º DE DIBUJO: Asiento

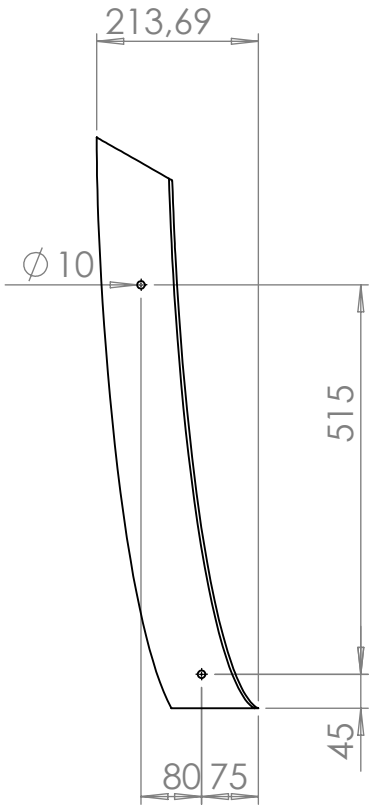
A4

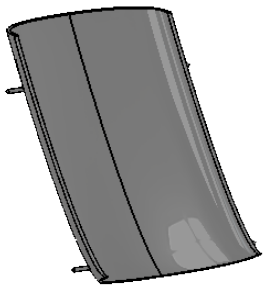
PESO:

ESCALA:1:5

HOJA 1 DE 1







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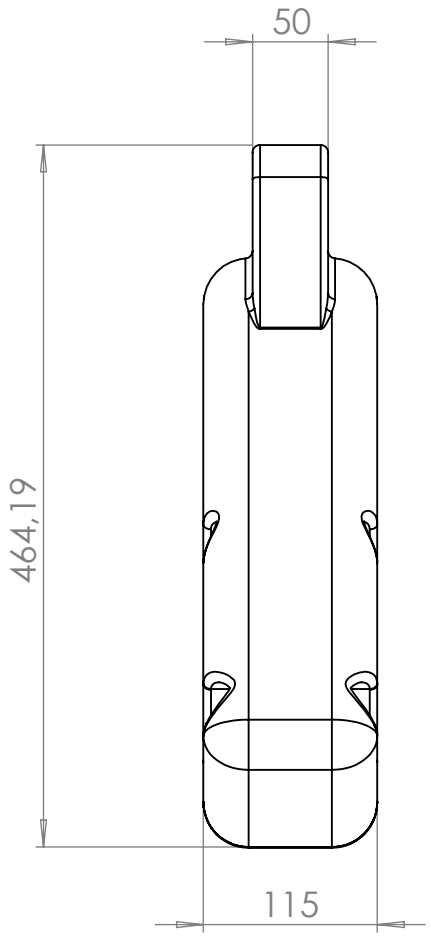
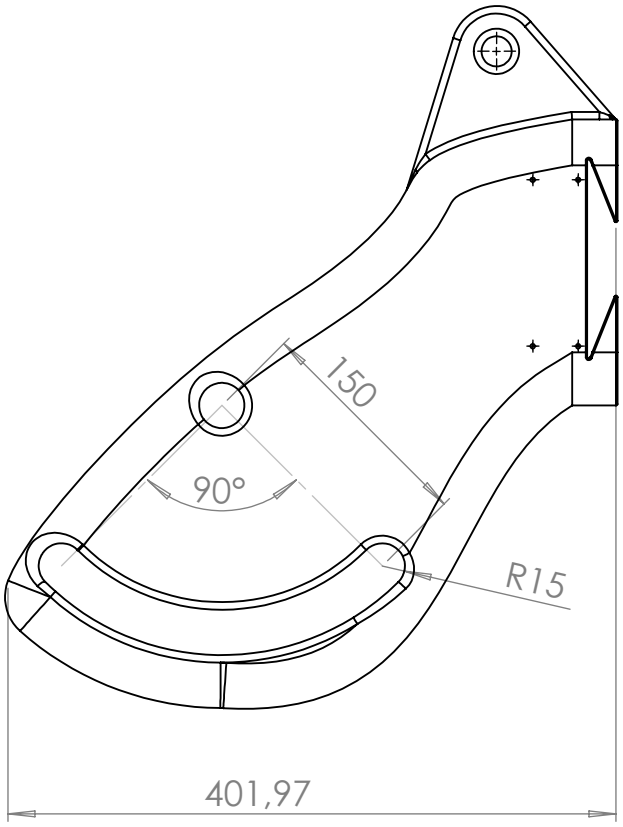
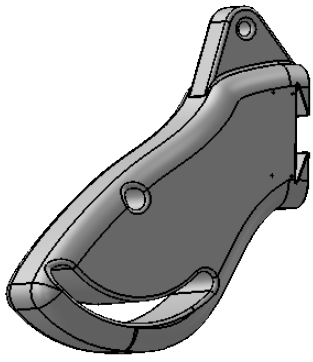
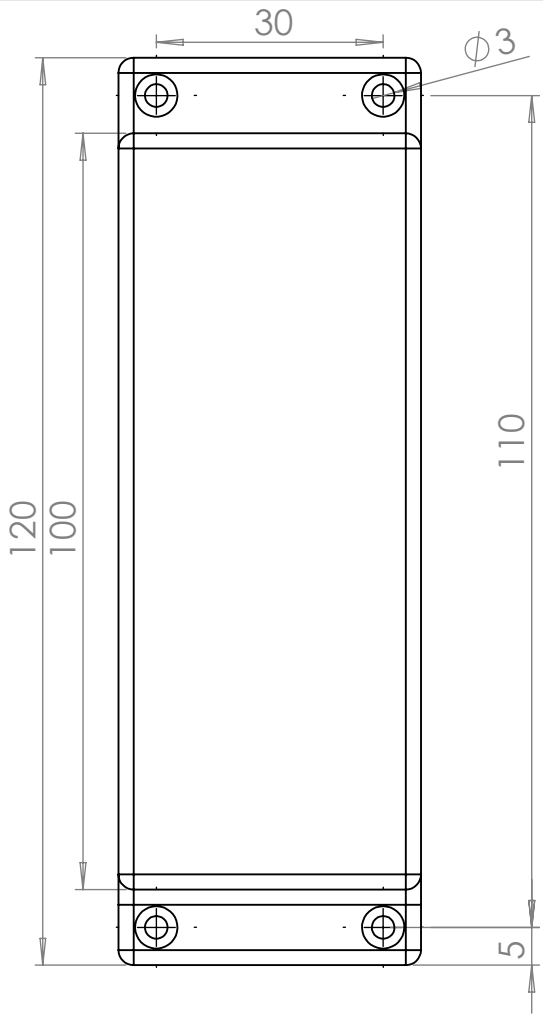
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Policarbonato reforzado con fibra de vidrio		N.º DE DIBUJO Respaldo	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1

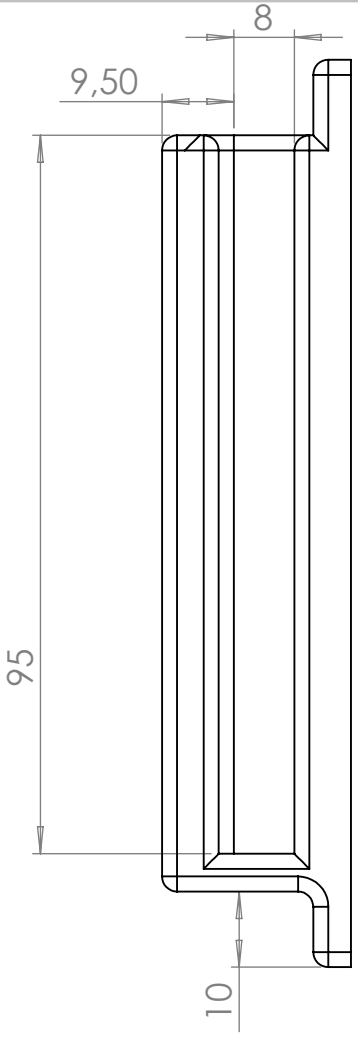


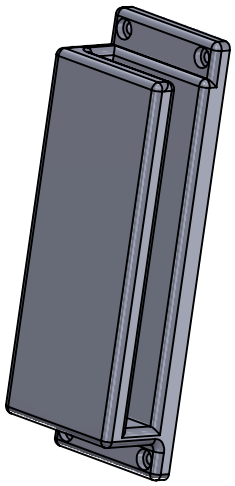


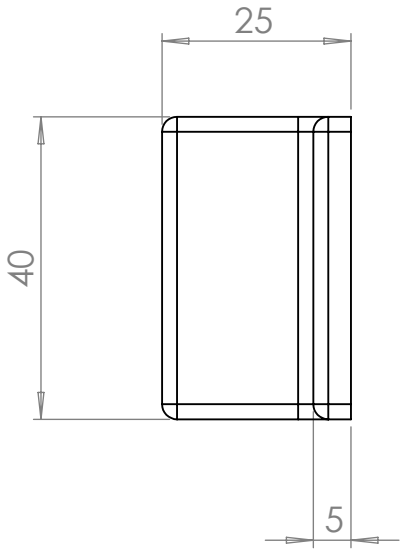


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN	
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Por definir tras fase de ensayo		N.º DE DIBUJO Acople liberable	A4
				PESO:		ESCALA:1:5	HOJA 1 DE 1







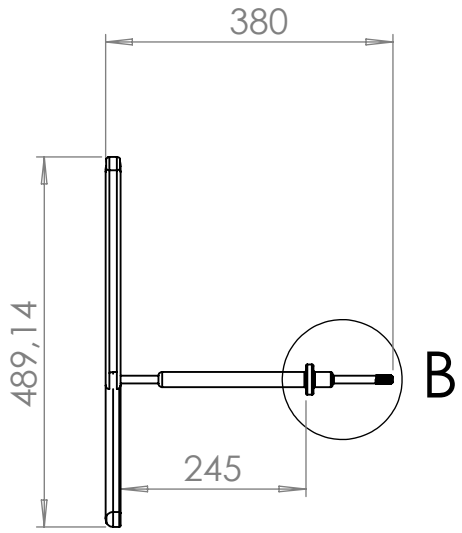


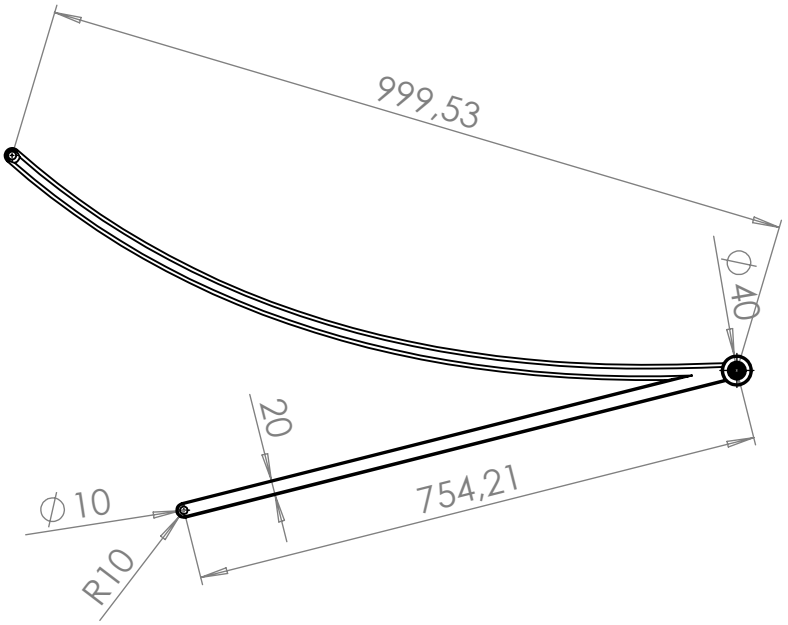
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

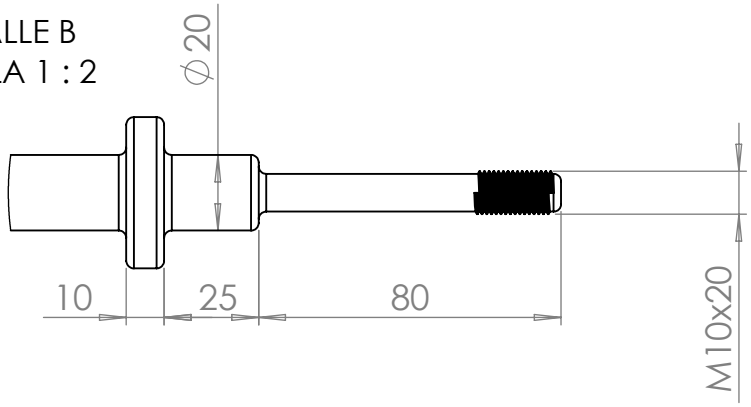
TÍTULO: Cierre palanca

MATERIAL:	N.º DE DIBUJO	
AISI 4340		A4
PESO:	ESCALA:1:1	HOJA 1 DE 1

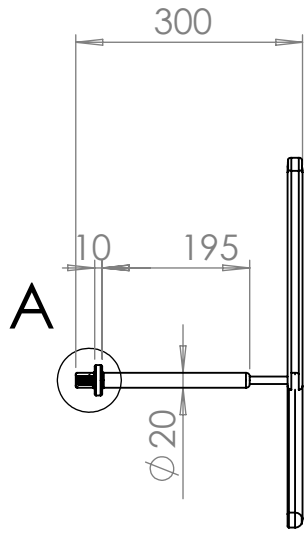


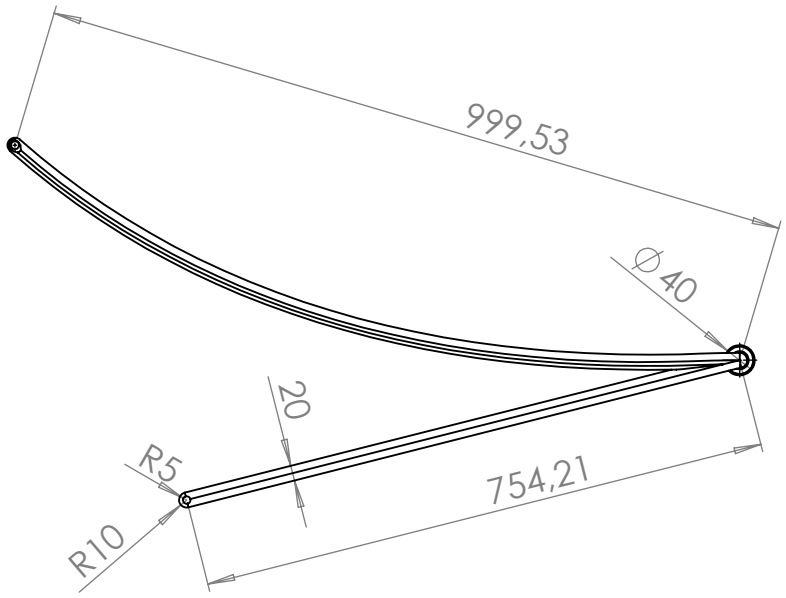


DETALLE B
ESCALA 1 : 2

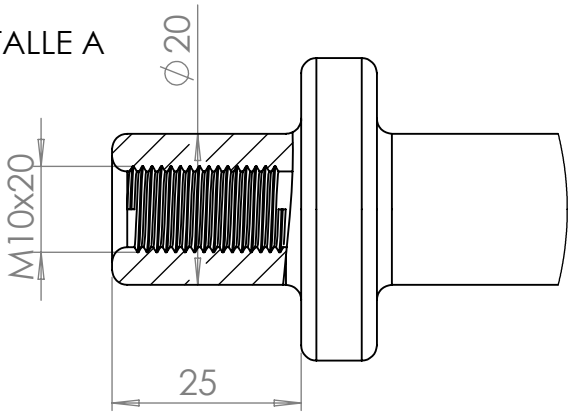


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Aluminio		N.º DE DIBUJO Sujeción lateral izqda.	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1

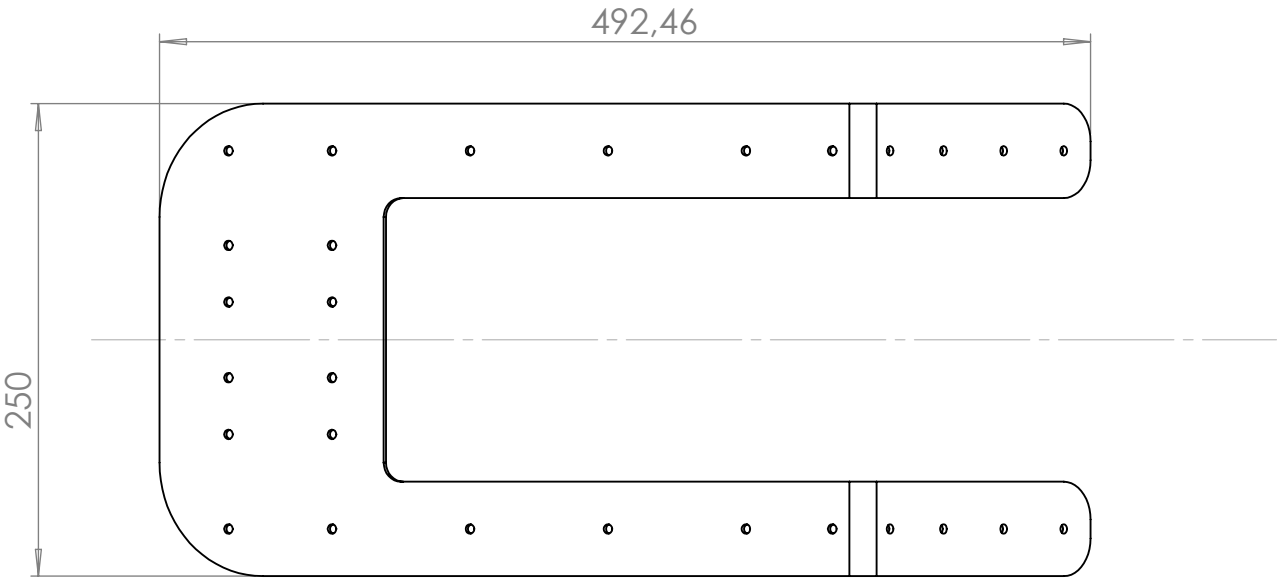


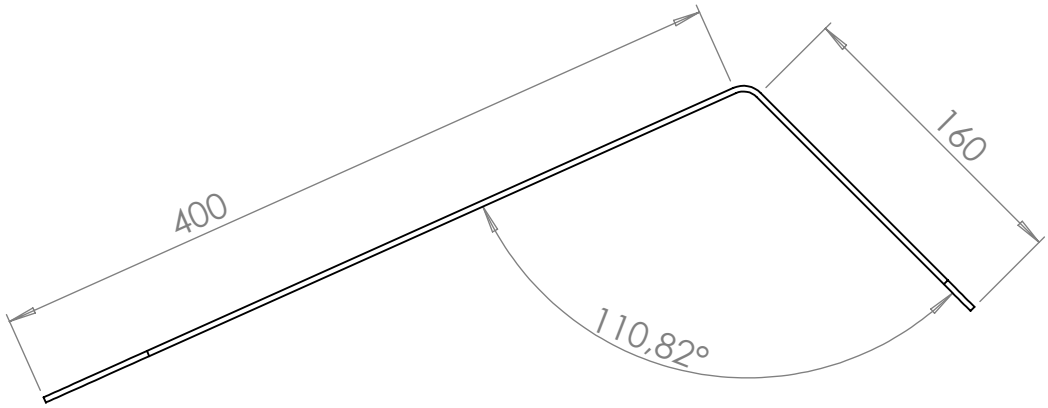


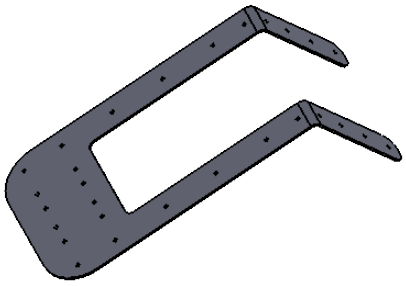
DETALLE A



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA		REVISIÓN	
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Aluminio		N.º DE DIBUJO Sujeción lateral derecha	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1

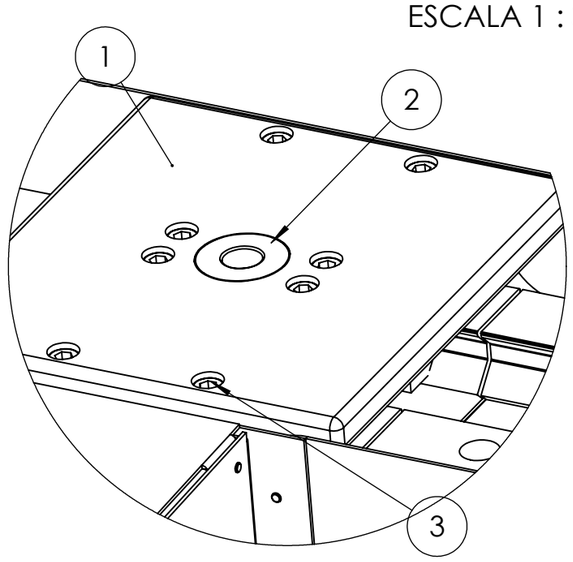


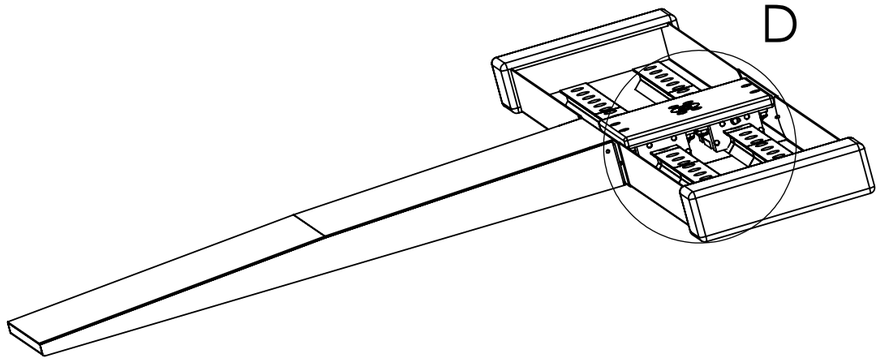




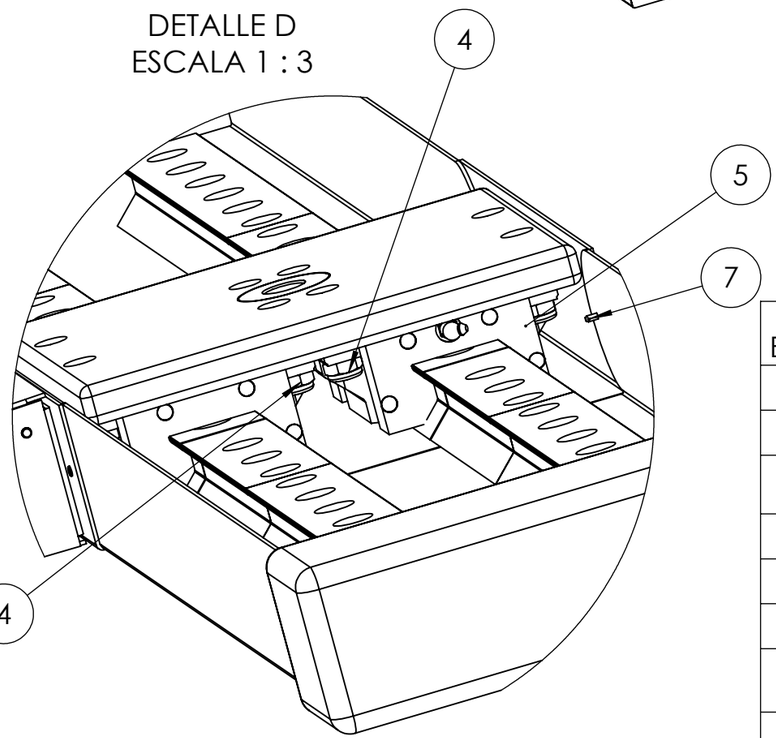
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 3mm		N.º DE DIBUJO Pletina unión asiento	A4
				PESO:		ESCALA:1:4	HOJA 1 DE 1

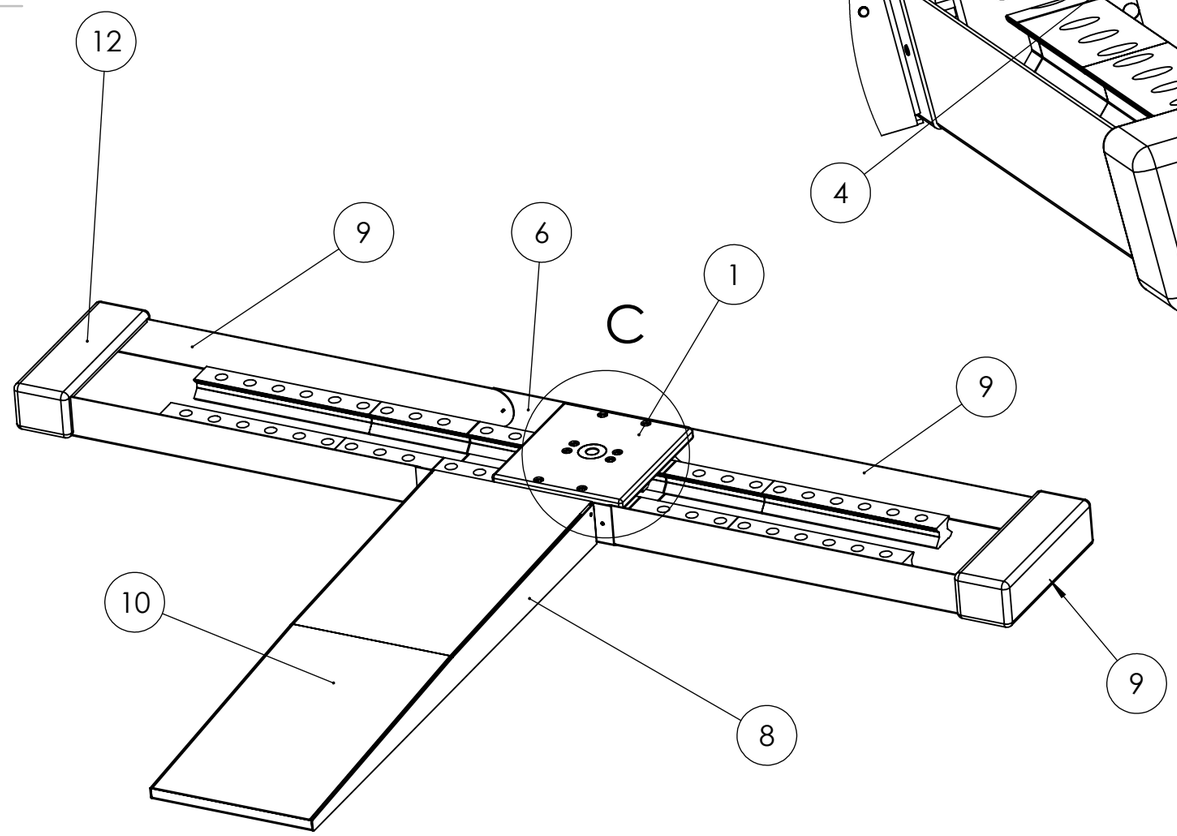
DETALLE C
ESCALA 1 : 3





DETALLE D
ESCALA 1 : 3

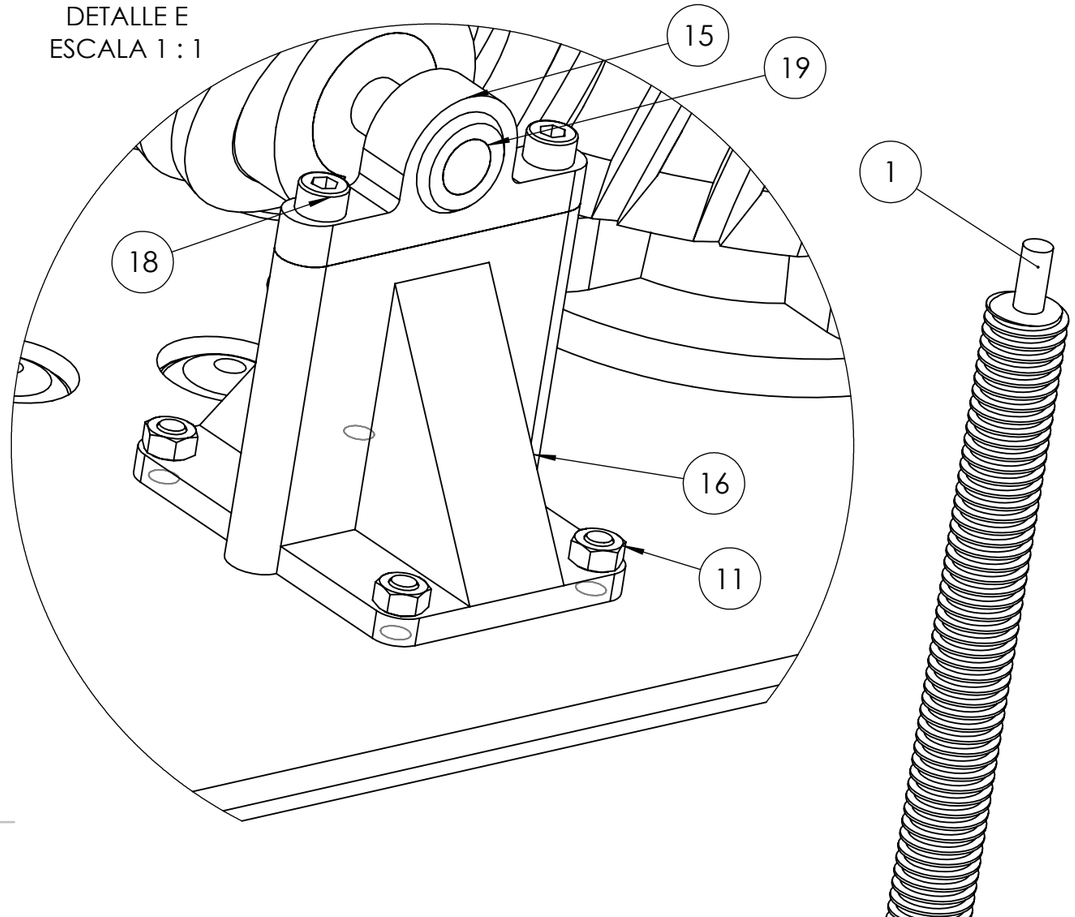


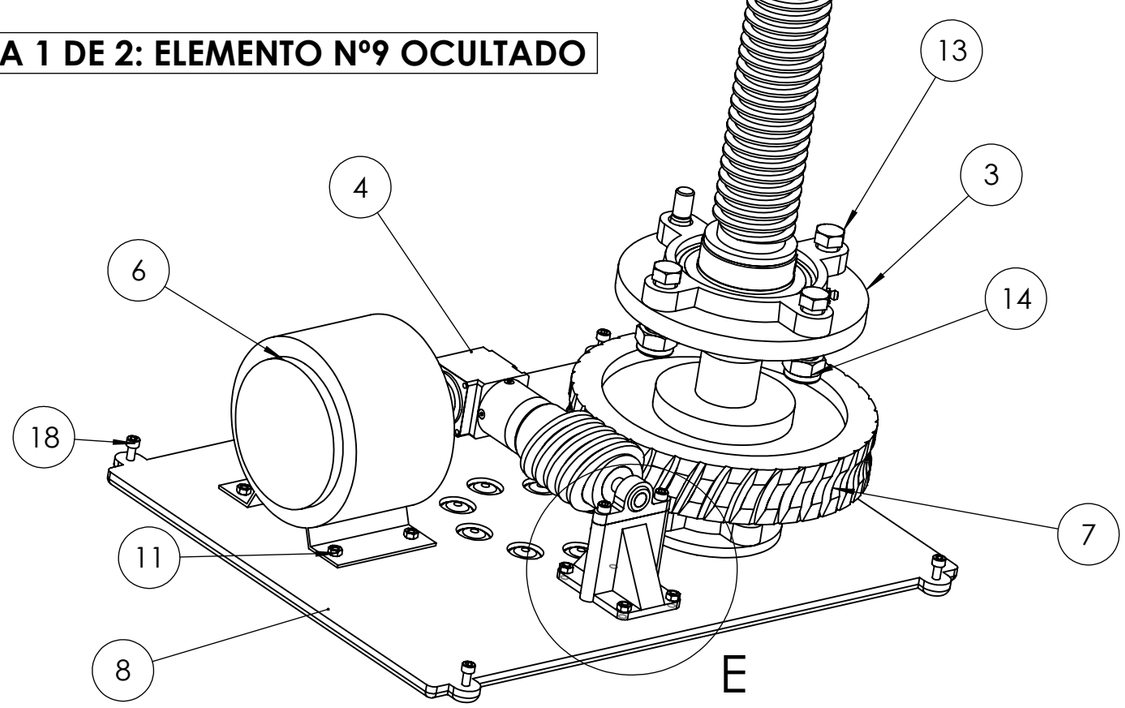


N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Placa de soporte	1
2	Rodamiento NSK N204W	1
3	Tornillo Allen DIN912 M10x30	8
4	Tuerca autocierre DIN958 M10	8
5	Soporte guía NSK-RA25	2
6	Subc. soldadura central	1
7	Pasador ∅3	6
8	Subc. soldadura base	1
9	Subc. soldadura lateral	2
10	Tapa	1
11	Tuerca autocierre DIN958 M8	8
12	Tapa guías lineales	2

SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO Conjunto deslizante	A3
				PESO:		ESCALA:1:10	HOJA 1 DE 1

DETALLE E
ESCALA 1 : 1

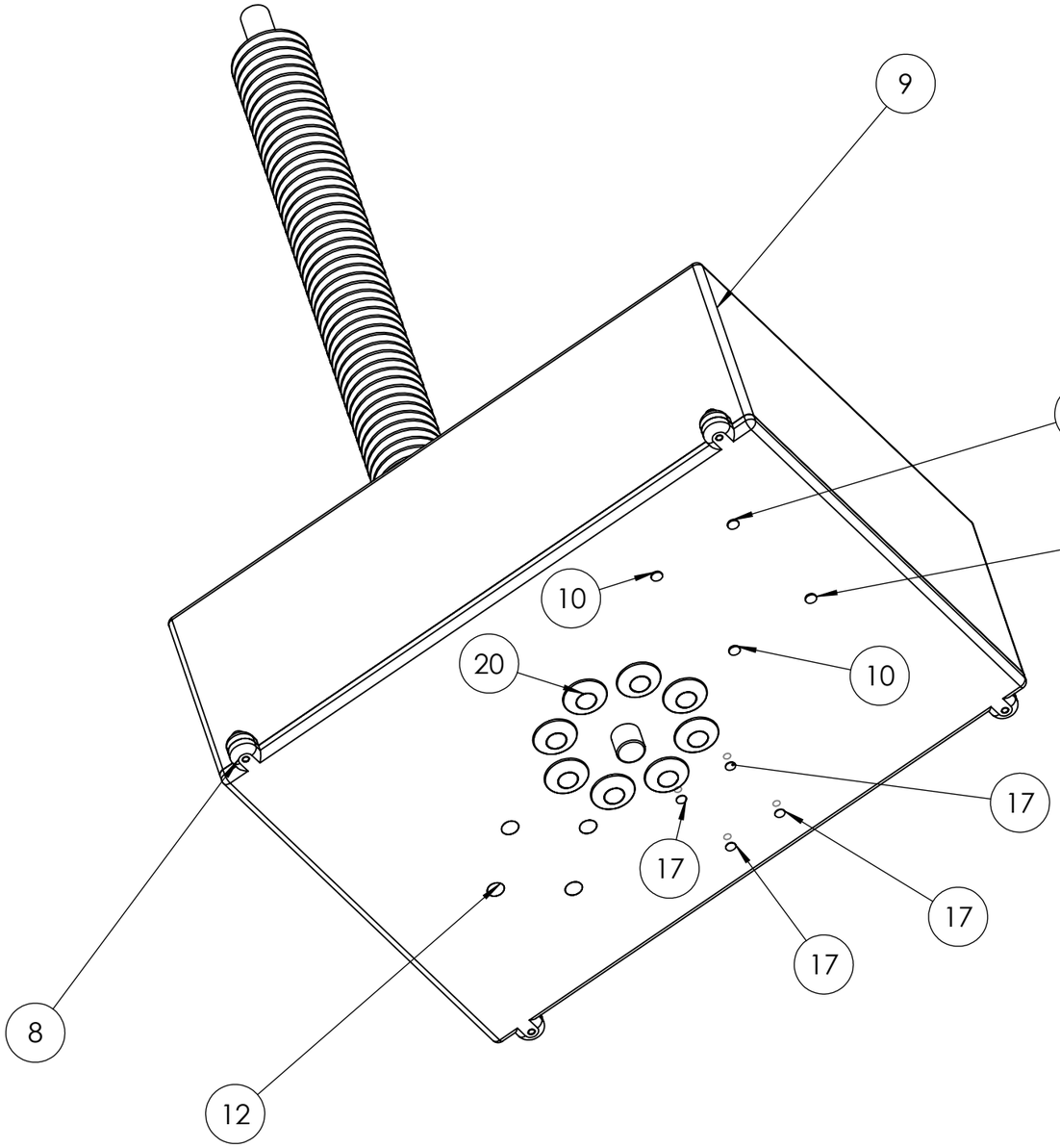




HOJA 1 DE 2: ELEMENTO Nº9 OCULTADO

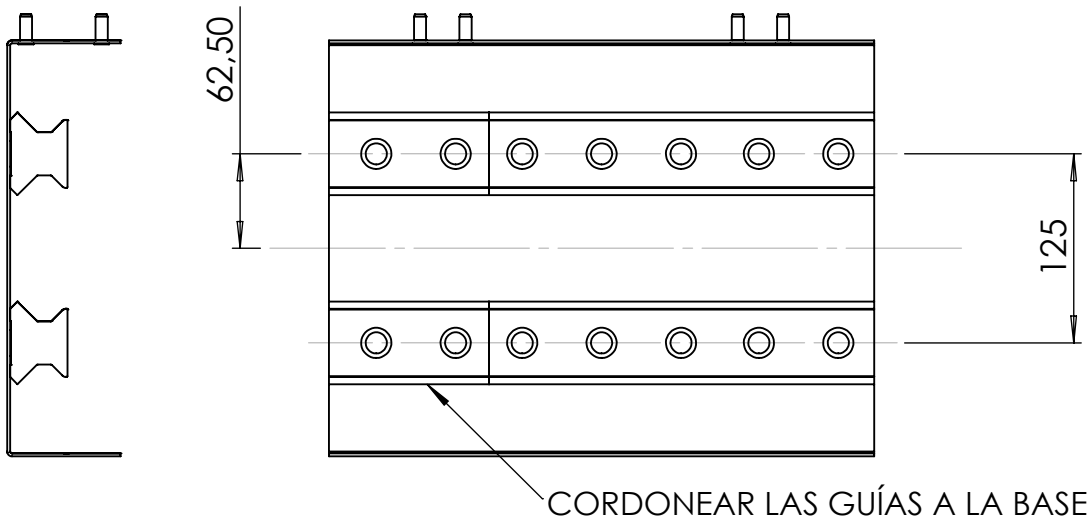
N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Husillo sinfín	1
2	Rodamiento NORELEM 24212-50210	1
3	Rodamiento NORELEM 24212-20204	2
4	Reductora NEUGART WPLE040	1
5	Acople reductora	1
6	Motor Miromax BLT-500	1
7	Sínfín con rueda dentada 8:1	1
8	Base cajón	1
9	Tapa cajón	1
10	Pernos insertables M5x15	4
11	Tuerca autocierre M5	8
12	Espárrago soldable ∅12	4
13	Tuerca hexagonal M12x50	4
14	Tuerca autocierre M16	3
15	Rodamiento pedestal NORELEM 23500-10	1
16	Soporte rodamiento motor	1
17	Pernos insertables M5x20	4
18	Tornillo Allen DIN912 M5x20	6
19	Acople sinfín	1
20	Posicionador de bola	8
21	Soporte reductora	1

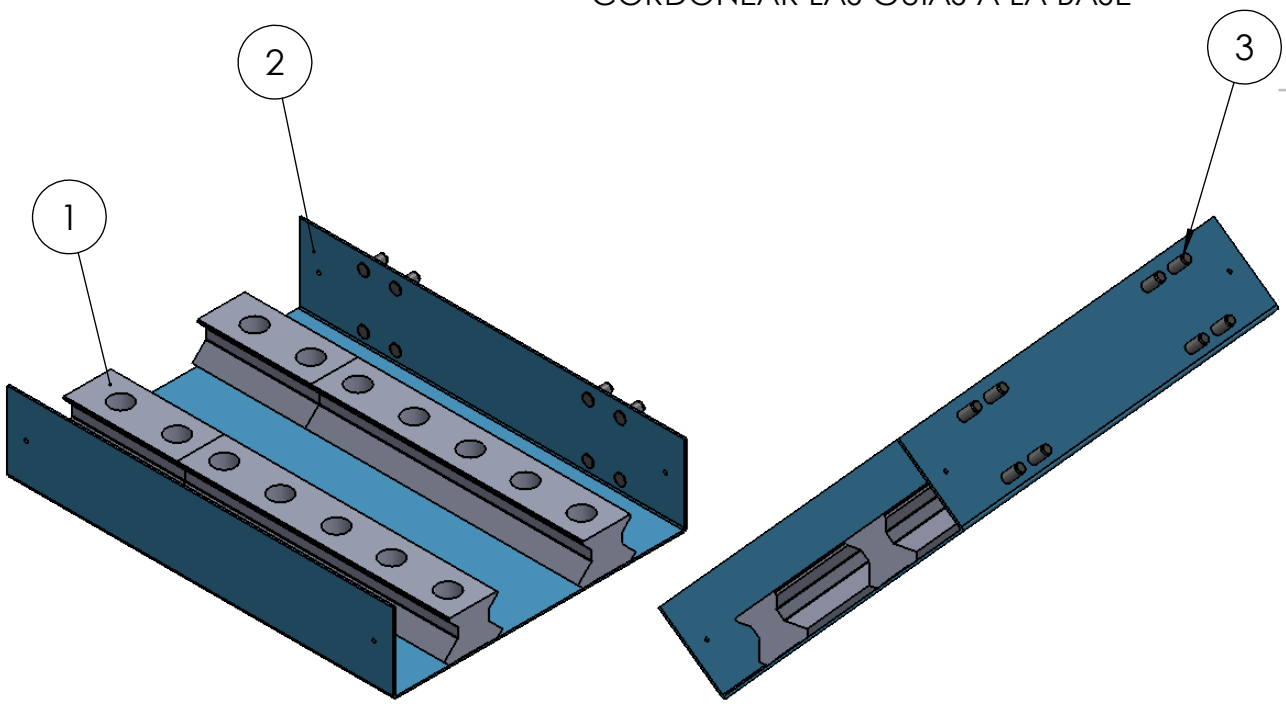
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN		
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO	A3
						Subconjunto motor	
				PESO:		ESCALA:1:4	HOJA 1 DE 2



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN	
	NOMBRE	FIRMA	FECHA		TÍTULO:		
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:	N.º DE DIBUJO Subconjunto motor		A3
				PESO:	ESCALA:1:4	HOJA 2 DE 2	

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Guía NSK-RA25	2
2	Base central	1
3	Pernos insertables M8x20 zincado	8





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

N.º DE DIBUJO: Subc. soldadura central

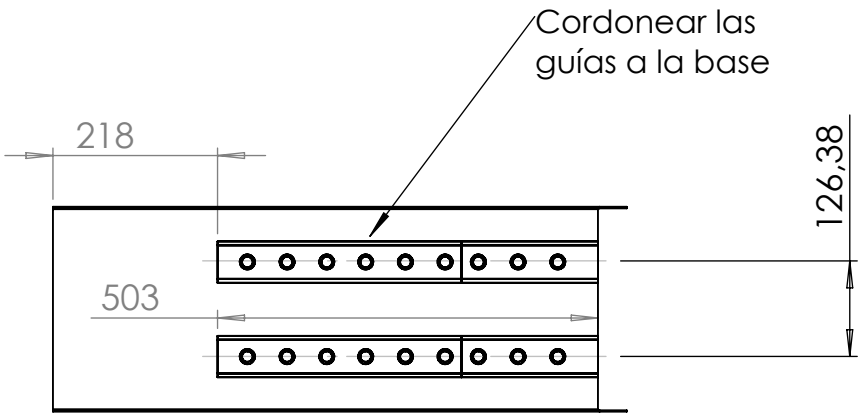
A4

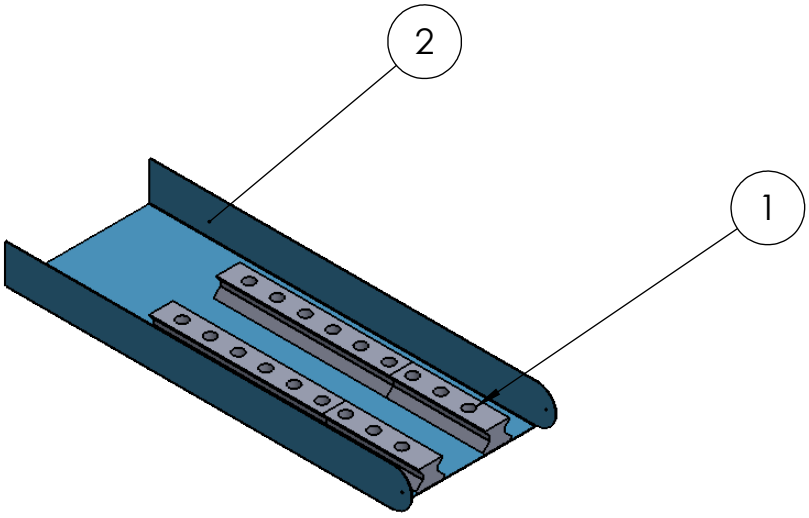
PESO:

ESCALA:1:10

HOJA 1 DE 1

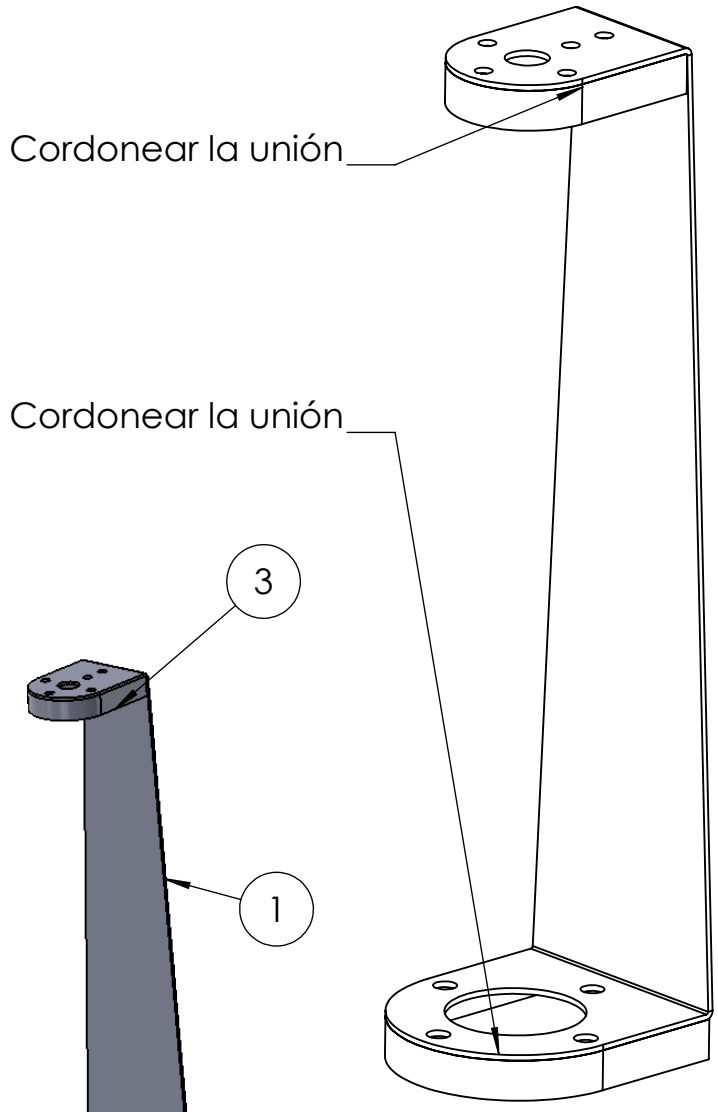
N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Guía NSK-RA25	2
2	Base lateral	1

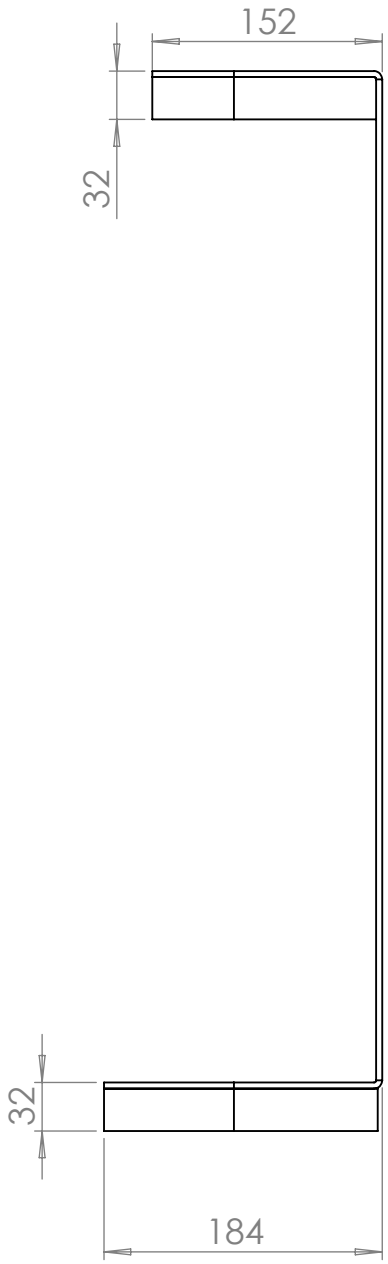




SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO	A4
						Subconjunto soldadura lateral	
				PESO:		ESCALA:1:10	HOJA 1 DE 1

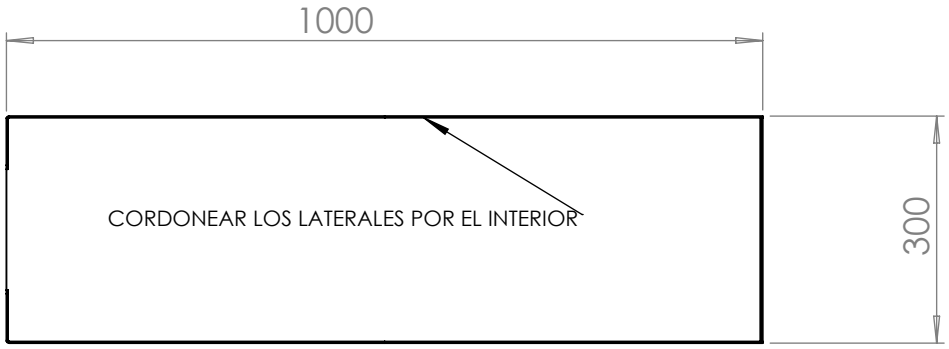
N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Soporte husillo	1
2	Tapa inferior	1
3	Tapa superior	1

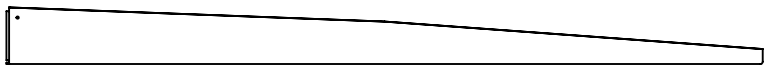


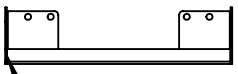


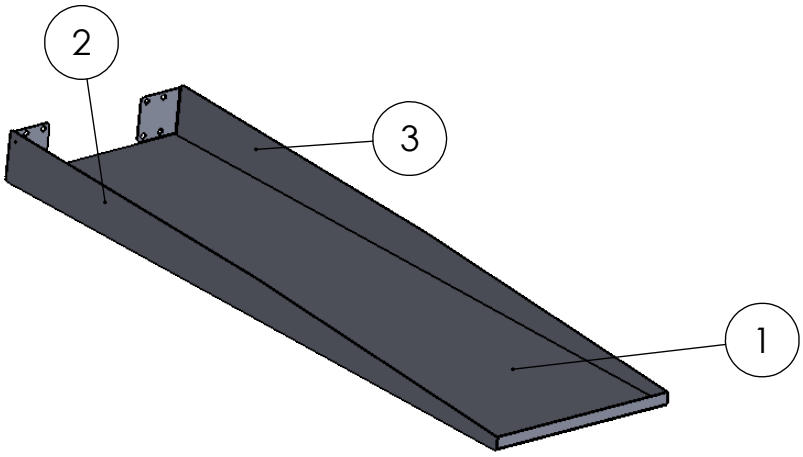
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA		REVISIÓN	
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO	Subc. soldadura soporte husillo
							A4
				PESO:		ESCALA:1:5	HOJA 1 DE 1

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Base	1
2	Lateral izquierdo	1
3	Lateral derecho	1









SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

PESO:

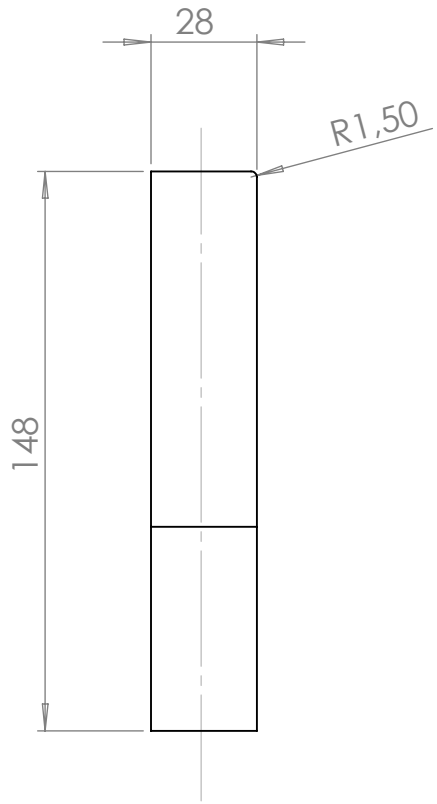
N.º DE DIBUJO

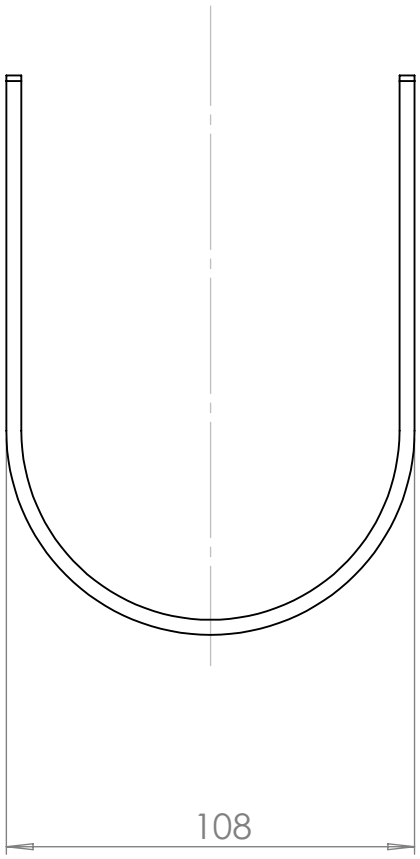
Subc. soldadura base

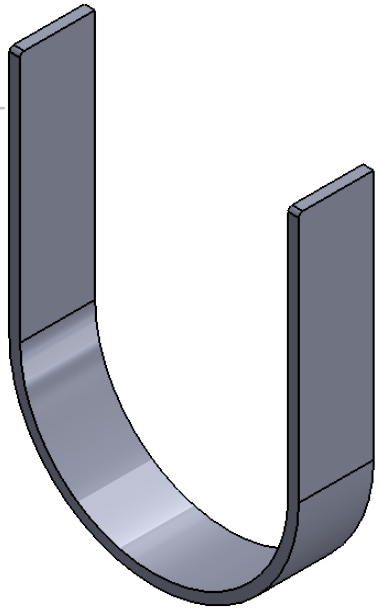
A4

ESCALA:1:10

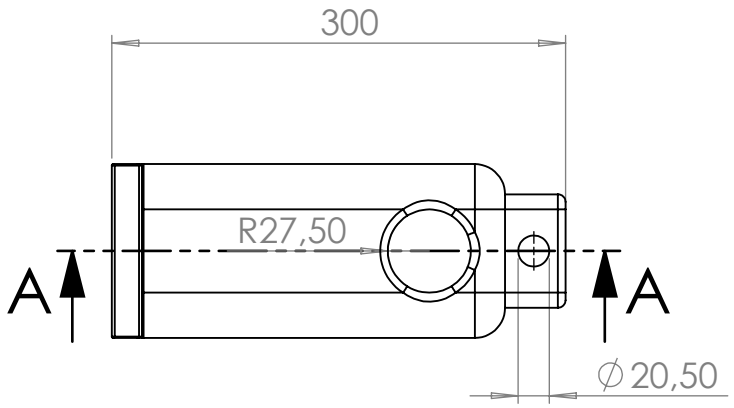
HOJA 1 DE 1

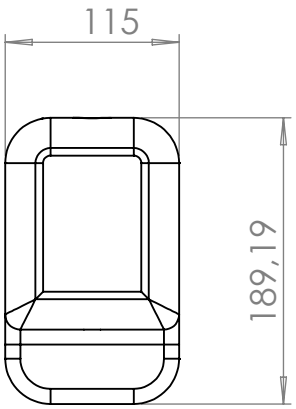


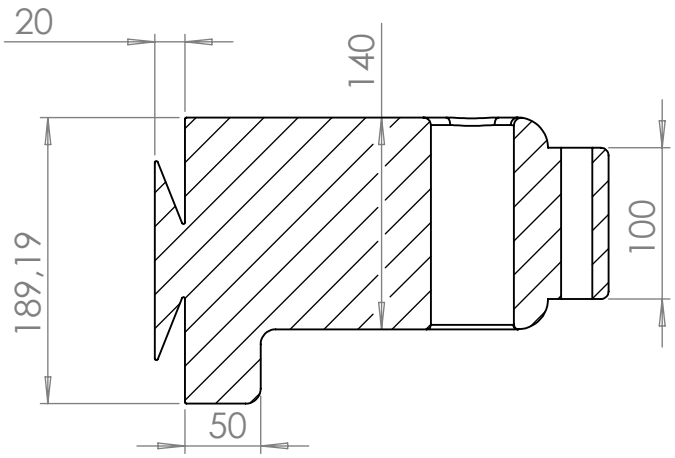




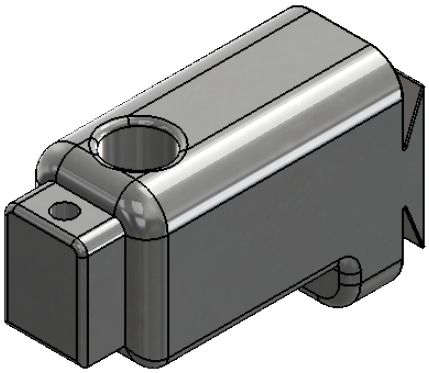
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 4mm		N.º DE DIBUJO Tapa superior	A4
				PESO:		ESCALA:1:2	HOJA 1 DE 1







SECCIÓN A-A



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340

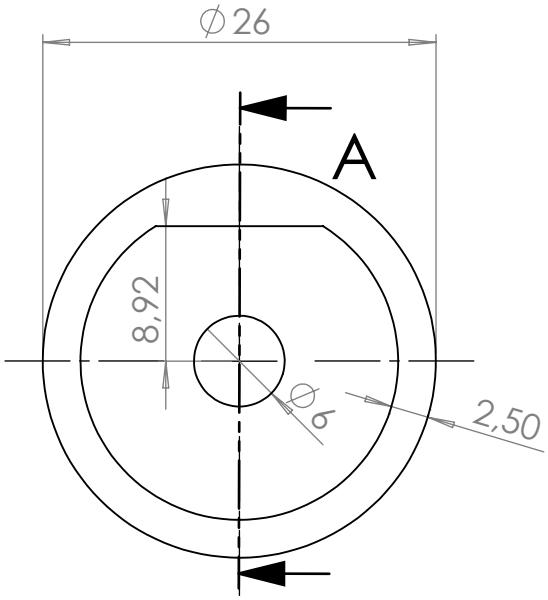
N.º DE DIBUJO: Acople husillo

A4

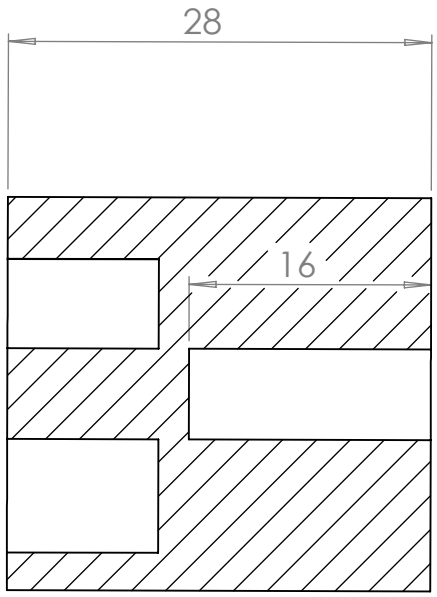
PESO:

ESCALA:1:5

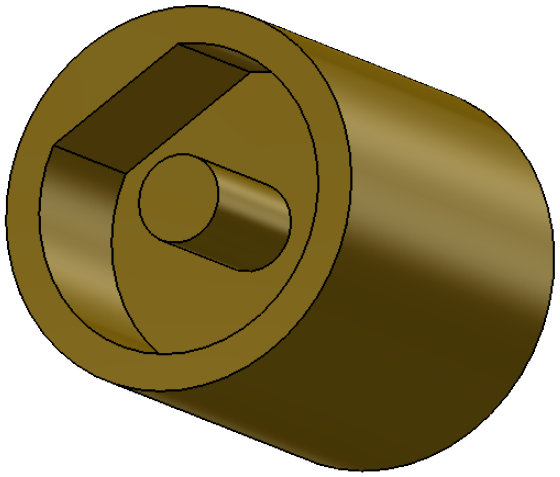
HOJA 1 DE 1



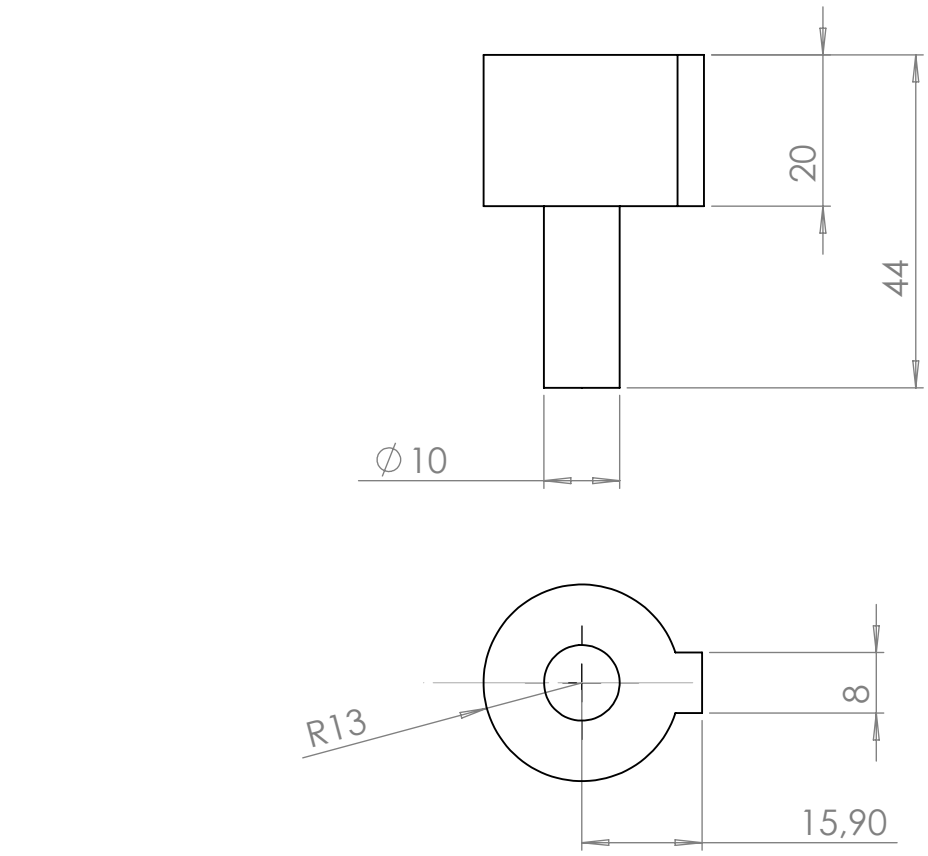
A

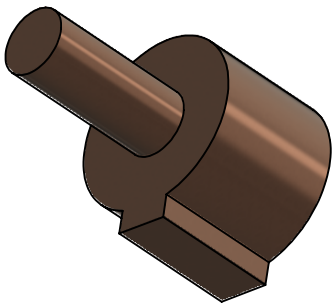


SECCIÓN A-A



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340		N.º DE DIBUJO Acople reductora	A4
				PESO:		ESCALA:2:1	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340

N.º DE DIBUJO: Acople sinfín

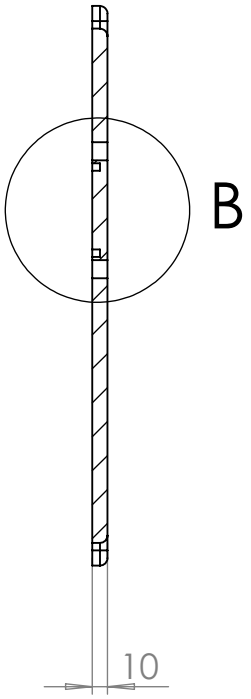
A4

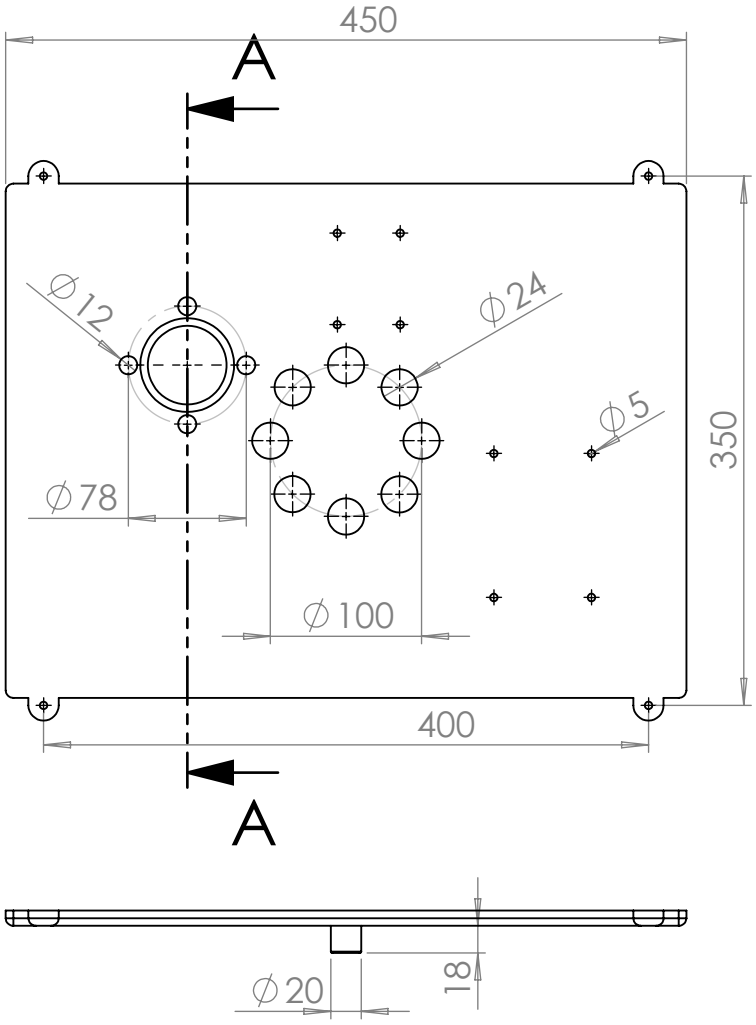
PESO:

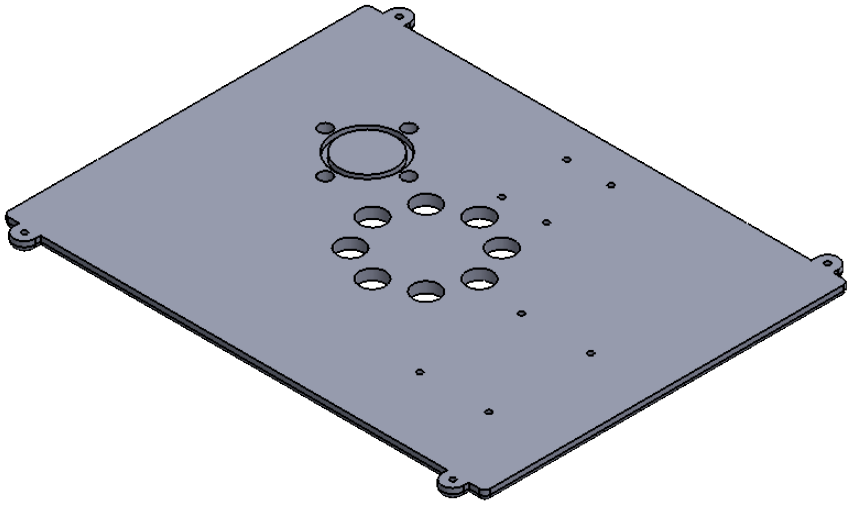
ESCALA:1:1

HOJA 1 DE 1

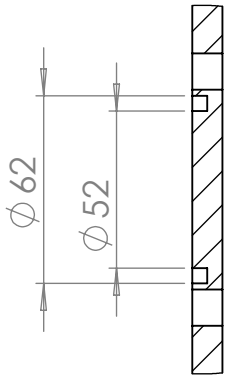
SECCIÓN A-A







DETALLE B



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.			
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Inox. AISI 316

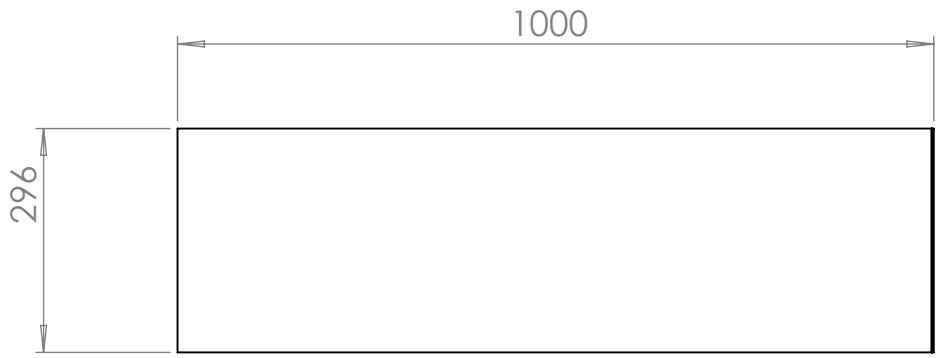
N.º DE DIBUJO: Base cajón

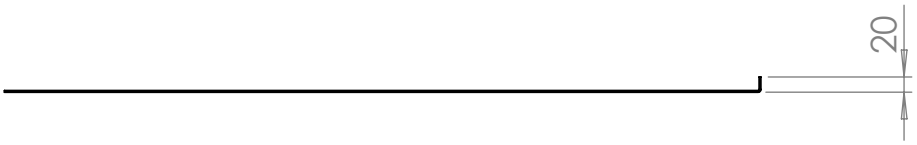
A4

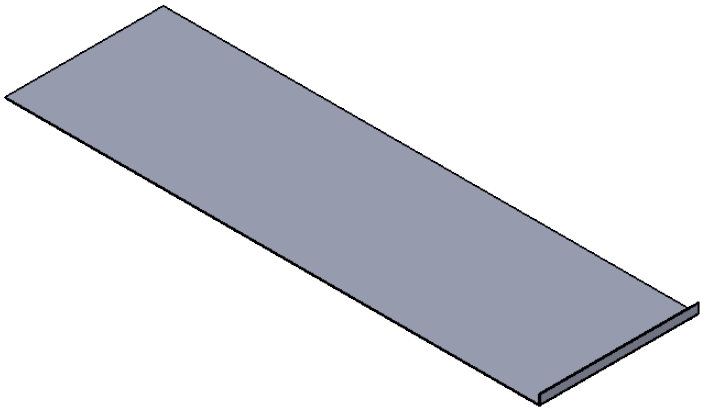
PESO:

ESCALA:1:5

HOJA 1 DE 1

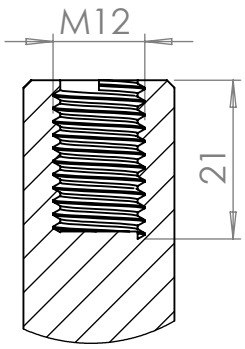


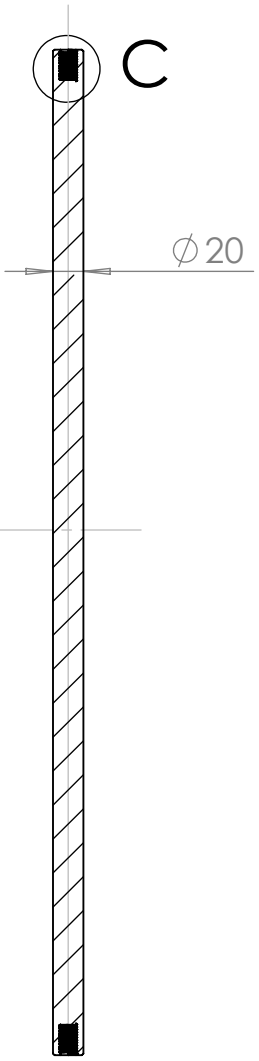




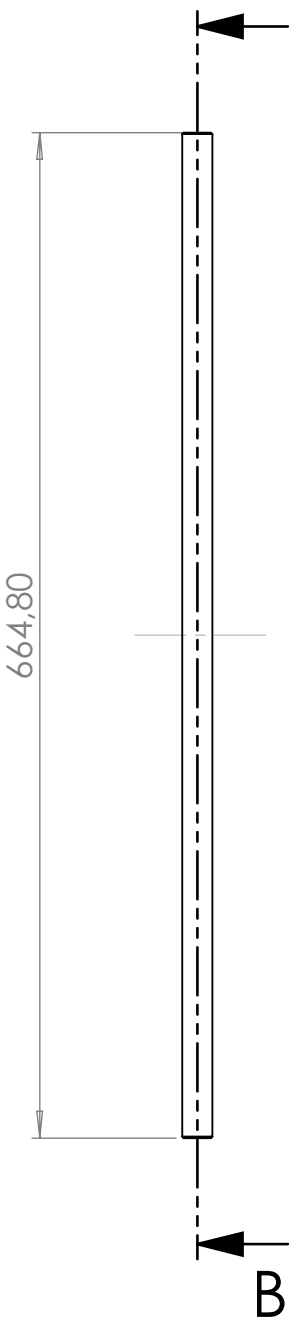
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
	DIBUJ.	D.H.A					
	VERIF.						
	APROB.						
	FABR.						
	CALID.			MATERIAL: Chapa galvanizada 2mm		N.º DE DIBUJO Base	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1

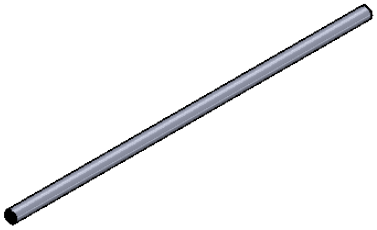
DETALLE C
ESCALA 1 : 1





SECCIÓN B-B





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340

N.º DE DIBUJO: Eje bloqueo giro

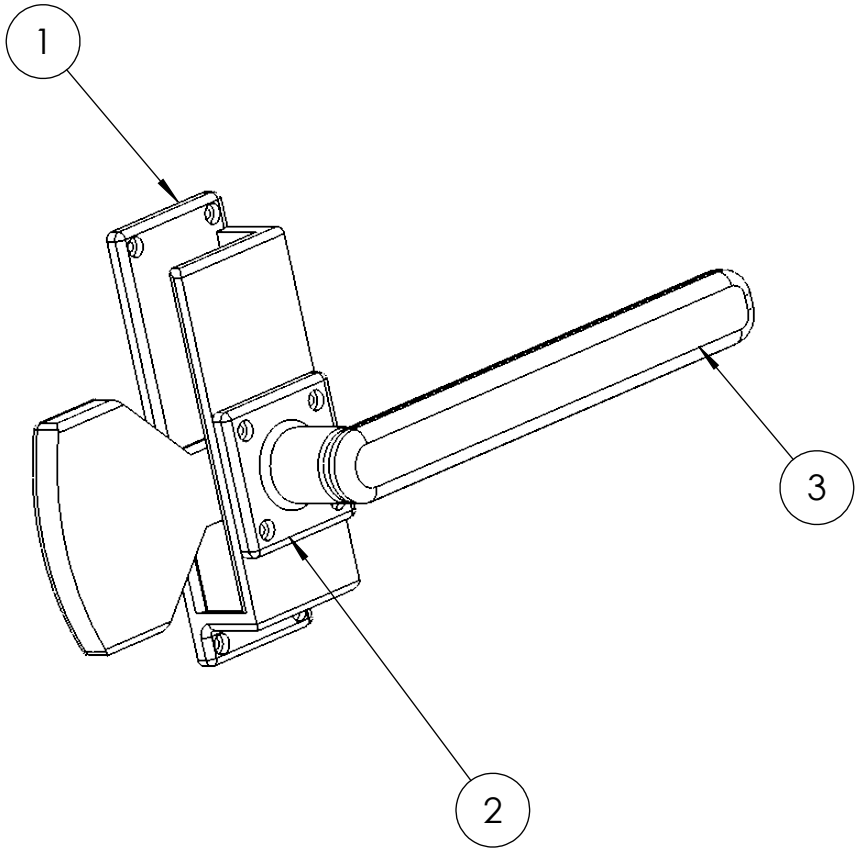
A4

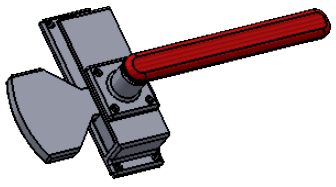
PESO:

ESCALA:1:10

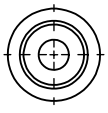
HOJA 1 DE 1

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Fijación palanca	1
2	Parte fija	1
3	Palanca móvil	1

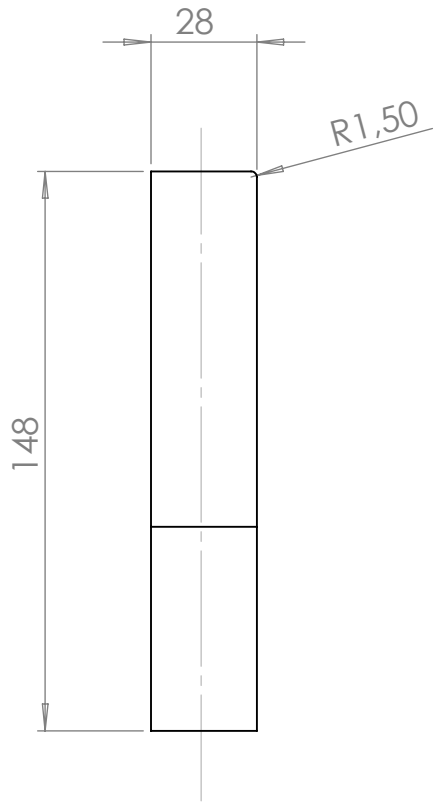


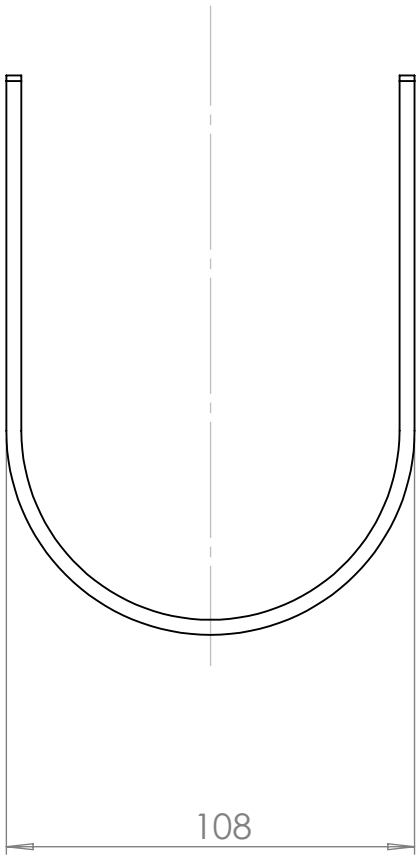


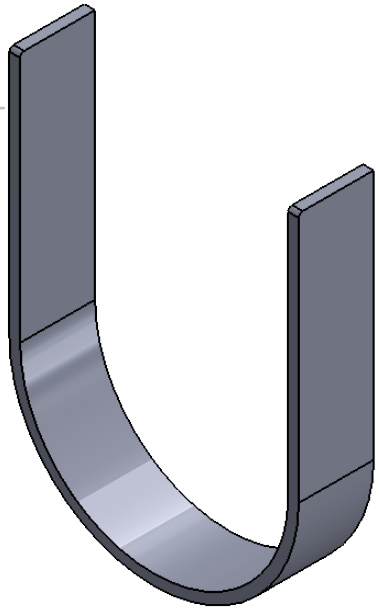
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:		N.º DE DIBUJO	A4
						Cierre seguridad acople	
				PESO:		ESCALA:1:5	HOJA 1 DE 1



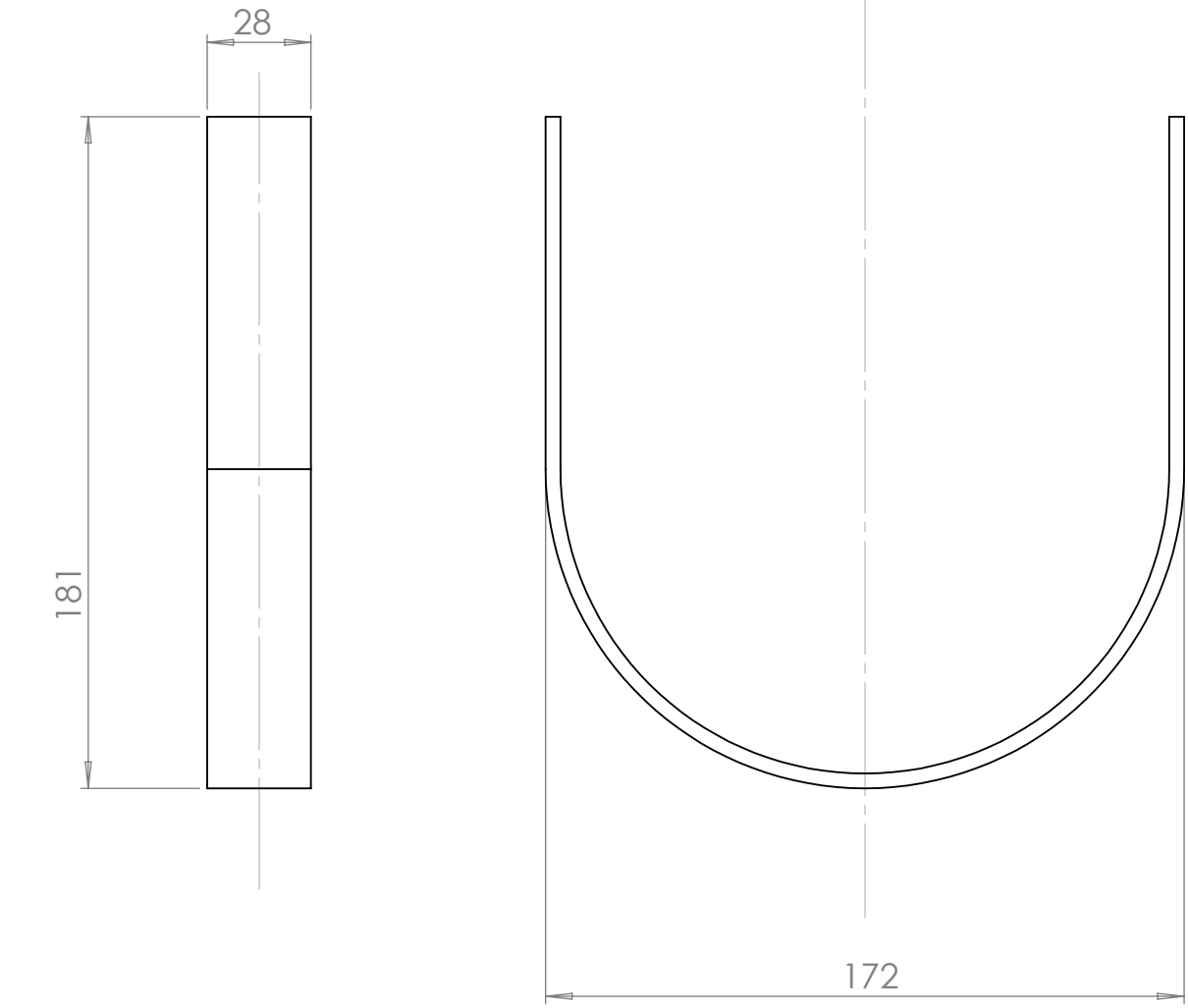
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS			NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340		N.º DE DIBUJO Husillo sinfín	A4
				PESO:		ESCALA:1:5	HOJA 1 DE 1

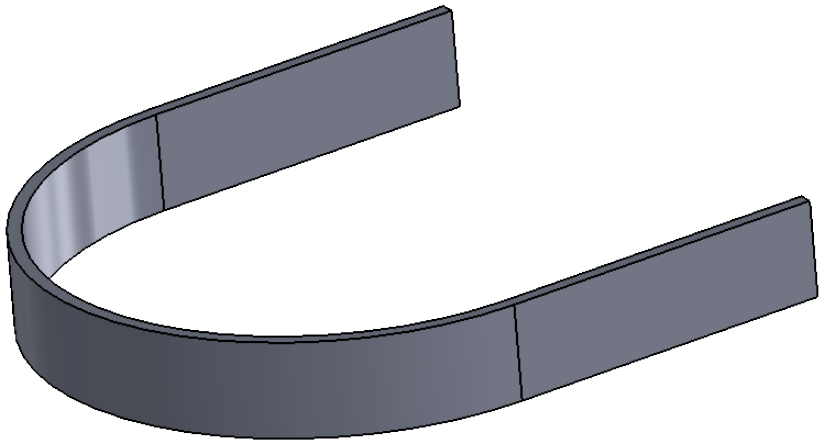




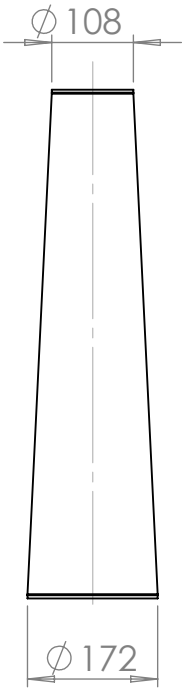


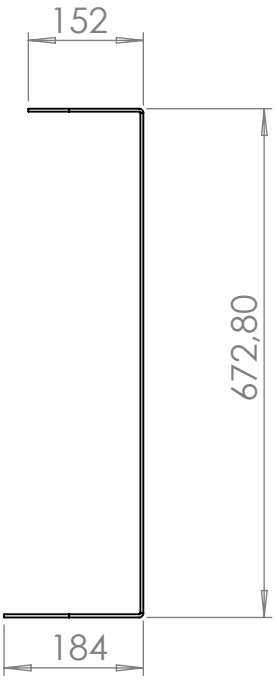
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 4mm		N.º DE DIBUJO Tapa superior	A4
				PESO:		ESCALA:1:2	HOJA 1 DE 1

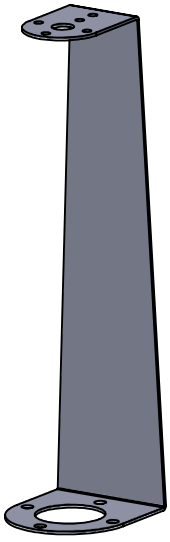


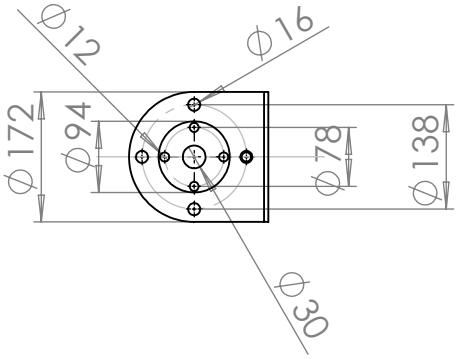


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 4mm		N.º DE DIBUJO Tapa inferior	A4
				PESO:		ESCALA:1:2	HOJA 1 DE 1

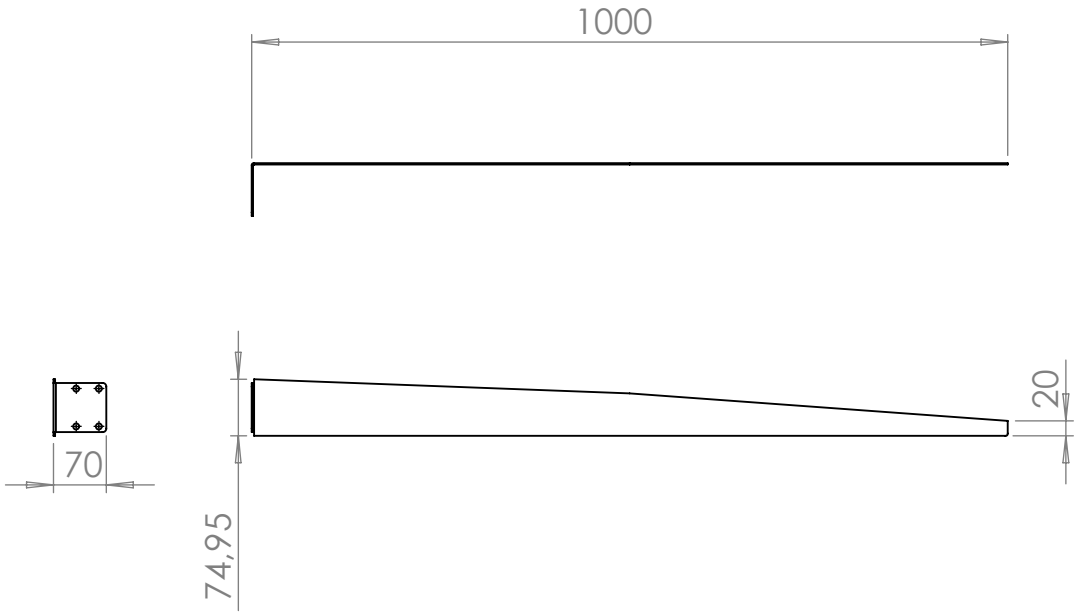


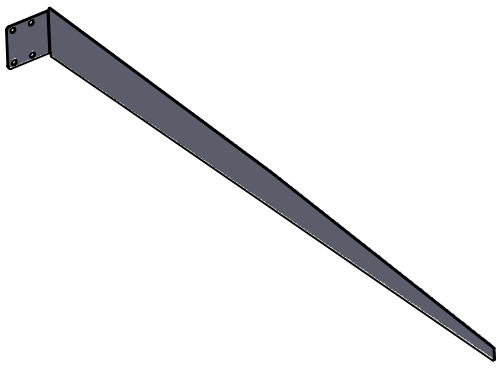






SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN	
	NOMBRE	FIRMA	FECHA	TÍTULO:		
DIBUJ.	D.H.A					
VERIF.						
APROB.						
FABR.						
CALID.				MATERIAL: Chapa galvanizada 4mm	N.º DE DIBUJO Soporte husillo	A4
				PESO:	ESCALA:1:10	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Chapa galvanizada 2mm

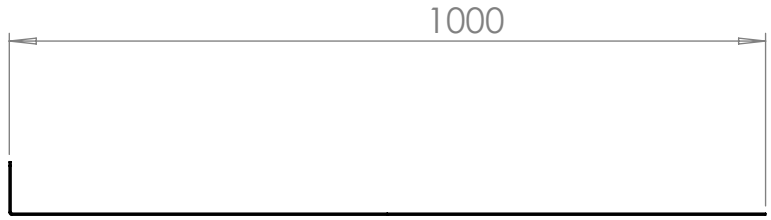
N.º DE DIBUJO: Lateral derecho

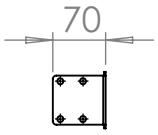
A4

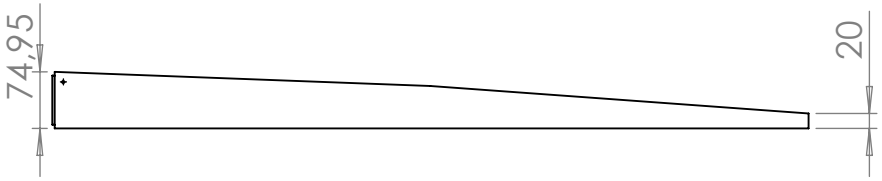
PESO:

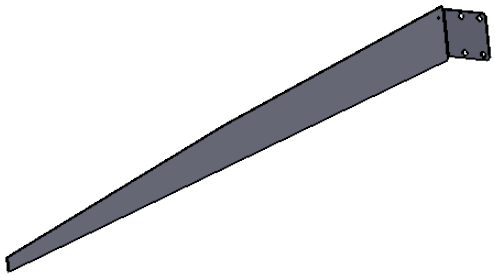
ESCALA:1:10

HOJA 1 DE 1









SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Chapa galvanizada 2mm

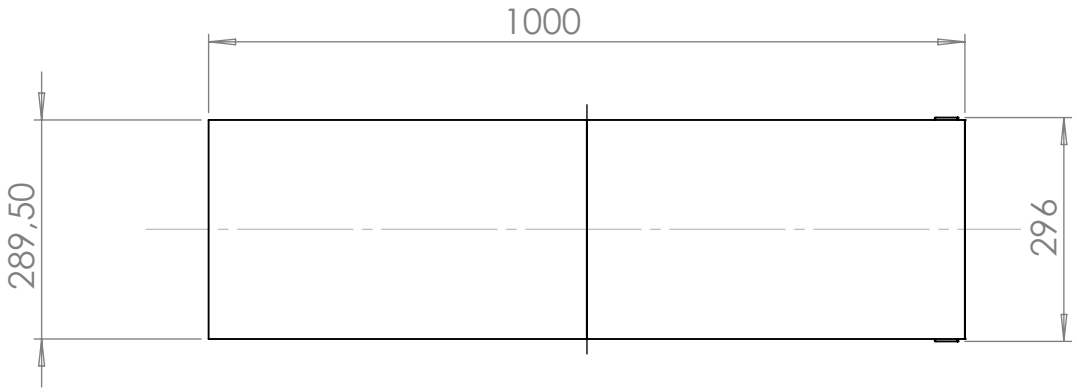
N.º DE DIBUJO: Lateral izquierdo

A4

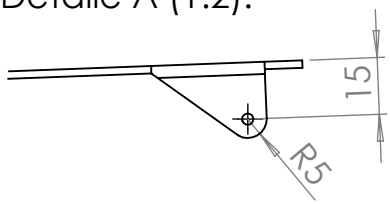
PESO:

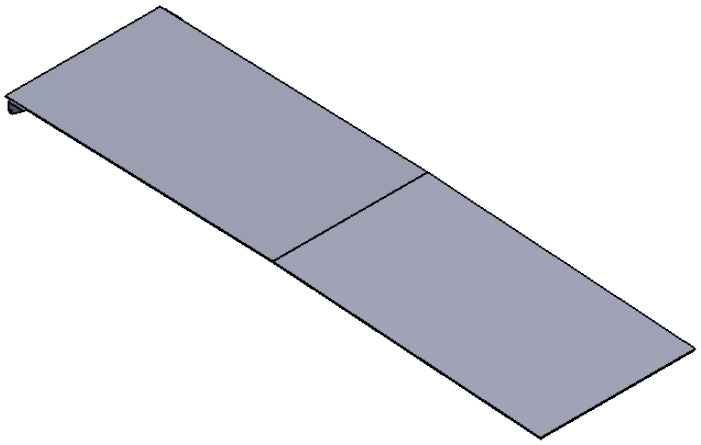
ESCALA:1:10

HOJA 1 DE 1



Detalle A (1:2):





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Chapa galvanizada 2mm

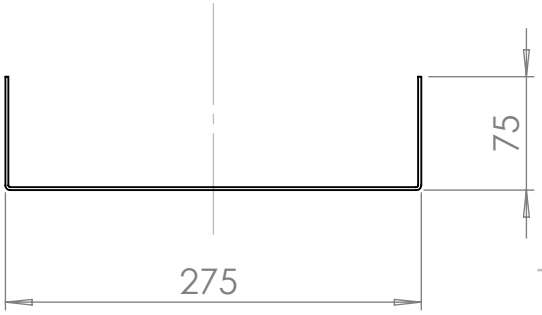
N.º DE DIBUJO: Tapa

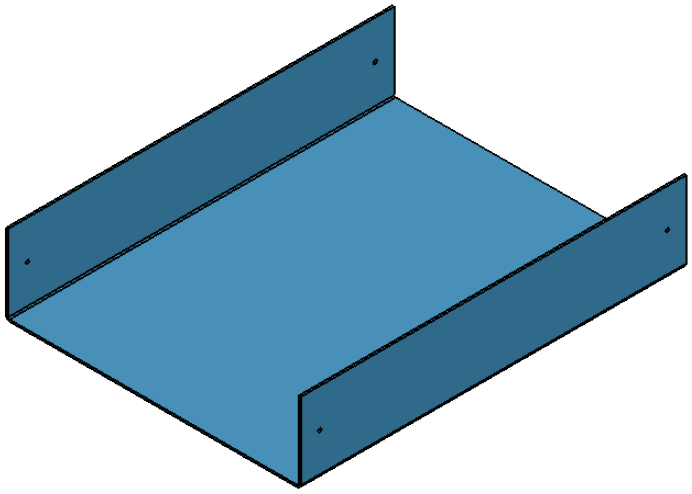
A4

PESO:

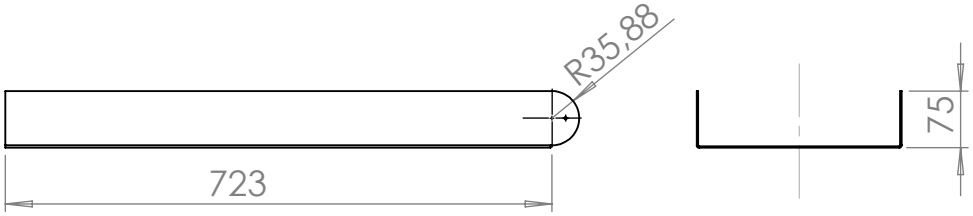
ESCALA:1:10

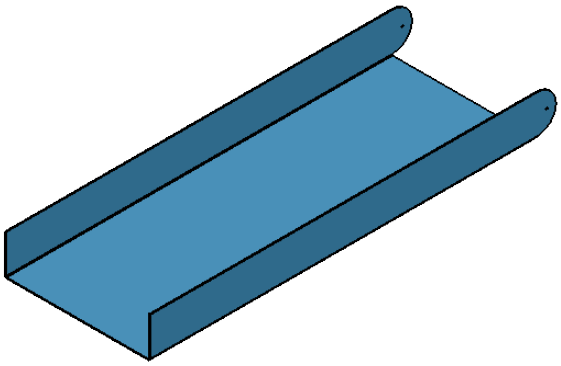
HOJA 1 DE 1



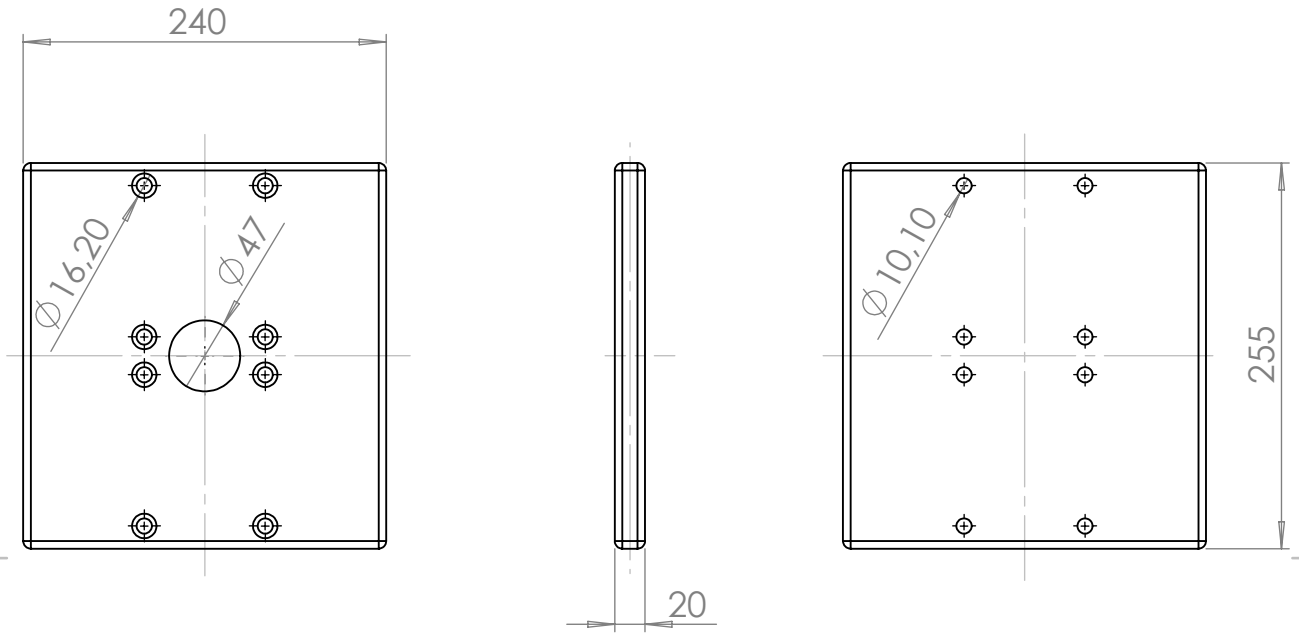


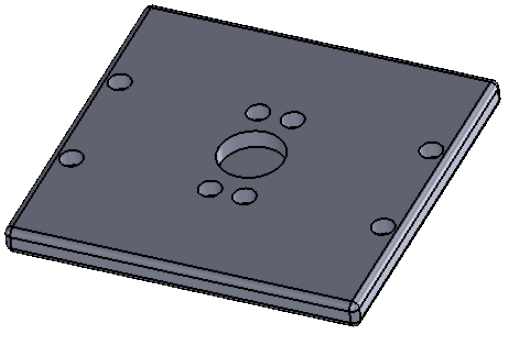
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A.						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 2mm		N.º DE DIBUJO Pieza base central	A4
				PESO:		ESCALA:1:5	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 2mm		N.º DE DIBUJO Pieza base lateral	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Inox. AISI 316

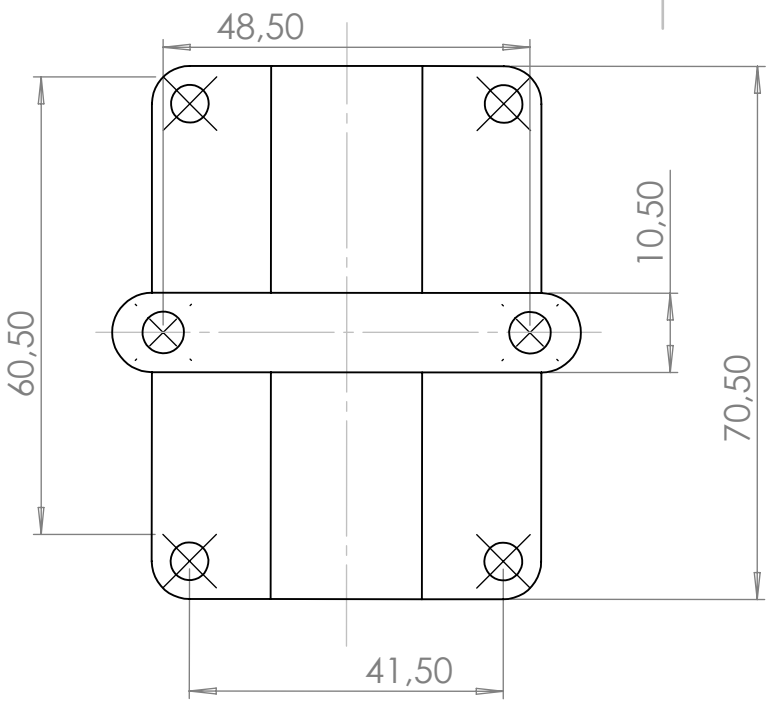
N.º DE DIBUJO: Placa soporte

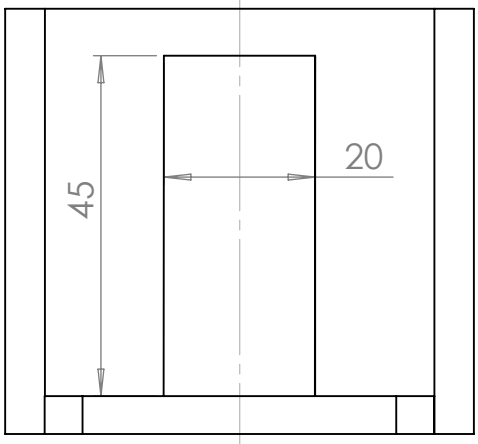
A4

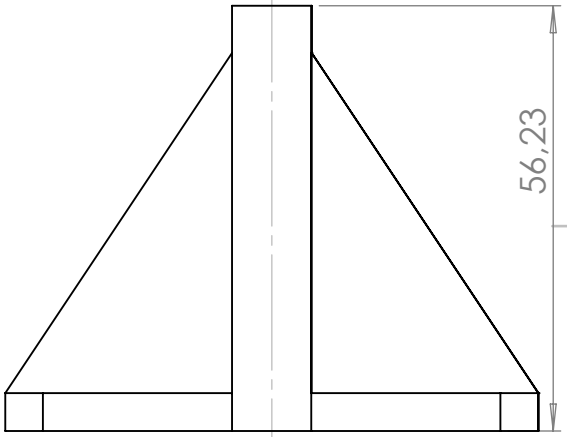
PESO:

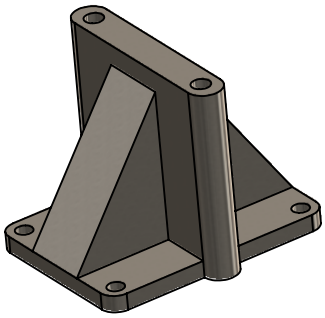
ESCALA:1:5

HOJA 1 DE 1

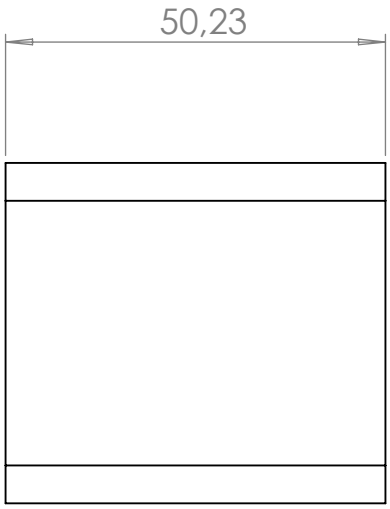


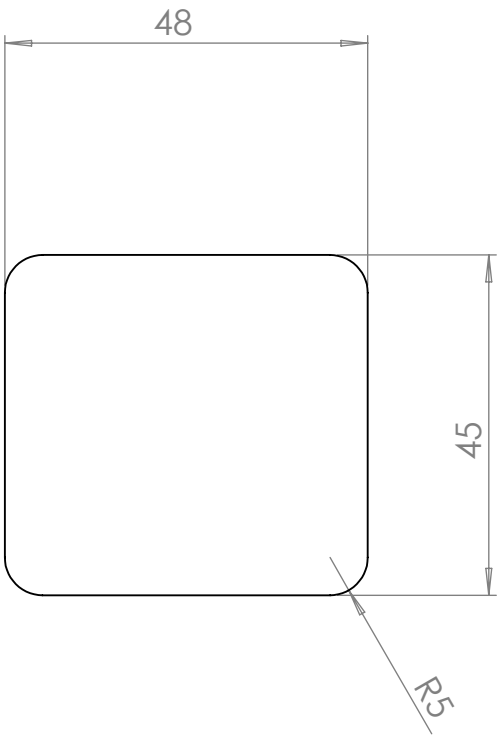


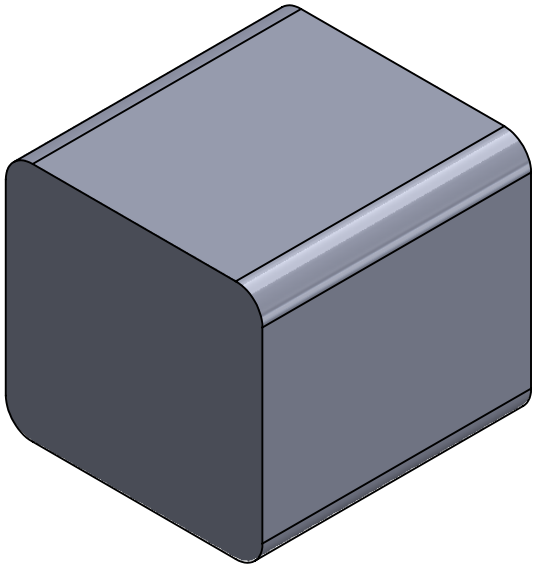




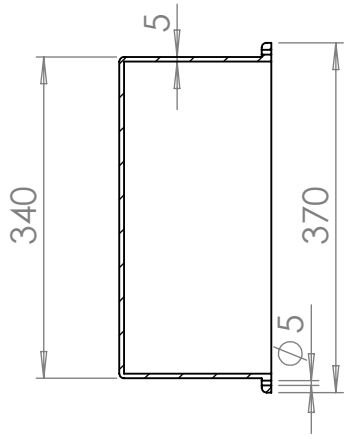
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340			N.º DE DIBUJO Soporte rodamiento motor
							A4
				PESO:		ESCALA:1:1	HOJA 1 DE 1



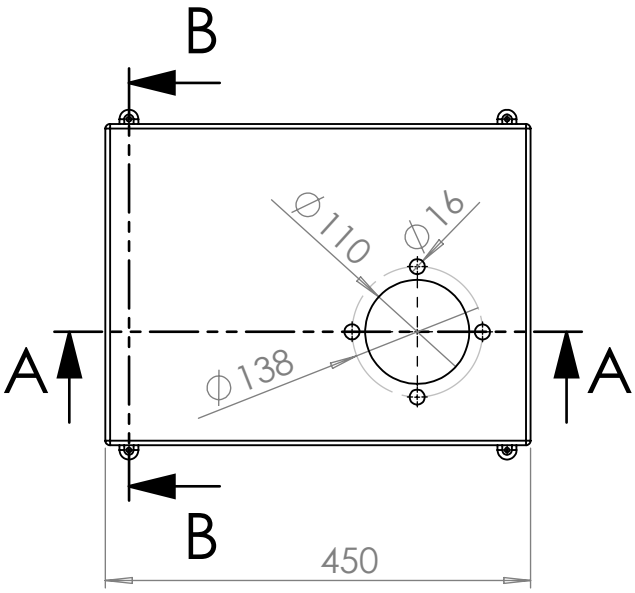


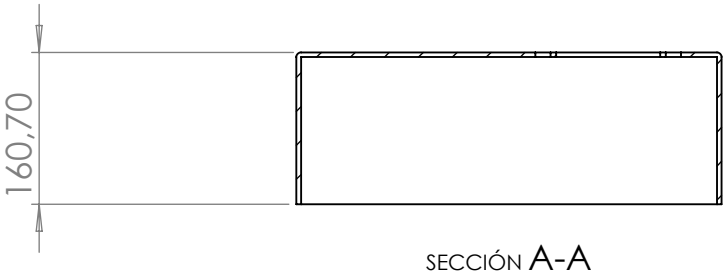


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340		N.º DE DIBUJO Soporte reductora	A4
				PESO:		ESCALA:1:1	HOJA 1 DE 1

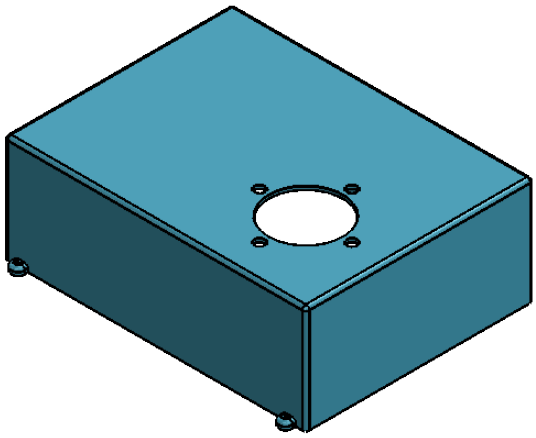


SECCIÓN B-B

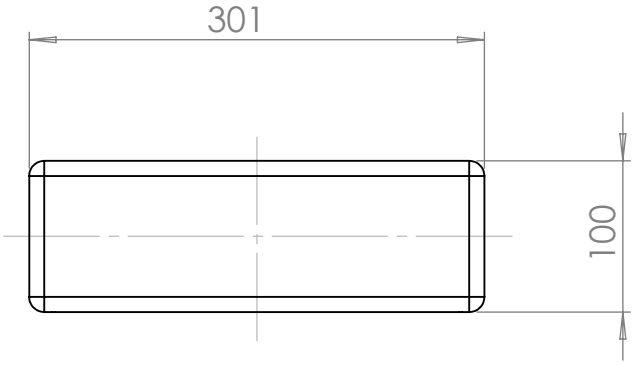


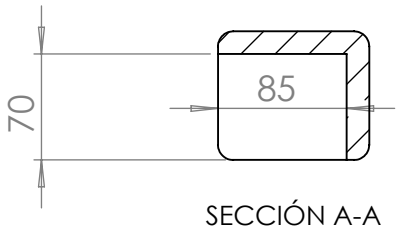


SECCIÓN A-A

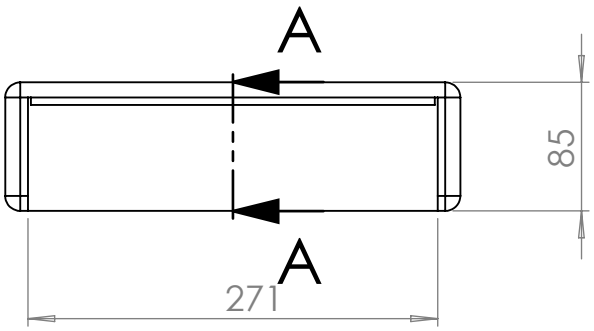


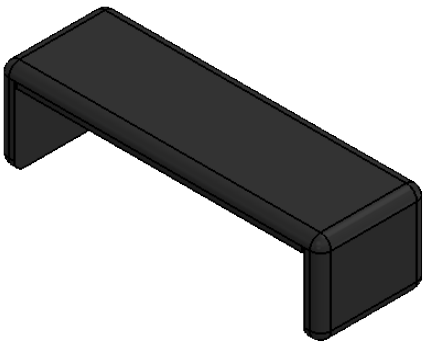
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:	
DIBUJ.	D.H.A							
VERIF.								
APROB.								
FABR.								
CALID.				MATERIAL: Inox. AISI 316			N.º DE DIBUJO Tapa cajón	A4
				PESO:		ESCALA:1:8		HOJA 1 DE 1



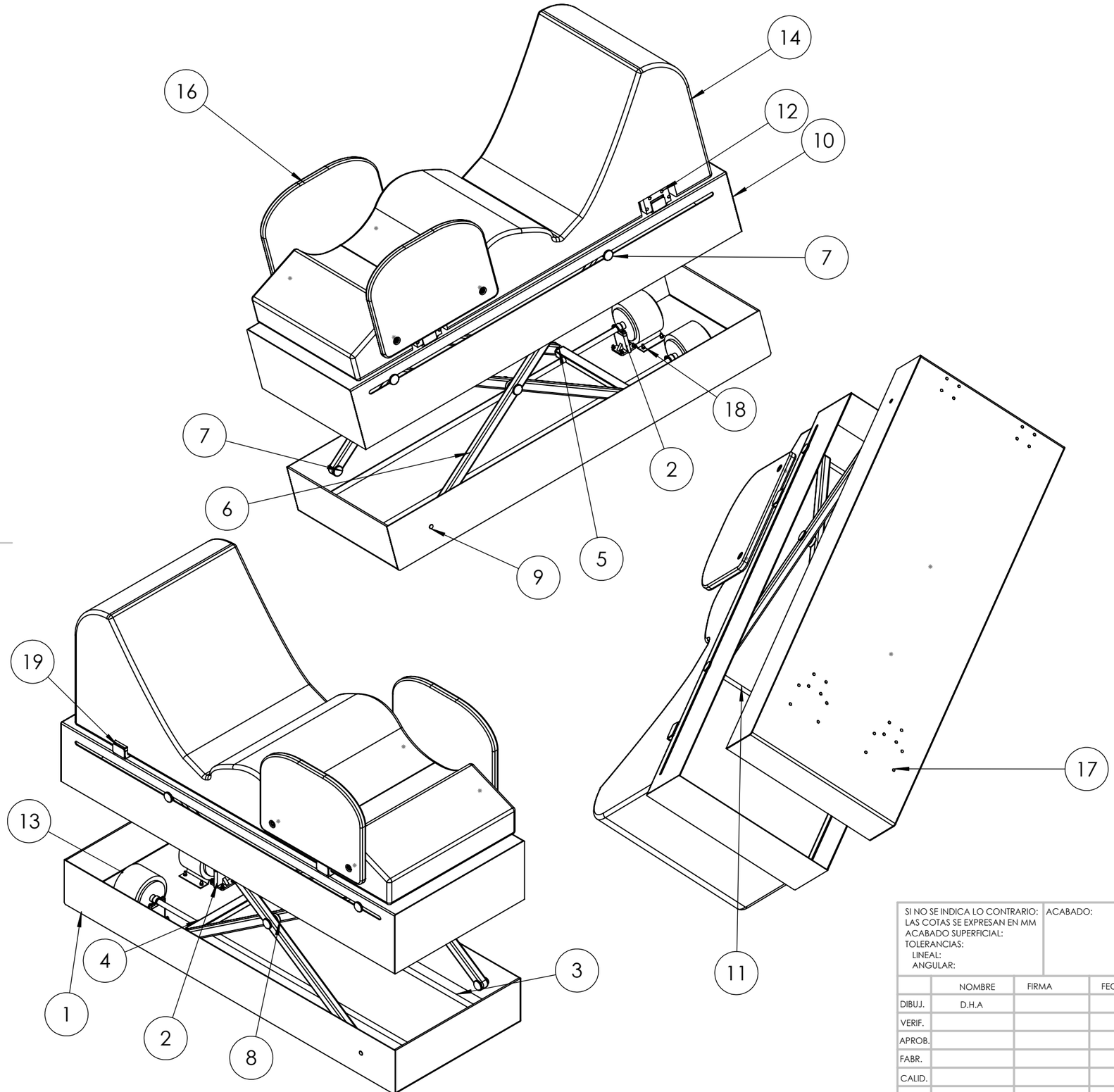


SECCIÓN A-A





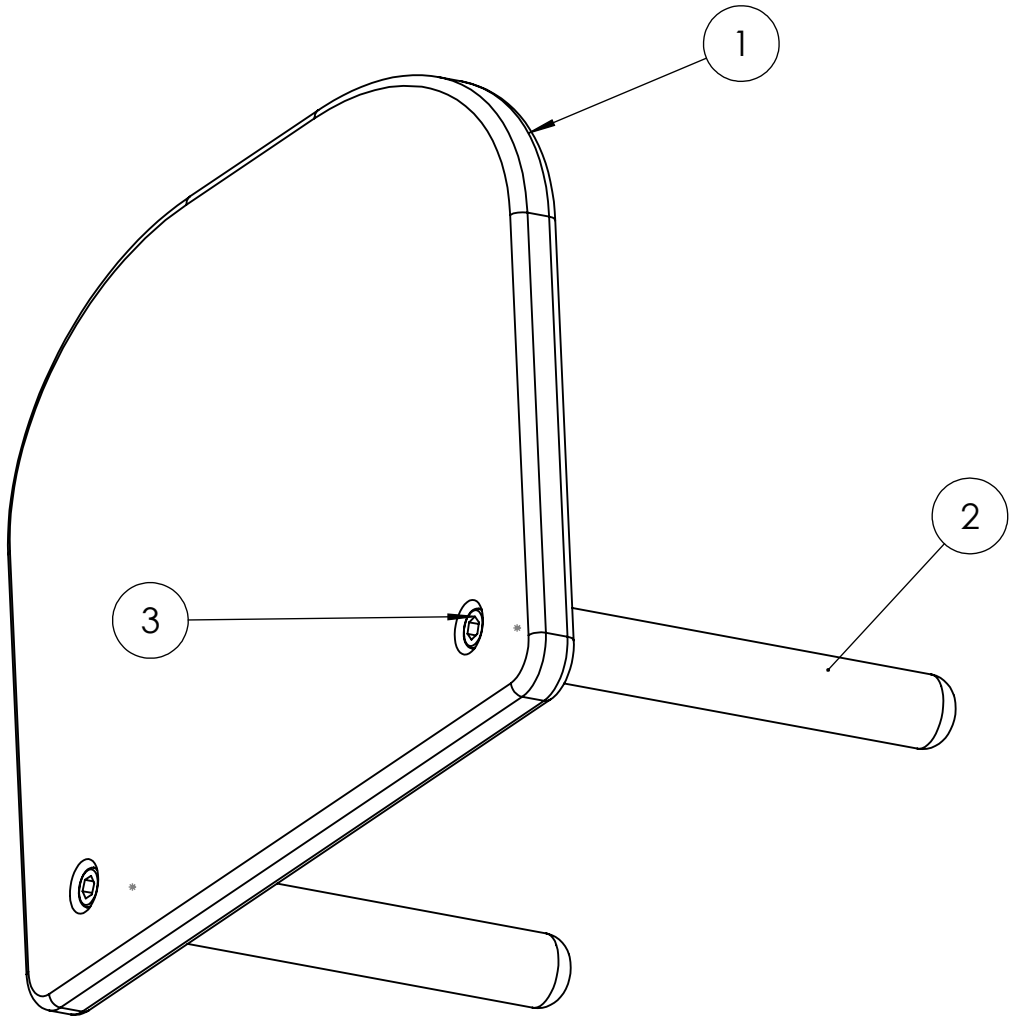
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Polipropileno		N.º DE DIBUJO Tapa guías lineales	A4
				PESO:		ESCALA:1:5	HOJA 1 DE 1



N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Soldadura caja suelo	1
2	Soporte rodamiento	4
3	Sinfín	2
4	Seguidor	1
5	Buje	2
6	Perfil	4
7	Tapón buje	12
8	Unión perfiles	2
9	Eje fijo	2
10	Soldadura caja superior	1
11	Eje caja superior	2
12	Guía + Soporte NSK-RA25	2
13	Motor Miromax BLT-500	2
14	Plataforma de recepción	1
15	Tornillo Allen DIN912 M12x30	8
16	Conjunto placa de retención	2
17	Perno insertable M5x20	24
18	Tuerca autocierre M5	24
19	Pletina freno guía	4

SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN		
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL:			N.º DE DIBUJO Elevador tijera
							A3
				PESO:		ESCALA:1:12	HOJA 1 DE 1

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Placa de retención	1
2	Perno placa de retención	2
3	Tornillo Allen DIN912 M10x30	2



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

N.º DE DIBUJO

Cjto. placa de retención

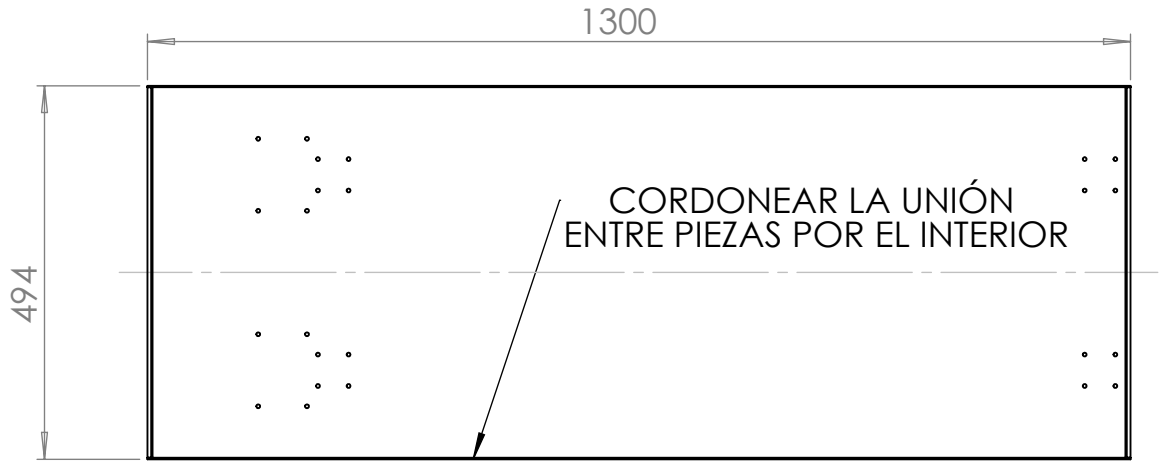
A4

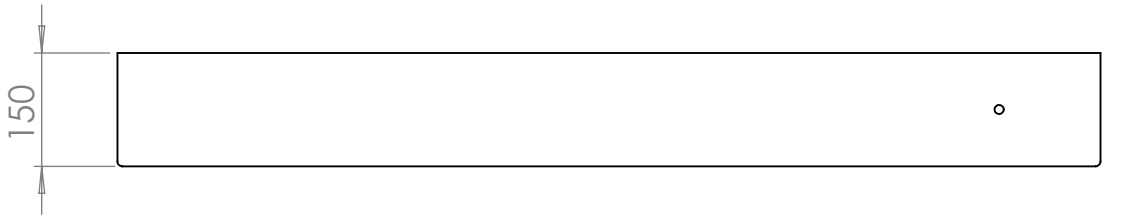
PESO:

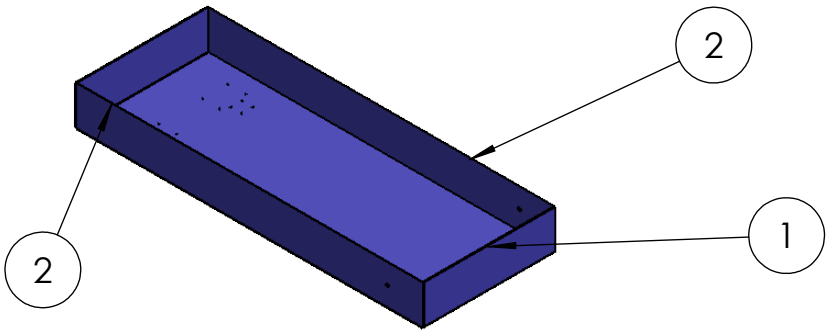
ESCALA:1:10

HOJA 1 DE 1

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	U suelo	1
2	Lateral	2







SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

N.º DE DIBUJO

Soldadura caja suelo

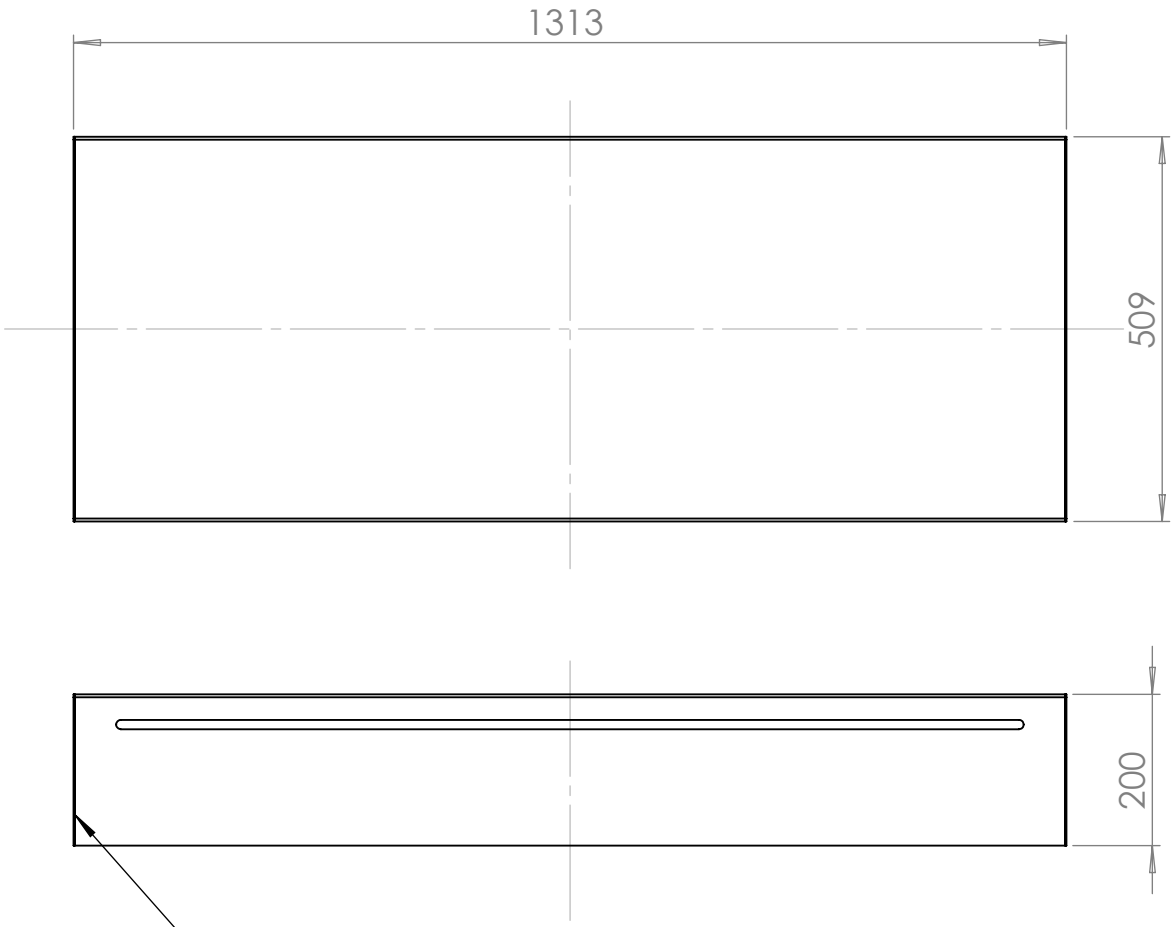
A4

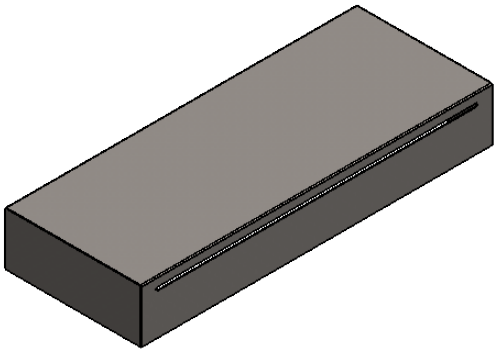
PESO:

ESCALA:1:10

HOJA 1 DE 1

N.º DE ELEMENTO	DESCRIPCIÓN	CANTIDAD
1	Caja superior	1
2	Frontal caja superior	2





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL:

N.º DE DIBUJO

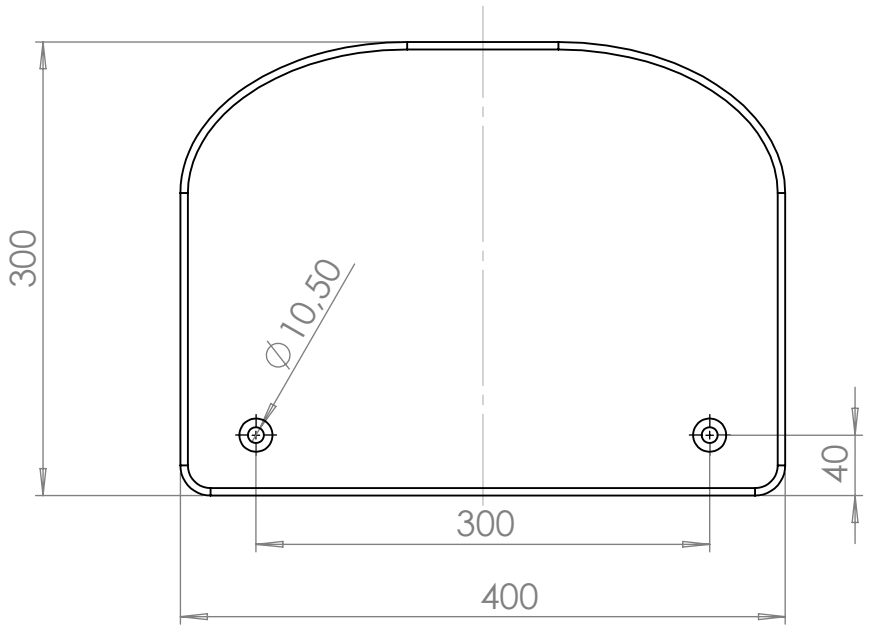
Soldadura caja superior

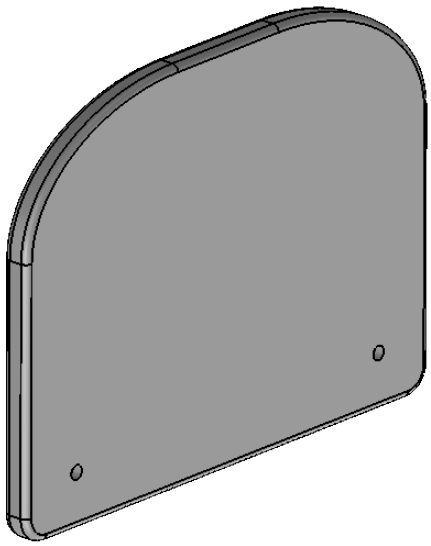
A4

PESO:

ESCALA:1:10

HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Polietileno

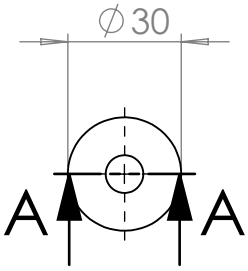
N.º DE DIBUJO: Placa de retención

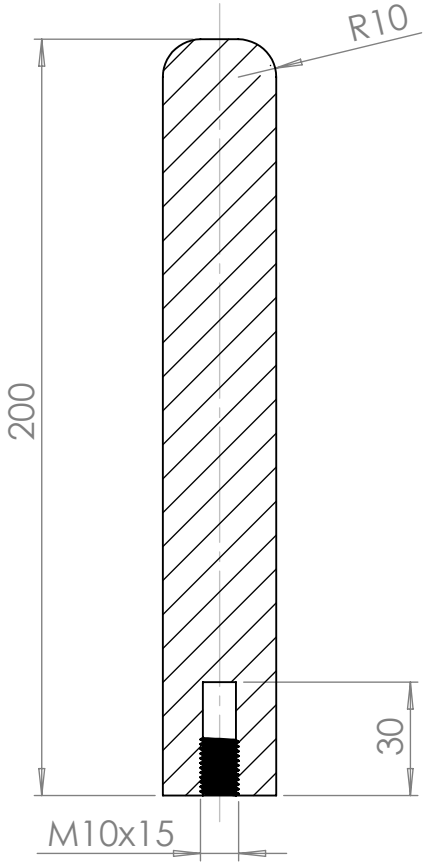
A4

PESO:

ESCALA:1:5

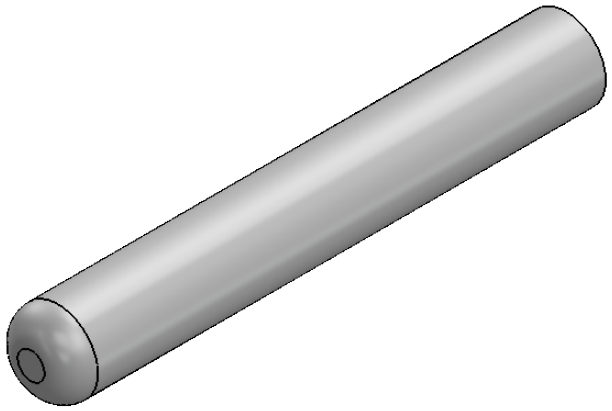
HOJA 1 DE 1



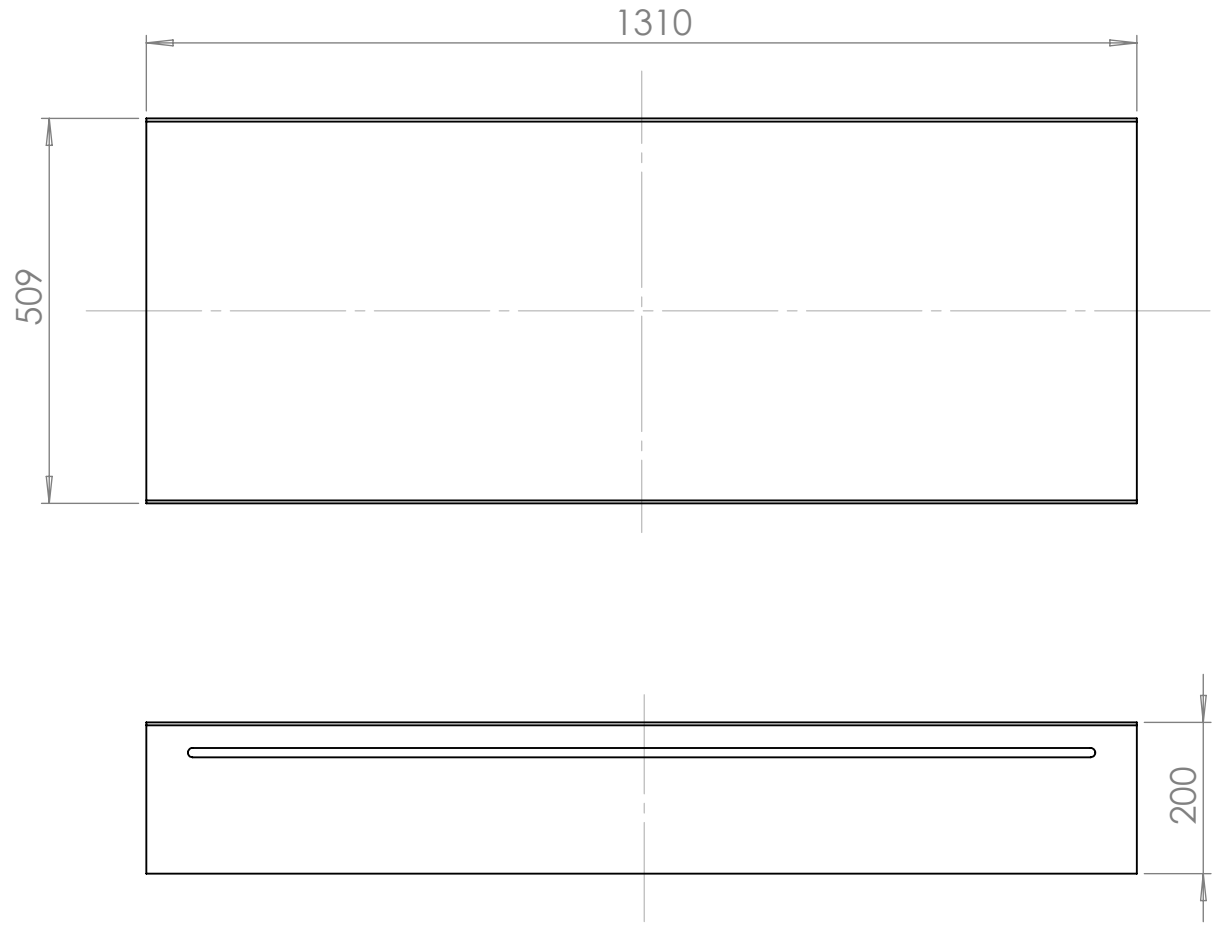


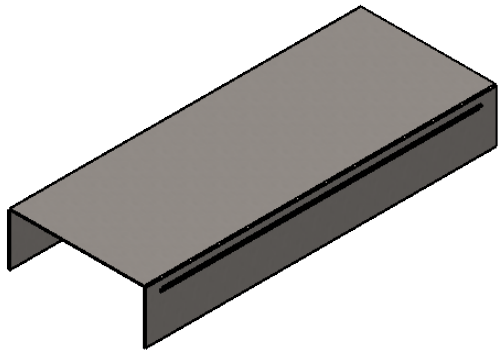
SECCIÓN A-A

ESCALA 1 : 2

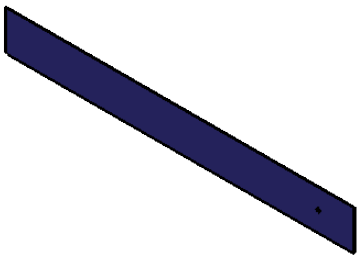


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:		ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:	
DIBUJ.	D.H.A							
VERIF.								
APROB.								
FABR.								
CALID.				MATERIAL: Polietileno			N.º DE DIBUJO Perno placa de retención	A4
				PESO:			ESCALA:1:2	HOJA 1 DE 1

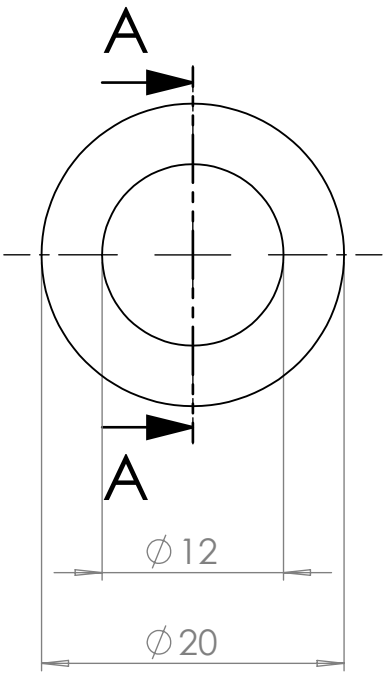


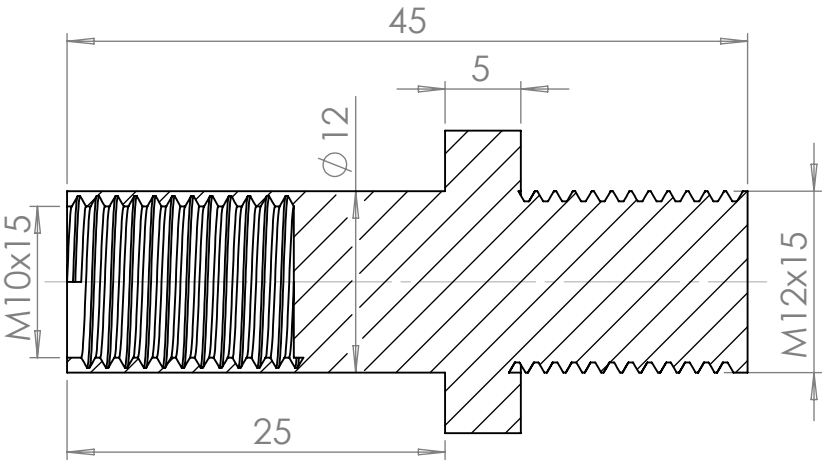


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS			NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 3mm		N.º DE DIBUJO U caja superior	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1

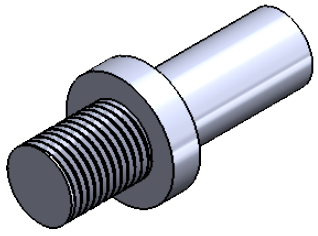


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA		REVISIÓN	
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 2 mm		N.º DE DIBUJO Lateral caja inferior	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1



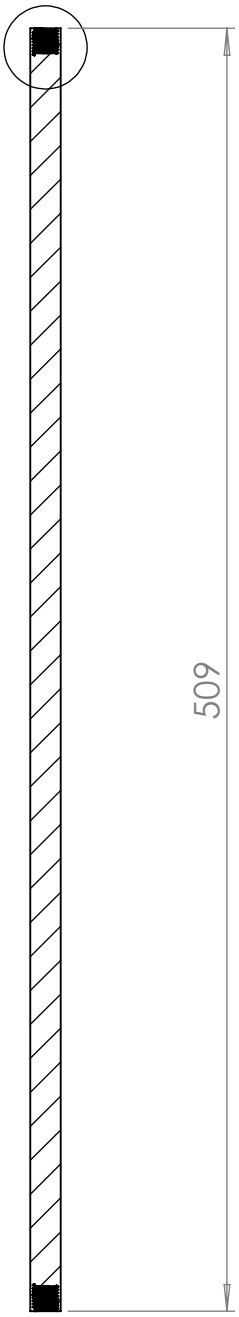


SECCIÓN A-A
ESCALA 2 : 1

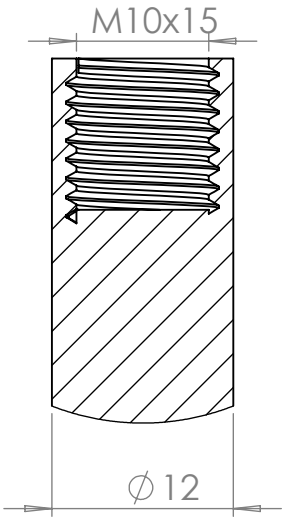


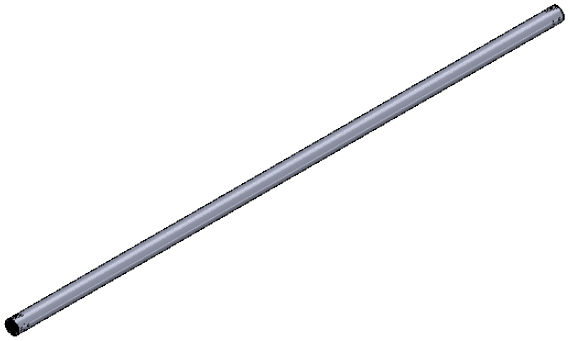
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA	REVISIÓN	
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340 + ZINCADO		N.º DE DIBUJO Buje	A4
PESO:						ESCALA:2:1	HOJA 1 DE 1

SECCIÓN B-B
ESCALA 1 : 3

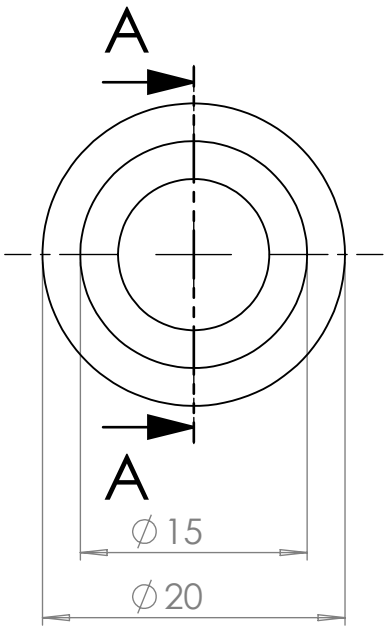


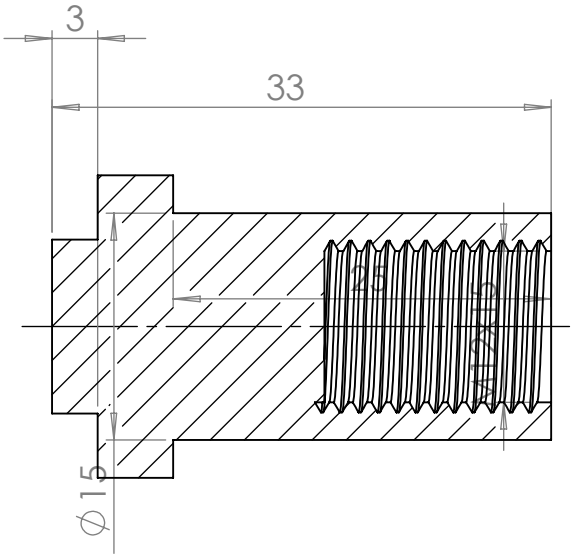
DETALLE C
ESCALA 2 : 1



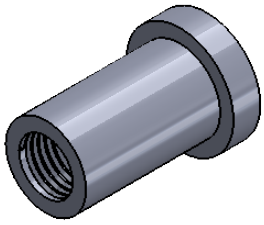


SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
	DIBUJ.	D.H.A					
	VERIF.						
	APROB.						
	FABR.						
	CALID.			MATERIAL: AISI 4340 + ZINCADO		N.º DE DIBUJO Eje caja superior	A4
				PESO:		ESCALA:1:3	HOJA 1 DE 1





SECCIÓN A-A



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

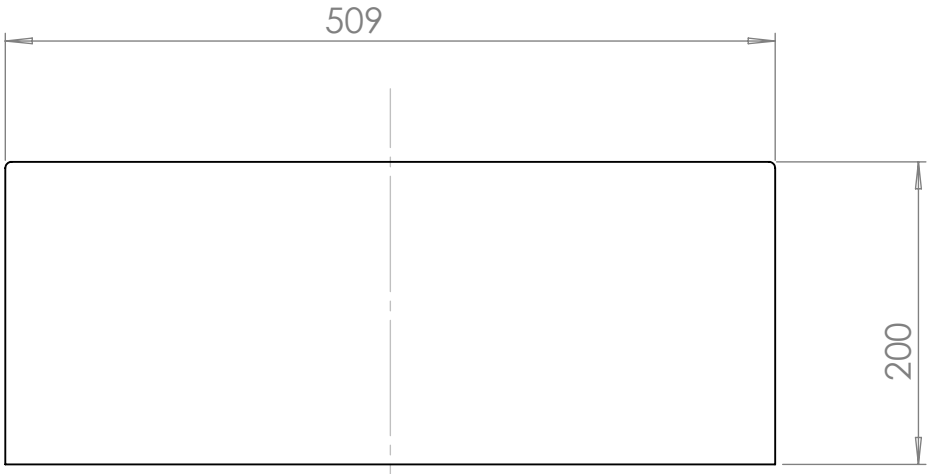
N.º DE DIBUJO: Eje fijo

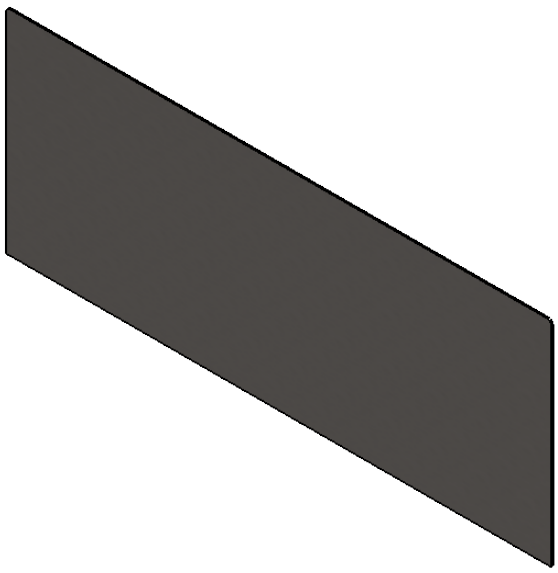
A4

PESO:

ESCALA:2:1

HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: Chapa galvanizada 1,5mm

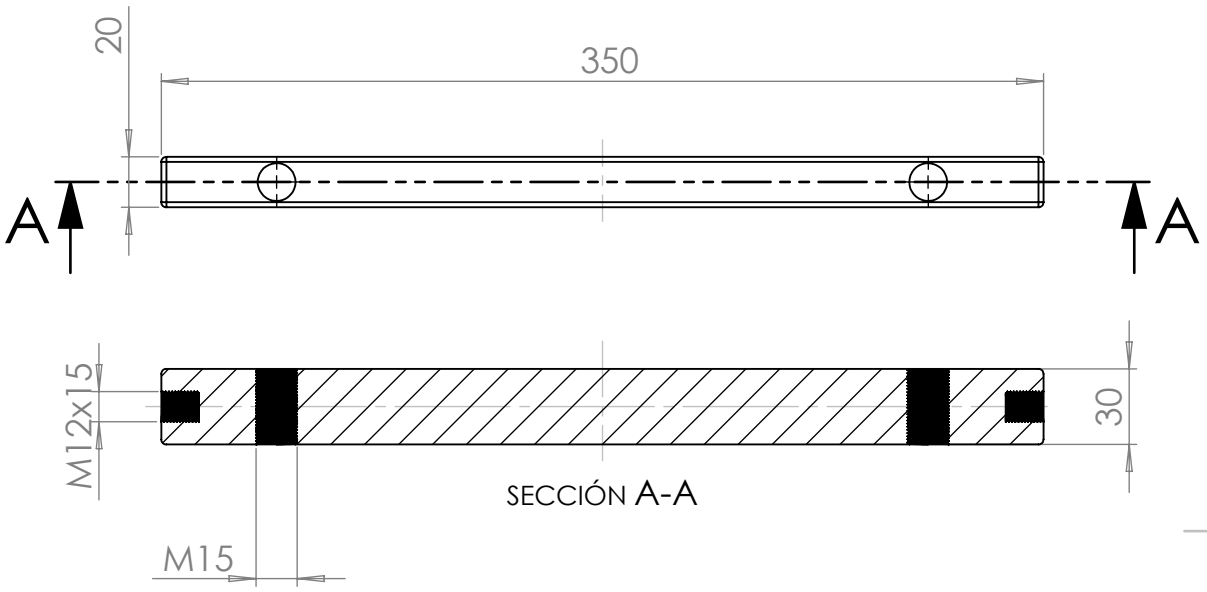
N.º DE DIBUJO: Frontal caja superior

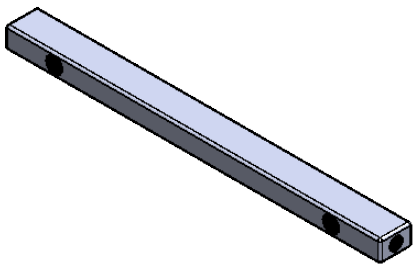
A4

PESO:

ESCALA:1:5

HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

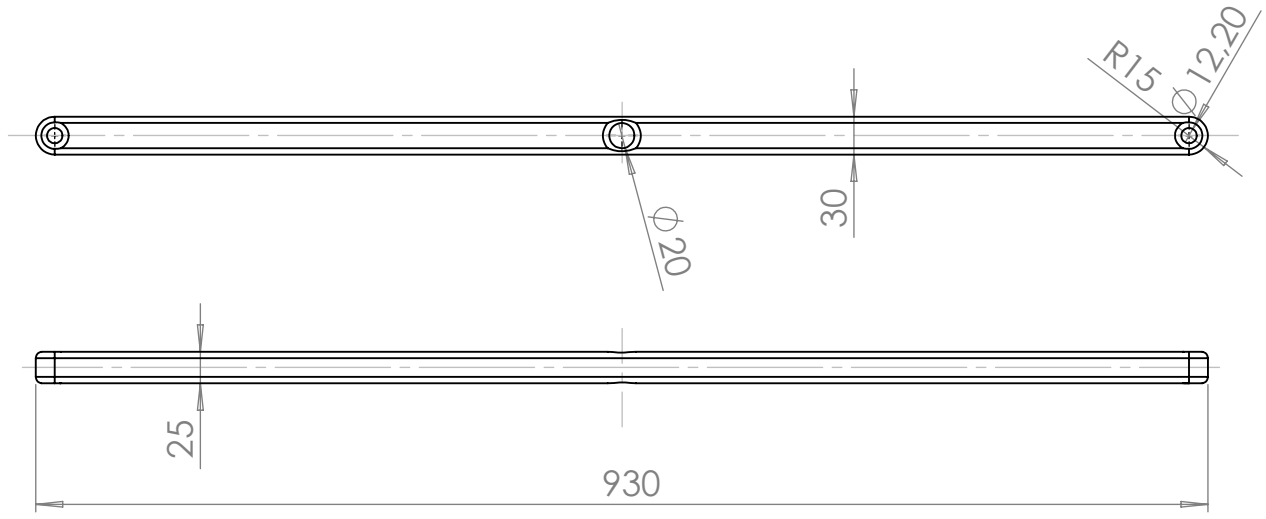
N.º DE DIBUJO: Guia

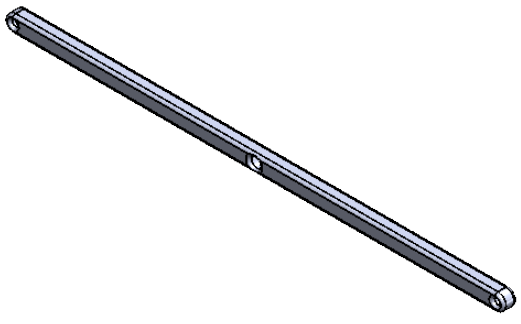
A4

PESO:

ESCALA:1:3

HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

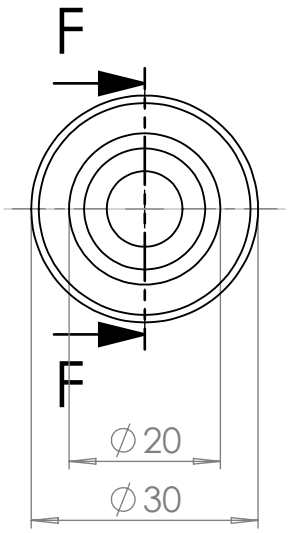
N.º DE DIBUJO: Perfil

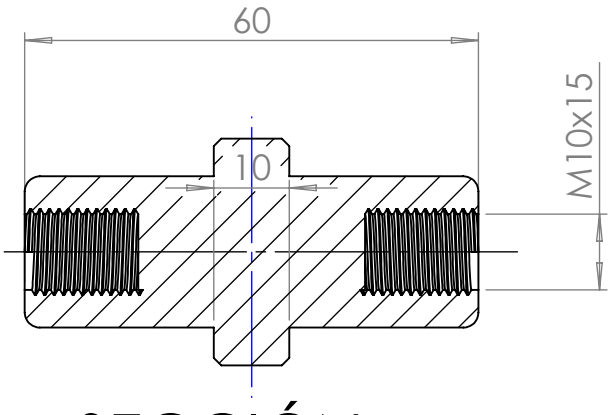
A4

PESO:

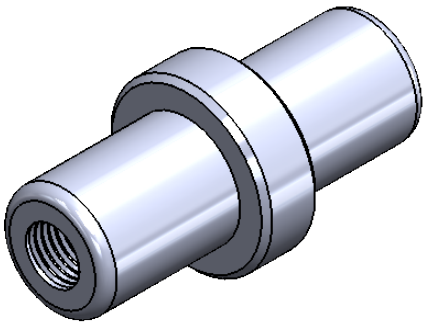
ESCALA:1:4

HOJA 1 DE 1





SECCIÓN F-F



SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

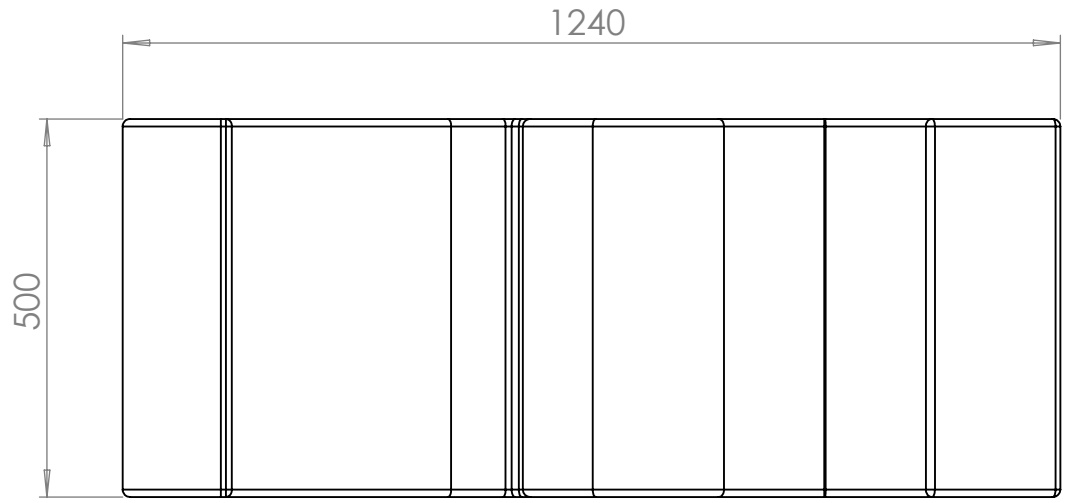
N.º DE DIBUJO: Unión perfiles

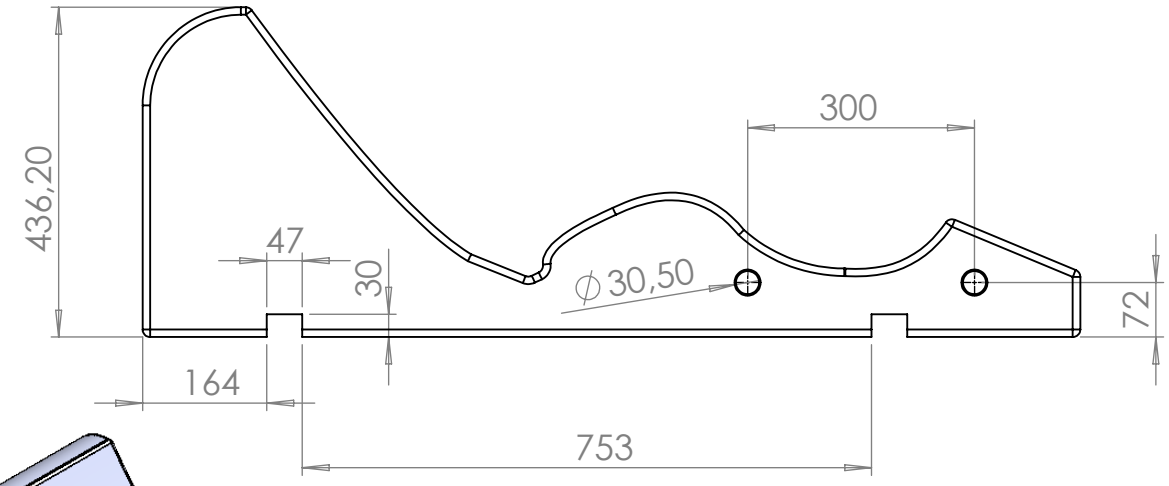
A4

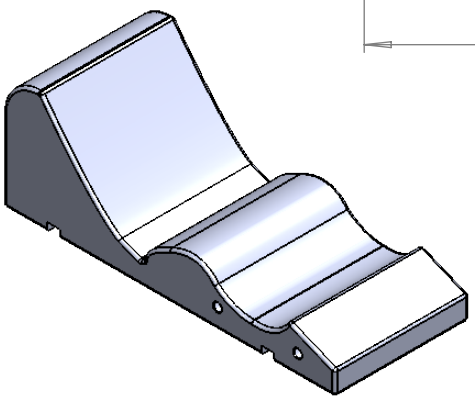
PESO:

ESCALA:1:1

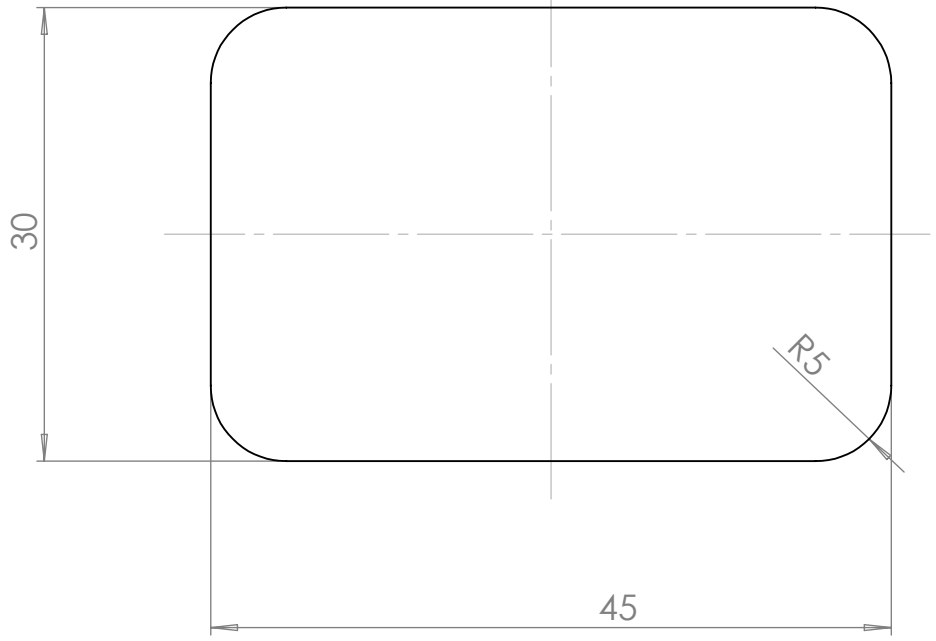
HOJA 1 DE 1

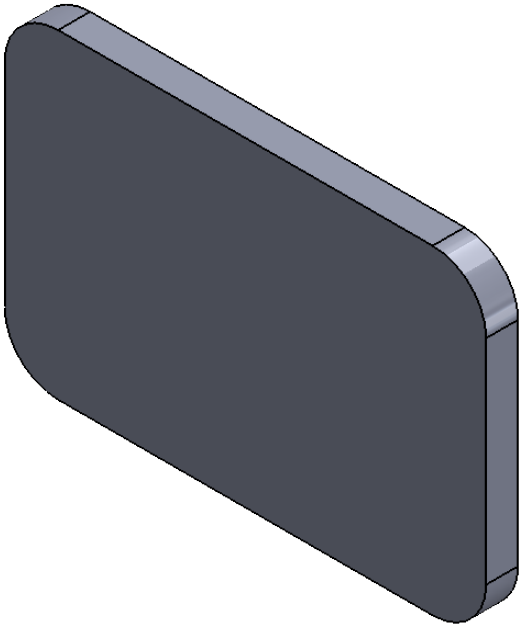




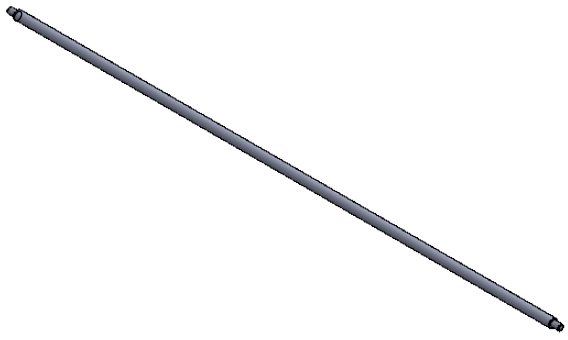


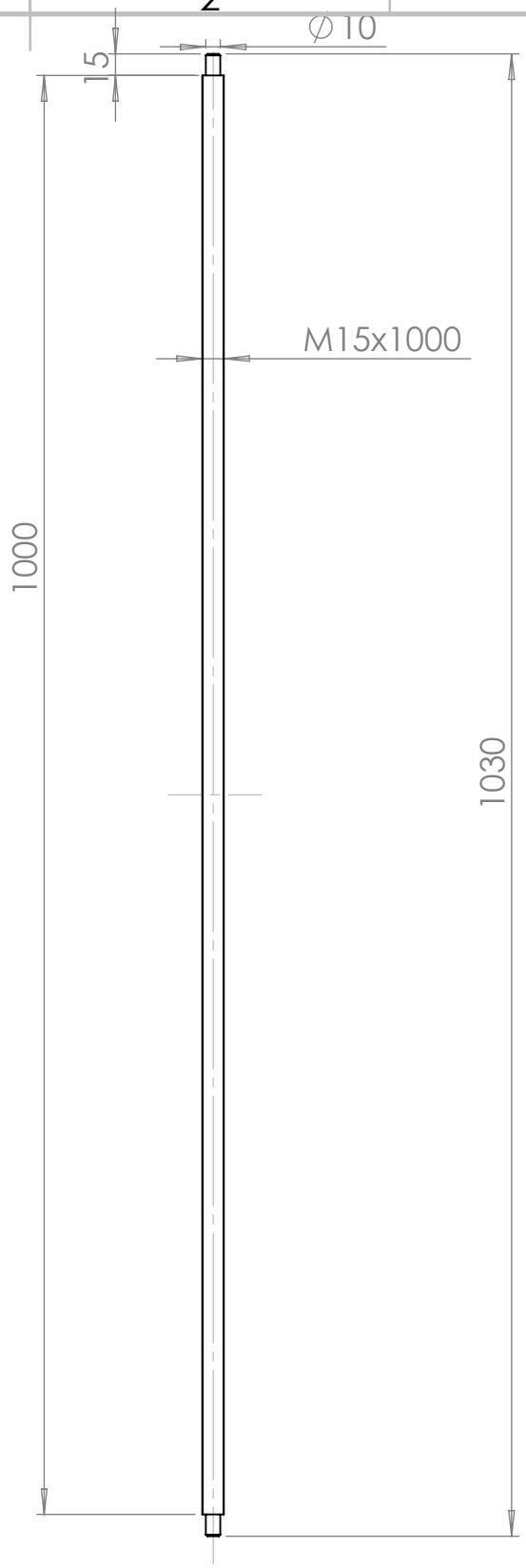
SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS		NO CAMBIE LA ESCALA		REVISIÓN
	NOMBRE	FIRMA	FECHA				TÍTULO:
	DIBUJ.	D.H.A					
	VERIF.						
	APROB.						
	FABR.						
	CALID.			MATERIAL: A definir		N.º DE DIBUJO Plataforma de recepción	A4
				PESO:		ESCALA:1:10	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:		REBARBAR Y ROMPER ARISTAS VIVAS			NO CAMBIE LA ESCALA	REVISIÓN
	NOMBRE	FIRMA	FECHA			TÍTULO:	
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: Chapa galvanizada 3mm		N.º DE DIBUJO Pletina freno guía	A4
				PESO:		ESCALA:2:1	HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN		

	NOMBRE	FIRMA	FECHA			
DIBUJ.	D.H.A					
VERIF.						
APROB.						
FABR.						
CALID.						

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

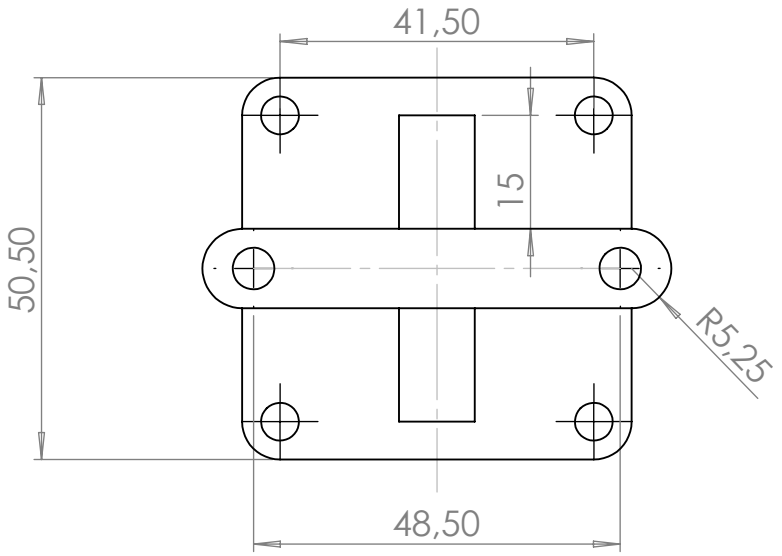
N.º DE DIBUJO: Sinfín

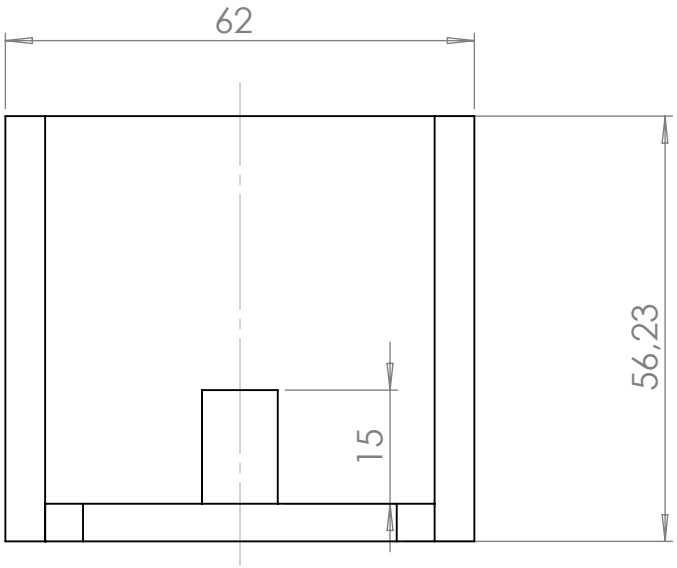
A4

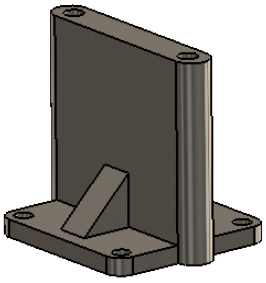
PESO:

ESCALA:1:5

HOJA 1 DE 1







SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA / REVISIÓN

	NOMBRE	FIRMA	FECHA
DIBUJ.	D.H.A		
VERIF.			
APROB.			
FABR.			
CALID.			

TÍTULO:

MATERIAL: AISI 4340 + ZINCADO

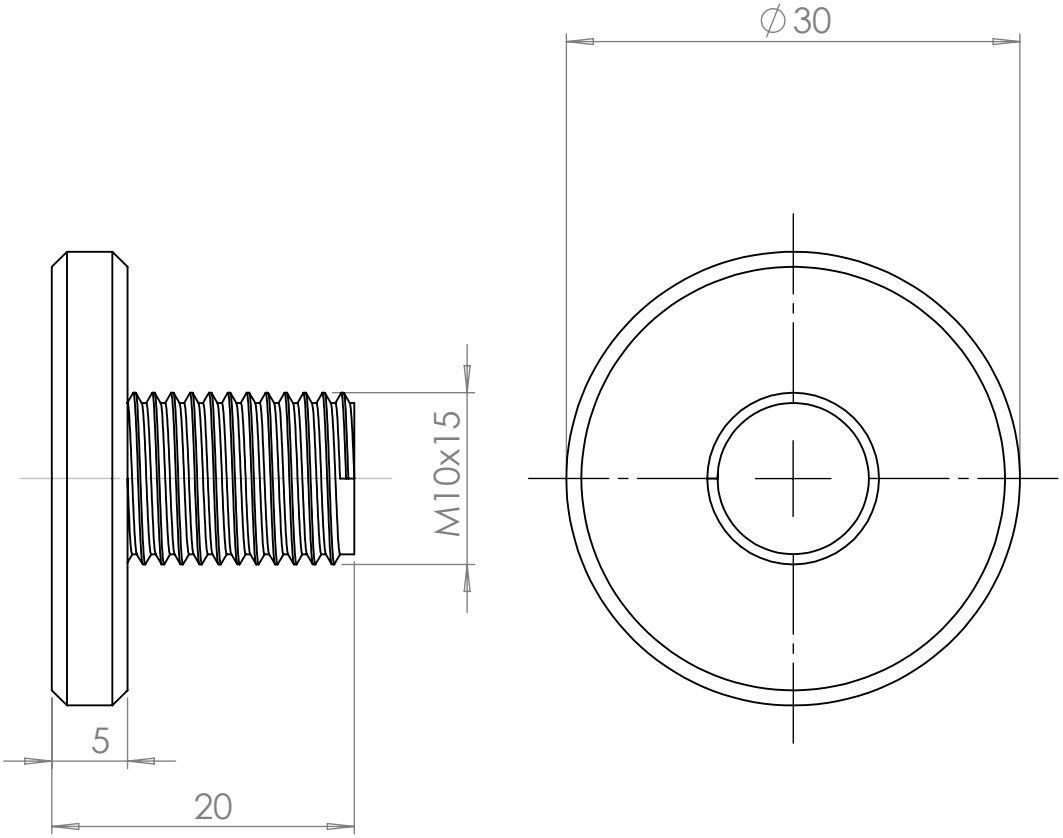
N.º DE DIBUJO: Soporte rodamiento

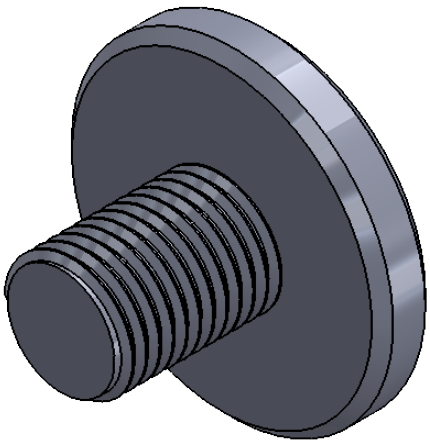
A4

PESO:

ESCALA:1:1

HOJA 1 DE 1





SI NO SE INDICA LO CONTRARIO: LAS COTAS SE EXPRESAN EN MM ACABADO SUPERFICIAL: TOLERANCIAS: LINEAL: ANGULAR:	ACABADO:	REBARBAR Y ROMPER ARISTAS VIVAS	NO CAMBIE LA ESCALA	REVISIÓN			
	NOMBRE	FIRMA	FECHA				TÍTULO:
DIBUJ.	D.H.A						
VERIF.							
APROB.							
FABR.							
CALID.				MATERIAL: AISI 4340 + ZINCADO			N.º DE DIBUJO Tapón buje
							A4
				PESO:		ESCALA:2:1	HOJA 1 DE 1

ANEXO 2: DOCUMENTACIÓN COMERCIAL

24212 Rodamiento de carcasa, rodamiento abridado UCFC con pieza de centrado

Descripción del artículo/Imágenes del producto

Descripción

Material:
Carcasa de fundición gris.
Rodamiento de acero del apoyo de cilindros 100Cr6.
Junta de goma NBR.

Versión:
Carcasa lacada.

Indicación:
El rodamiento de carcasa consiste en un rodamiento de bolas estanco de una sola fila y con un anillo exterior esférico montado en la carcasa. Gracias a la superficie exterior esférica del rodamiento, se pueden compensar errores de alineación del eje. Los rodamientos están fabricados con tolerancia positiva. Como resultado, en caso de uso de árboles con tolerancias h, se obtienen asientos de paso y asientos deslizables. La fijación del árbol se realiza con los tornillos de sujeción del anillo interior.

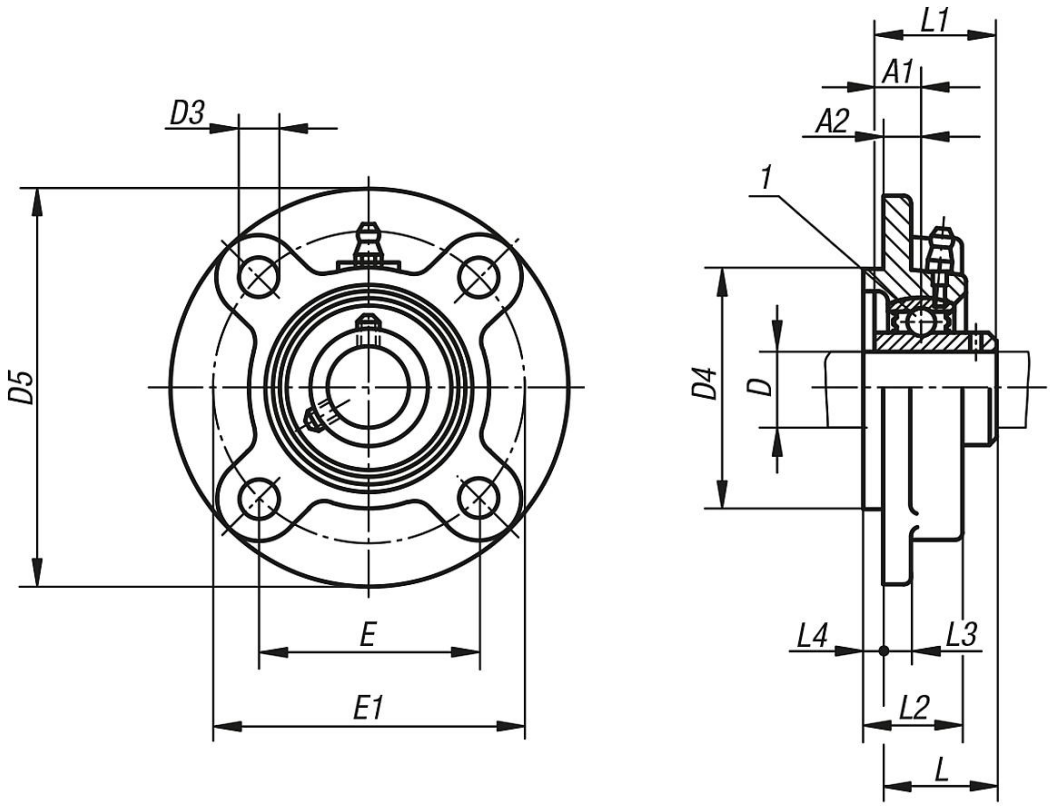
En condiciones normales, los rodamientos de carcasa no precisan mantenimiento gracias a la lubricación permanente aplicada. Si se requiere una nueva lubricación debido a condiciones ambientales complicadas, se podrá aplicar lubricante posteriormente a través del racor de lubricación.

Todas las medidas de la carcasa son medidas nominales para las que deben tenerse en cuenta las tolerancias de fundición habituales.

Rango de temperatura:
De -15 °C a +100 °C.

Indicación sobre el dibujo:
1) Rodamiento de bolas

Planos



Nuestros productos

Referencia	Rodamiento	Carcasa	D	A1	A2	D3	D4	D5	E	E1	L	L1	L2	L3	L4	α	Tornillo/s de fijación
24212-20204	UC 204	FC 204	20	12,7	10	12	62	100	55,1	78	28,3	31	20,5	7	5	10°	M10
24212-25205	UC 205	FC 205	25	14,3	10	12	70	115	63,6	90	29,8	34	21	7	6	10°	M10
24212-30206	UC 206	FC 206	30	15,9	10	12	80	125	70,7	100	32,2	38,1	23	8	8	10°	M10
24212-35207	UC 207	FC 207	35	17,5	11	14	90	135	77,8	110	36,4	42,9	26	9	8	10°	M12
24212-40208	UC 208	FC 208	40	19	11	14	100	145	84,8	120	41,2	49,2	26	9	10	10°	M12
24212-45209	UC 209	FC 209	45	19	10	16	105	160	93,3	132	40,2	49,2	26	14	12	10°	M14
24212-50210	UC 210	FC 210	50	19	10	16	110	165	97,6	138	42,6	51,6	28	14	12	10°	M14
24212-55211	UC 211	FC 211	55	22,2	13	19	125	185	106,1	150	46,4	55,6	31	15	12	10°	M16
24212-60212	UC 212	FC 212	60	25,4	17	19	135	195	113,1	160	56,7	65,1	36	15	12	10°	M16

Item description/product images

Description

Material:
Housing igumid® G.
Swivel ball iglidur® W300

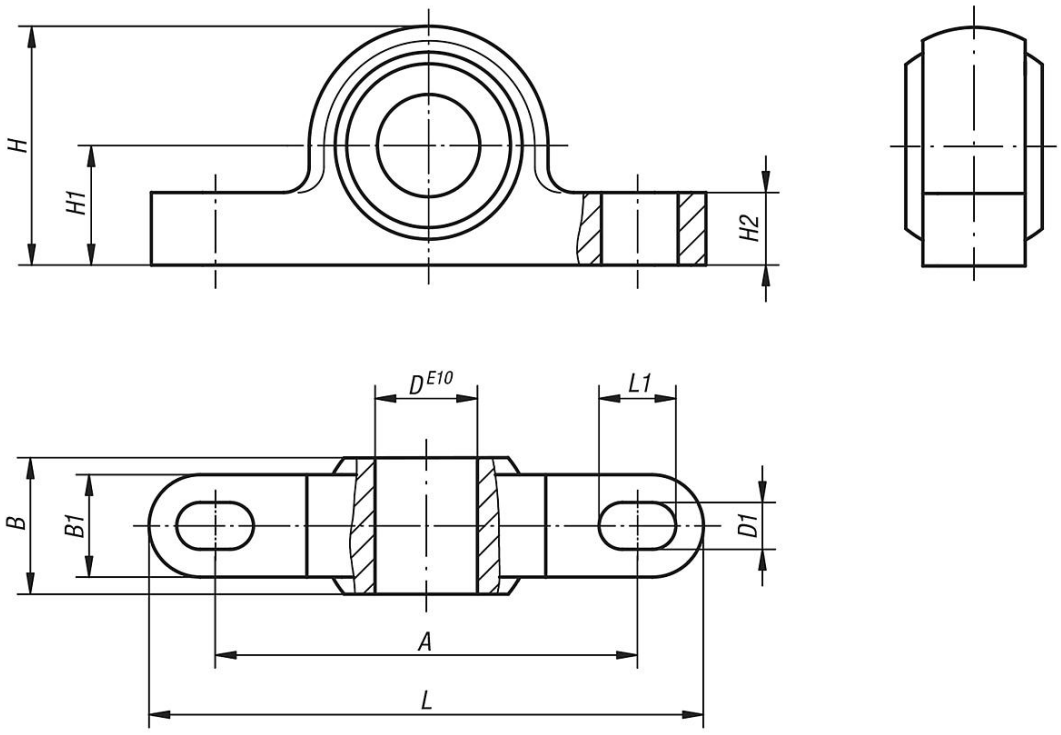
Version:
black.

Note:
The ability to pivot allows pillow block bearings to compensate for misalignment and possible shaft deflection. They are easy to install and suitable for the accomodation of rotating, oscillating and linear movements.
igubal® pillow block bearings are maintenance free and conceived for dry running condition.

Assembly:
These pillow block bearings are designed for mounting with 2 screws.

The ID tolerance is E10. The matching shaft should have a tolerance of h6 to h9.

Drawings

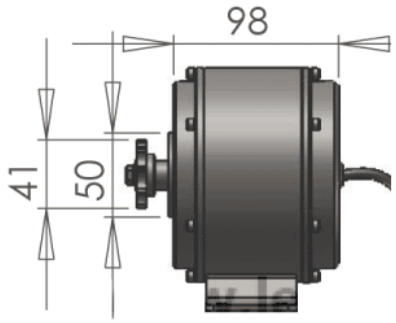


Overview of items

Order No.	A	B	B1	D	D1	H	H1	H2	L	L1	Max. swivel angle	Max. static tensile stress N short-term	Max. static tensile stress N long-term	Max. static axial pressure stress N	Max. tightening torque for oblong holes Nm
23500-05	26,7	8	6	5	3,3	14	7	4	34	5	30°	700	350	400	0,6
23500-06	34,5	9	7	6	4,5	18	10	5,5	43	6	29°	1100	550	400	1,3
23500-08	35,5	12	9	8	4,5	20	10	6	47	7	25°	1300	650	800	1,3
23500-10	48,5	14	10,5	10	5,5	26	14	7,5	62	8	25°	1500	750	1100	2,5
23500-12	49,5	16	12	12	5,5	28	14	8,5	65	9	25°	2200	1100	1150	2,5

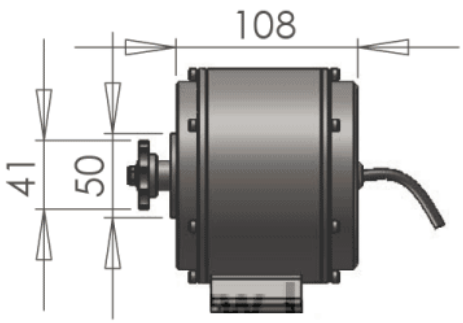
Overview of items

Order No.	A	B	B1	D	D1	H	H1	H2	L	L1	Max. swivel angle	Max. static tensile stress N short-term	Max. static tensile stress N long-term	Max. static axial pressure stress N	Max. tightening torque for oblong holes Nm
23500-14	64,4	19	13,5	14	6,6	34	18	9,5	82	11	23°	2400	1200	1200	4,5
23500-16	65,4	21	15	16	6,6	36	18	10,5	86	12	23°	3000	1500	1800	4,5
23500-18	72	23	16,5	18	9	42	22	11,5	93	13	23°	3500	1750	1900	10,5
23500-20	73	25	18	20	9	44	22	13	98	14	23°	4700	2350	2500	10,5
23500-22	81	28	20	22	9	48	24	14	108	16	22°	6100	3050	2700	10,5
23500-25	94	31	22	25	9	54	27	16	124	17	22°	6600	3300	3200	10,5
23500-30	105	37	25	30	11	64	32	17	139	20	22°	8100	4050	3750	21,5



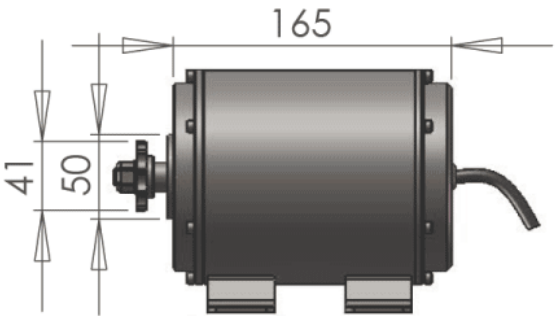
BLT - 500

6 kg



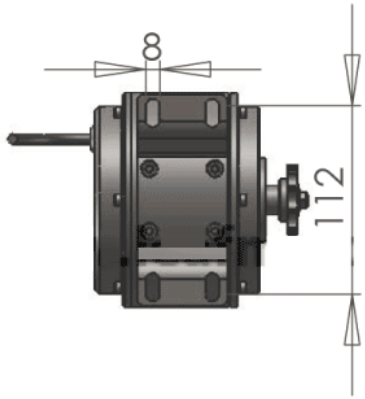
BLT - 650

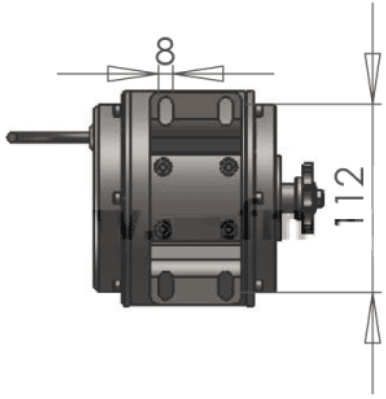
6.5 kg

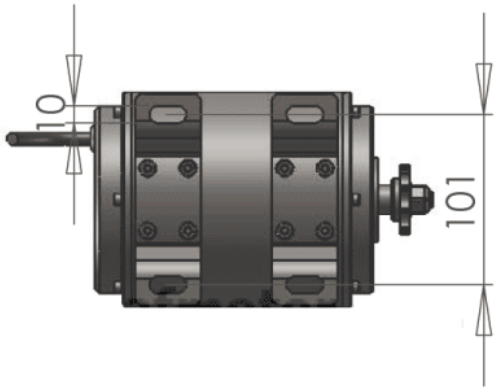


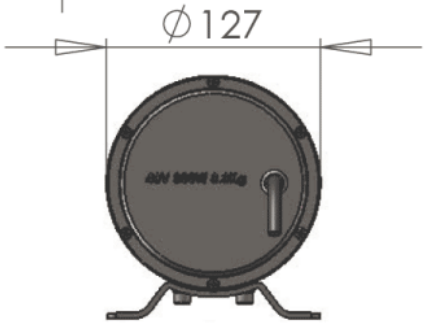
BLT - 800

8.8 kg









BLT 500/650/800

NEUGART

Precision gearbox catalog

WPLE

The versatile right angle planetary gearbox with lower weight and appealing cost effectiveness

The **WPLE** is a consistent continuation of the benefits offered by the Economy Line. With its compact, but powerful design, it is ideal for dynamic multiple axis systems. Our right angle gearbox features lifetime lubrication, is easy to install, all this at an unrivalled price-performance ratio.

❷ Efficient and effective

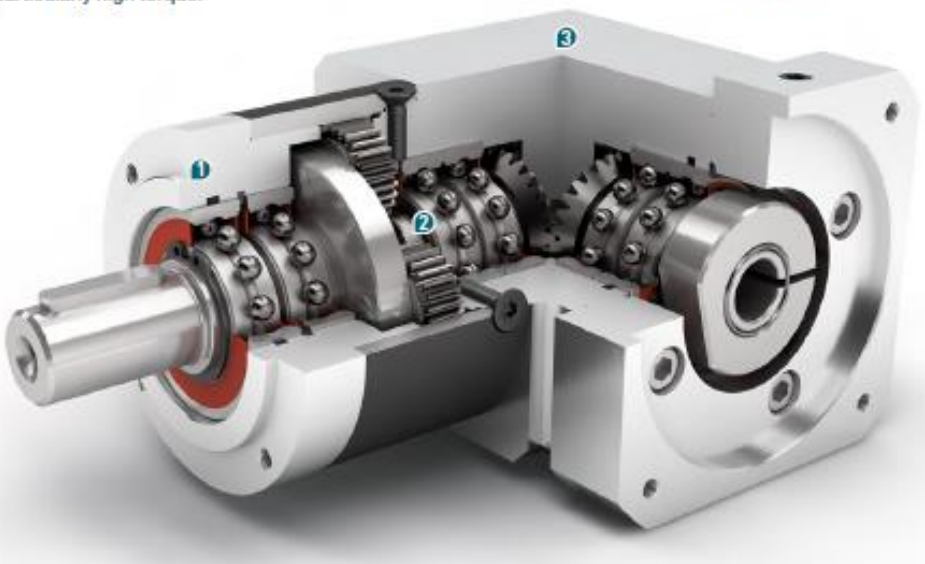
As a genuine multi-talent of right angle planetary gearboxes, the **WPLE** is the specialist among the generalists – and that at an unbeatable price-performance ratio.

❶ The highest dynamics in multiple axis systems

The **WPLE** right angle gearbox delivers more than just above average performance: With 25% less weight, it outputs a particularly high torque.

❸ Flexible installation options and reliability

Fitted with lifetime lubrication, our **WPLE** right angle planetary gearbox lets you exploit restricted space to the optimal extent. It can be installed in any direction, making it the ideal choice for many applications.



- Individual adaptation of the input flange to the motor
- Lifetime lubrication for maintenance-free operation
- Equidirectional rotation
- Wide range of output shaft designs
- Precise gearing
- Wide range of ratios i = 3 to i = 512

Code	Gearbox characteristics			WPLE040	WPLE060	WPLE080	WPLE120	z[1]
	Service life	t_L	h	20,000				
	Service life at T_{2N} x 0.88			30,000				
	Efficiency at full load[2]	η	%	95				1
				94				2
				88				3
	Min. operating temperature	T_{min}	°C (°F)	-25 (- 13)				
	Max. operating temperature	T_{max}		90 (194)				
	Protection class			IP 54				
S	Standard lubrication			Grease				
F	Food grade lubrication			Grease				
L	Low temperature lubrication[3]			Grease				
	Installation position			Any				
S	Standard backlash	j_t	arcmin	< 21	< 16	< 13	< 11	1
				< 25	< 18	< 15	< 13	2
				< 28	< 21	< 17	< 15	3
	Torsional stiffness[2]	c_g	Nm/arcmin (lb$_f$.in/ arcmin)	0.6 - 0.8 (5 - 7)	1.5 - 2.0 (13 - 18)	3.8 - 5.1 (34 - 45)	9.6 - 12.9 (85 - 114)	1
				0.6 - 0.8 (5 - 7)	1.6 - 2.0 (14 - 18)	4.1 - 5.1 (36 - 45)	10.4 - 12.9 (92 - 114)	2
				0.6 - 0.8 (5 - 7)	1.5 - 2.0 (13 - 18)	3.9 - 5.1 (35 - 45)	9.9 - 12.9 (88 - 114)	3
	Gearbox weight	m_G	kg (lb$_m$)	0.5 (1.1)	1.7 (3.7)	4.4 (9.7)	12 (26.5)	1
				0.6 (1.3)	1.9 (4.2)	5 (11.0)	14 (30.9)	2
				0.7 (1.5)	2.1 (4.6)	5.5 (12.1)	16 (35.3)	3
S	Standard surface			Housing: Steel – nitrocarburized and post-oxidized (black)				
	Running noise[4]	Q_g	dB(A)	68	70	73	75	
	Max. bending moment based on the gearbox input flange[5]	M_b	Nm (lb$_f$.in)	2 (18)	5 (44)	10.5 (93)	26 (230)	
	Motor flange precision			DIN 42955-N				

Output shaft loads			WPLE040	WPLE060	WPLE080	WPLE120	z[1]
Radial force for 20,000 h[5][7]	$F_{r\,20.000\,h}$	N (lb$_f$)	200 (45)	400 (90)	750 (169)	1750 (394)	
Axial force for 20,000 h[5][7]	$F_{a\,20.000\,h}$		200 (45)	500 (113)	1000 (225)	2500 (563)	
Radial force for 30,000 h[5][7]	$F_{r\,30.000\,h}$		160 (36)	340 (77)	650 (146)	1500 (338)	
Axial force for 30,000 h[5][7]	$F_{a\,30.000\,h}$		160 (36)	450 (101)	900 (203)	2100 (473)	
Static radial force[7][8]	$F_{r\,Stat}$		200 (45)	700 (158)	1250 (281)	2000 (450)	
Static axial force[7][8]	$F_{a\,Stat}$		240 (54)	800 (180)	1600 (360)	3800 (855)	
Tilting moment for 20,000 h[5][8]	$M_{K\,20.000\,h}$	Nm (lb$_f$.in)	5 (44)	14 (124)	31 (274)	101 (894)	
Tilting moment for 30,000 h[5][8]	$M_{K\,30.000\,h}$		4 (35)	12 (106)	27 (239)	86 (761)	

Moment of inertia			WPLE040	WPLE060	WPLE080	WPLE120	z[1]
Mass moment of inertia[2]	J	kgcm^2 (lb$_f$.in.s^{2}10^{-4})	0.032 - 0.049 (0.283 - 0.434)	0.221 - 0.376 (1.956 - 3.328)	0.917 - 1.409 (8.115 - 12.470)	1.849 - 3.204 (16.364 - 28.355)	1
			0.032 - 0.049 (0.283 - 0.434)	0.223 - 0.378 (1.974 - 3.345)	0.931 - 1.424 (8.239 - 12.602)	1.919 - 3.397 (16.983 - 30.063)	2
			0.032 - 0.048 (0.283 - 0.425)	0.223 - 0.240 (1.974 - 2.124)	0.931 - 1.368 (8.239 - 12.107)	1.919 - 3.175 (16.983 - 28.099)	3

(1) Number of stages
(2) The ratio-dependent values can be retrieved in Tec Data Finder – www.nougart.com
(3) T_{min} = -40°C (-40°F). Optimal operating temperature max. 50°C (122°F)
(4) Sound pressure level from 1 m, measured on input running at n_1=3000 rpm no load; +-5
(5) Max. motor weight* in kg= 0.2 x M_b / motor length in m
* with symmetrically distributed motor weight
* with horizontal and stationary mounting
(6) These values are based on an output shaft speed of n_2= 100 rpm
(7) Based on center of output shaft
(8) Other (sometimes higher) values following changes to T_{2N}, F_r, F_a, cycle, and service life of bearing. Application specific configuration with NCP – www.nougart.com

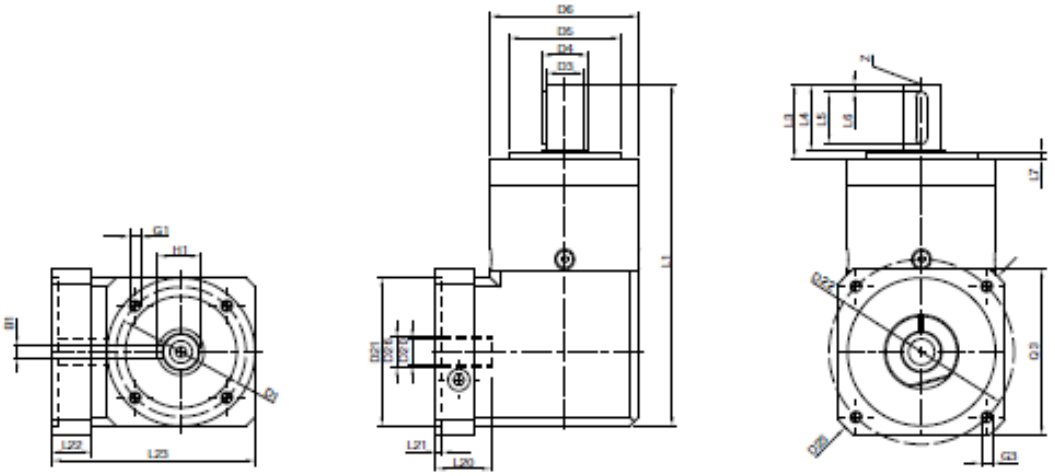
Output torques			WPLE040	WPLE060	WPLE080	WPLE120	i[1]	z[2]
Nominal output torque[3][4]	T_{2N}	Nm (lb$_f$.in)	4.5 (40)	14 (124)	40 (354)[5]	80 (708)[5]	3	1
			6 (53)	19 (168)	53 (469)[5]	105 (929)[5]	4	
			7.5 (66)	24 (212)	67 (593)[5]	130 (1151)[5]	5	
			8.5 (75)	25 (221)	65 (575)	135 (1195)	7	
			6 (53)	19 (159)	50 (443)	120 (1062)	8	
			5 (44)	15 (133)	38 (336)	95 (841)	10	
			16.5 (146)[5]	44 (389)[5]	130 (1151)[5]	210 (1859)[5]	9	2
			20 (177)[5]	44 (389)	120 (1062)[5]	260 (2301)[5]	12	
			18 (159)[5]	44 (389)	110 (974)	230 (2036)	15	
			20 (177)[5]	44 (389)	120 (1062)	260 (2301)	16	
			20 (177)[5]	44 (389)	120 (1062)	260 (2301)	20	
			18 (159)	40 (354)	110 (974)	230 (2036)	25	
			20 (177)	44 (389)	120 (1062)	260 (2301)	32	
			18 (159)	40 (354)	110 (974)	230 (2036)	40	
			7.5 (66)	18 (159)	50 (443)	120 (1062)	64	
			20 (177)	44 (389)	110 (974)	260 (2301)	60	3
			20 (177)	44 (389)	120 (1062)	260 (2301)	80	
			20 (177)	44 (389)	120 (1062)	260 (2301)	100	
			18 (159)	44 (389)	110 (974)	230 (2036)	120	
			20 (177)	44 (389)	120 (1062)	260 (2301)	160	
			18 (159)	40 (354)	110 (974)	230 (2036)	200	
			20 (177)	44 (389)	120 (1062)	260 (2301)	256	
			18 (159)	40 (354)	110 (974)	230 (2036)	320	
			7.5 (66)	18 (159)	50 (443)	120 (1062)	512	
Max. output torque[4][6]	T_{2max}	Nm (lb$_f$.in)	7 (62)	22 (195)	64 (566)	128 (1133)	3	1
			10 (89)	30 (266)	85 (752)	168 (1487)	4	
			12 (106)	38 (336)	107 (947)	208 (1841)	5	
			13.5 (119)	40 (354)	104 (920)	216 (1912)	7	
			10 (89)	29 (257)	80 (708)	192 (1699)	8	
			8 (71)	24 (212)	61 (540)	152 (1345)	10	
			26 (230)	70 (620)	208 (1841)	336 (2974)	9	2
			32 (283)	70 (620)	192 (1699)	416 (3682)	12	
			29 (257)	70 (620)	176 (1558)	368 (3257)	15	
			32 (283)	70 (620)	192 (1699)	416 (3682)	16	
			32 (283)	70 (620)	192 (1699)	416 (3682)	20	
			29 (257)	64 (566)	176 (1558)	368 (3257)	25	
			32 (283)	70 (620)	192 (1699)	416 (3682)	32	
			29 (257)	64 (566)	176 (1558)	368 (3257)	40	
			12 (106)	29 (257)	80 (708)	192 (1699)	64	
			32 (283)	70 (620)	176 (1558)	416 (3682)	60	3
			32 (283)	70 (620)	192 (1699)	416 (3682)	80	
			32 (283)	70 (620)	192 (1699)	416 (3682)	100	
			29 (257)	70 (620)	176 (1558)	368 (3257)	120	
			32 (283)	70 (620)	192 (1699)	416 (3682)	160	
			29 (257)	64 (566)	176 (1558)	368 (3257)	200	
			32 (283)	70 (620)	192 (1699)	416 (3682)	256	
			29 (257)	64 (566)	176 (1558)	368 (3257)	320	
			12 (106)	29 (257)	80 (708)	192 (1699)	512	

[1] Ratios ($i=n_1/n_2$)
[2] Number of stages
[3] Application specific configuration with NCP – www.neugart.com
[4] Values for feather key (code "A"): for repeated load
[5] Different service life: 10,000 h at T_{2N}
[6] 30,000 rotations of the output shaft permitted; see page 128

Output torques			WPLE040	WPLE060	WPLE080	WPLE120	i[1]	z[2]
Emergency stop torque[3]	T_{2Stop}	Nm (lb$_f$.in)	22.5 (199)	66 (584)	180 (1593)	360 (3186)	3	1
			28 (248)	86 (761)	240 (2124)	474 (4195)	4	
			35 (310)	80 (708)	220 (1947)	500 (4425)	5	
			26 (230)	80 (708)	178 (1575)	340 (3009)	7	
			27 (239)	80 (708)	190 (1682)	380 (3363)	8	
			25 (221)	70 (620)	170 (1505)	430 (3806)	10	
			33 (292)	88 (779)	260 (2301)	500 (4425)	9	2
			40 (354)	88 (779)	240 (2124)	520 (4602)	12	
			36 (319)	88 (779)	220 (1947)	500 (4425)	15	
			40 (354)	88 (779)	240 (2124)	520 (4602)	16	
			40 (354)	88 (779)	240 (2124)	520 (4602)	20	
			36 (319)	80 (708)	220 (1947)	500 (4425)	25	
			40 (354)	88 (779)	240 (2124)	520 (4602)	32	
			36 (319)	80 (708)	220 (1947)	500 (4425)	40	
			27 (239)	80 (708)	190 (1682)	380 (3363)	64	
			40 (354)	88 (779)	220 (1947)	520 (4602)	60	3
			40 (354)	88 (779)	240 (2124)	520 (4602)	80	
			40 (354)	88 (779)	240 (2124)	520 (4602)	100	
			36 (319)	88 (779)	220 (1947)	500 (4425)	120	
			40 (354)	88 (779)	240 (2124)	520 (4602)	160	
			36 (319)	80 (708)	220 (1947)	500 (4425)	200	
			40 (354)	88 (779)	240 (2124)	520 (4602)	256	
			36 (319)	80 (708)	220 (1947)	500 (4425)	320	
			27 (239)	80 (708)	190 (1682)	380 (3363)	512	

Input speeds			WPLE040	WPLE060	WPLE080	WPLE120	i[1]	z[2]
Average thermal input speed at T_{2N} and S1[4][5]	n_{1N}	rpm	5000	4500[R]	3500[R]	2850[R]	3	1
			5000	4500[R]	3550[R]	2950[R]	4	
			5000	4500[R]	3600[R]	3050[R]	5	
			5000	4500	4000[R]	3500[R]	7	
			5000	4500	4000[R]	3500[R]	8	
			5000	4500	4000	3500	10	
			5000	4500[R]	3250[R]	2950[R]	9	2
			5000	4500[R]	3850[R]	3050[R]	12	
			5000	4500	4000[R]	3500[R]	15	
			5000	4500	4000[R]	3450[R]	16	
			5000	4500	4000[R]	3500[R]	20	
			5000	4500	4000	3500[R]	25	
			5000	4500	4000	3500	32	
			5000	4500	4000	3500	40	
			5000	4500	4000	3500	64	
			5000	4500	4000	3500	60	3
			5000	4500	4000	3500	80	
			5000	4500	4000	3500	100	
			5000	4500	4000	3500	120	
			5000	4500	4000	3500	160	
			5000	4500	4000	3500	200	
			5000	4500	4000	3500	256	
			5000	4500	4000	3500	320	
			5000	4500	4000	3500	512	
Max. mechanical input speed[6]	n_{1Limit}	rpm	18000	13000	7000	6500		

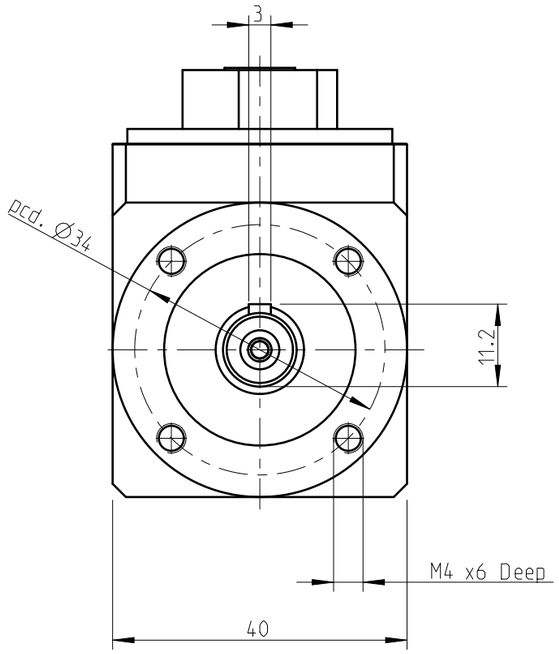
(1) Ratios ($i=n_1/n_2$)
(2) Number of stages
(3) Permitted 1000 times
(4) Application-specific speed configurations with NCP – www.nougart.com
(5) See page 128 for the definition
(6) Average thermal input speed at 50% T_{2N} and S1

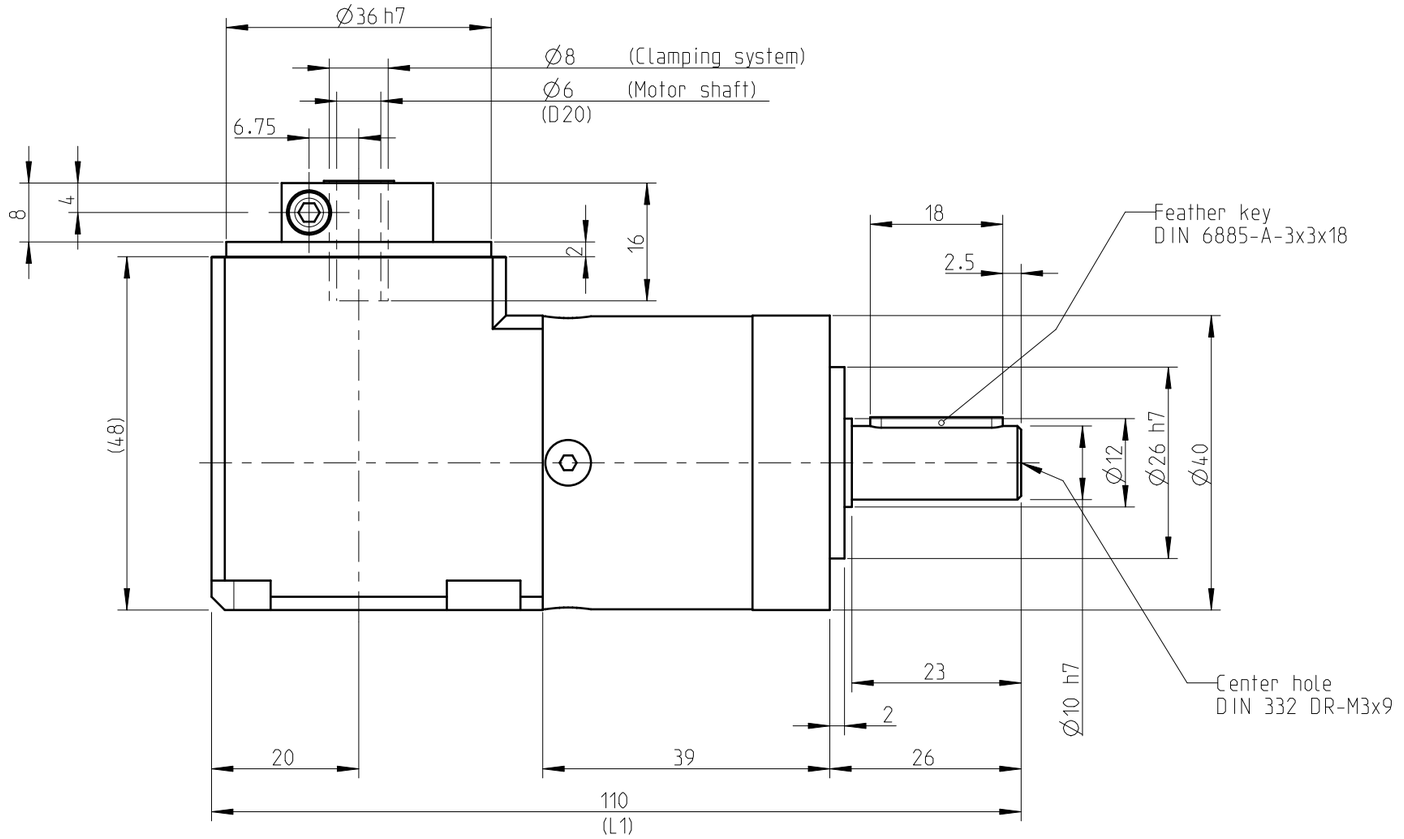


Drawing corresponds to a WPLE080 / 1-stage / output shaft with feather key / 19 mm clamping system / motor adaptation – 2-part – square universal flange / B5 flange type motor
All other variants can be retrieved in the Tec Data Finder at www.neugart.com

Geometry[1]			WPLE040	WPLE060	WPLE080	WPLE120	z[2]	Code
Pitch circle diameter output	D1		34 (1.339)	52 (2.047)	70 (2.756)	100 (3.937)		
Shaft diameter output	D3	h7	10 (0.394)	14 (0.551)	20 (0.787)	25 (0.984)		
Shaft collar output	D4		12 (0.472)	17 (0.669)	25 (0.984)	35 (1.378)		
Centering diameter output	D5	h7	26 (1.024)	40 (1.575)	60 (2.362)	80 (3.150)		
Housing diameter	D6		40 (1.575)	60 (2.362)	80 (3.150)	115 (4.528)		
Mounting thread x depth	G1	4x	M4x6	M5x8	M6x10	M10x16		
Total length	L1		110 (4.331)	147 (5.787)	184 (7.244)	249.5 (9.823)	1	
			123 (4.843)	159.5 (6.280)	201.5 (7.933)	277 (10.905)	2	
			135.5 (5.335)	172 (6.772)	219 (8.622)	304.5 (11.988)	3	
Shaft length output	L3		26 (1.024)	35 (1.378)	40 (1.575)	55 (2.165)		
Centering depth output	L7		2 (0.079)	3 (0.118)	3 (0.118)	4 (0.157)		
Min. overall height	L23		62 (2.441)	86 (3.366)	110 (4.331)	146 (5.728)		
Clamping system diameter input	D26		More information on page 117					
Motor shaft diameter j6/k6	D20		The dimensions vary with the motor/gearbox flange. The input flange geometries can be retrieved for each specific motor in Tec Data Finder at www.neugart.com					
Max. permis. motor shaft length Min. permis. motor shaft length	L20							
Centering diameter input	D21							
Centering depth input	L21							
Pitch circle diameter input	D22							
Motor flange length	L22							
Diagonal dimension input	D23							
Mounting thread x depth	G3	4x						
Flange cross section input	Q3	▪						
Output shaft with feather key (DIN 6885-1)			A 3x3x18	A 5x5x25	A 6x6x28	A 8x7x40		A
Feather key width (DIN 6885-1)	B1		3 (0.118)	5 (0.197)	6 (0.236)	8 (0.315)		
Shaft height including feather key (DIN 6885-1)	H1		11.2 (0.441)	16 (0.630)	22.5 (0.886)	28 (1.102)		
Shaft length from shoulder	L4		23 (0.906)	30 (1.181)	36 (1.417)	50 (1.969)		
Feather key length	L5		18 (0.709)	25 (0.984)	28 (1.102)	40 (1.575)		
Distance from shaft end	L6		2.5 (0.098)	2.5 (0.098)	4 (0.157)	5 (0.197)		
Center hole (DIN 332, type DR)	Z		M3x9	M5x12.5	M6x16	M10x22		
Smooth output shaft								B
Shaft length from shoulder	L4		23 (0.906)	30 (1.181)	36 (1.417)	50 (1.969)		

[1] Dimensions in mm (in)
[2] Number of stages

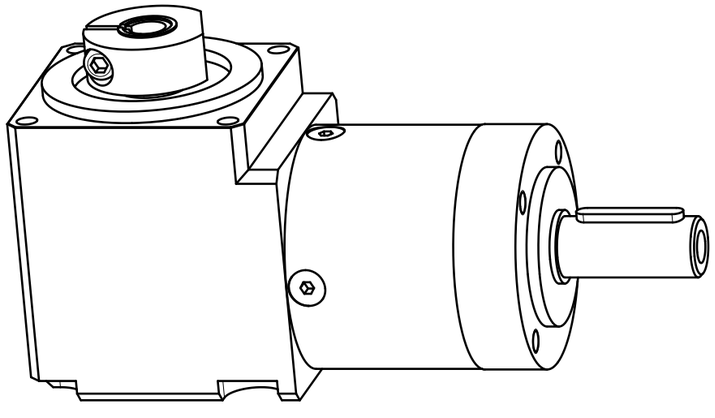


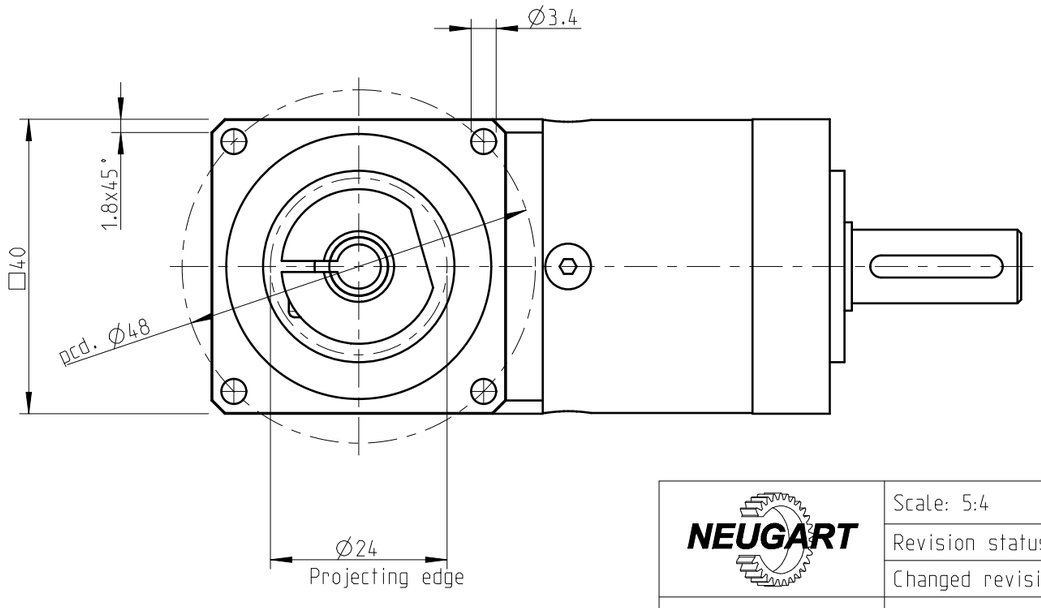


Materials / Surfaces:
Input flange: Aluminum / Untreated
Angle housing: Aluminum / Untreated
Housing: Steel / Nitrocarburized and post-oxidized (black)
Output flange: Aluminum / Untreated

Variables on the drawing are dependent upon the motor.
The given dimensions are exemplary.

Please see installation instructions!
Please see instruction manual!
Subject to modifications!





NEUGART	Scale: 5:4	DIN A3	ISO
	Revision status: E from: 17.05.2016		
	Changed revision status: D from: 01.10.2012		
General tolerance DIN ISO 2768-cL	WPLE040-aii-SSSA3AA-T(D20)		
Neugart GmbH Keltenstr. 16 D-77971 Kippenheim	MB-2966		Sheet 1/2

Technical data	Character	Unit	
Bevel gearbox - gearing type	-	-	Straight teeth
Number of stages	Z	-	1-stage
Output shaft bearing	-	-	Deep groove ball bearing
Seal	-	-	2RS bearing seal
Service life (L10h)	t_L	h	20.000
Max. operating temperature	T_{min} / T_{max}	°C	-25 / +90
Protection class	-	-	IP 54
Lubrication (lifetime lubrication)	-	-	Standard lubrication (grease)
Installation position	-	-	Any
Max. bending moment based on the gearbox input flange (for motor weight) (1)	M_b	Nm	2
Motor flange precision	-	-	DIN 42955-N
Required motor shaft tolerance	-	-	j6; k6
Min. permissible motor shaft length	$L_{20\ min}$	mm	11
Clamp screw tightening torque	$T_{A,K}$	Nm	2
Reference operating mode	-	-	S1
Reference operating factor	K_A	-	1
Reference speed	n_2	rpm	100
Reference ambient temperature	T_{Amb}	°C	20
Radial force for output bearing based on shaft center after L10h=20,000h with Fa=0N	$F_{r\ 20.000h}$	N	200
Axial force for output bearing based on gearbox axis after L10h=20,000h with Fr=0N	$F_{a\ 20.000h}$	N	200
Radial force for output bearing based on shaft center after L10h=30,000h with Fa=0N	$F_{r\ 30.000h}$	N	160
Axial force for output bearing based on gearbox axis after L10h=30,000h with Fr=0N	$F_{a\ 30.000h}$	N	160
Static radial force based on shaft center and T2=0Nm	$F_{r\ Stat}$	N	200
Static axial force based on gearbox axis and T2=0Nm	$F_{a\ Stat}$	N	240

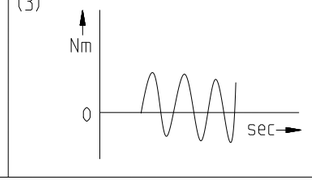
Ratio-dependent data	Character	Unit						
Ratio	aii	-	3	4	5	7	8	10
Nominal output torque No alternating torque (2)	T_{2N}	Nm	4,5	6	7,5	8,5	6	5
Nominal output torque Alternating torque permitted for 10,000,000 load changes (3)	$T_{2N\ 10Mio}$	Nm	4,5	6	7,5	8,5	6	5
Nominal output torque Alternating torque permitted for 100,000,000 load changes (3)	$T_{2N\ 100Mio}$	Nm	4,5	6	7	7	6	5
Max. output torque for 30,000 output shaft rotations	T_{2max}	Nm	7	10	12	13,5	10	8
Emergency stop torque permitted 1000 times	T_{2Stop}	Nm	22,5	28	35	26	27	25
Idle torque for n1=3,000 rpm and 20 °C gearbox temperature	T_0	Nm	0,1	0,1	0,1	0,1	0,1	0,1
Average thermal input speed at 50% T2N, S1, and T_Amb Operating temperature may not be exceeded!	$n_{1N\ 50\%}$	rpm	5000	5000	5000	5000	5000	5000
Average thermal input speed at 100% T2N, S1, and T_Amb Operating temperature may not be exceeded!	$n_{1N\ 100\%}$	rpm	5000	5000	5000	5000	5000	5000
Max. mechanical input speed Operating temperature may not be exceeded!	$n_{1\ Limit}$	rpm	18000	18000	18000	18000	18000	18000
Torsional backlash based on output shaft	j_t	arcmin	< 21	< 21	< 21	< 21	< 21	< 21
Torsional stiffness based on output shaft	c_g	Nm/arcmin	0,8	0,8	0,8	0,7	0,7	0,6
Efficiency at T2N, gearbox temperature 70 °C and n1=1,000rpm	η	%	94	94	94	94	92	90
Running noise at n1=3,000 rpm without load at a distance of 1m	Q_g	dB(A)	68	68	68	68	68	68
Gearbox weight	m_G	kg	0,45	0,45	0,45	0,45	0,45	0,45
Mass moment of inertia based on clamping system diameter input	J	kgcm²	0,049	0,041	0,035	0,033	0,032	0,032

(1) Max. motor weight* in kg = $\frac{0{,}2 * M_b}{\text{motor length in m}}$

* with symmetrically distributed motor weight
* with horizontal and stationary mounting

(2)

(3)



Subject to modifications!

NEUGART

WPLE040-aii-SSSA3AA-T(D20)

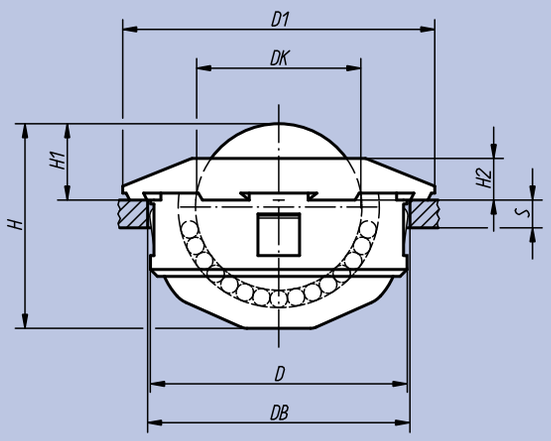
MB-2966 | Sheet 2/2

Revision status: E from: 17.05.2016

Ball Transfer Units

with spring clip

Form B: cap and housing galvanized
Form C: all parts galvanized,
balls in stainless steel



Material:
Steel

Surface finish:
Cover and housing galvanized; all parts galvanized and balls in stainless steel

Sample order:
nlm 95160-122

Note:
Ball Transfer Units with spring clip for easy assembly and disassembly from the load side. Fixing is by means of spring clips, which permit generous tolerances in the mounting hole. The special cover shape requires use of an assembly tool (95162) by installation.

S = Minimum nominal thickness of mounting base.

Order No.	Surface finish	DK	D	D1	Receiving-Ø DB	H	H1	H2	S	Base load (N)	□ kg
95160-115	B	15	24 -0,13	31	24 +0,5	20,2	9,5 ±0,2	5,5	1,5	500	0,044
95160-122	B	22	36 -0,16	45	36 +0,5	28,6	9,8 ±0,2	6	2	1300	0,146
95160-130	B	30	45 -0,16	55	45 +1,0	37,5	13,8 ±0,3	8	2,5	2500	0,290
95160-215	C	15	24 -0,13	31	24 +0,5	20,2	9,5 ±0,2	5,5	1,5	370	0,044
95160-222	C	22	36 -0,16	45	36 +0,5	28,6	9,8 ±0,2	6	2	970	0,146
95160-230	C	30	45 -0,16	55	45 +1,0	37,5	13,8 ±0,3	8	2,5	1900	0,290

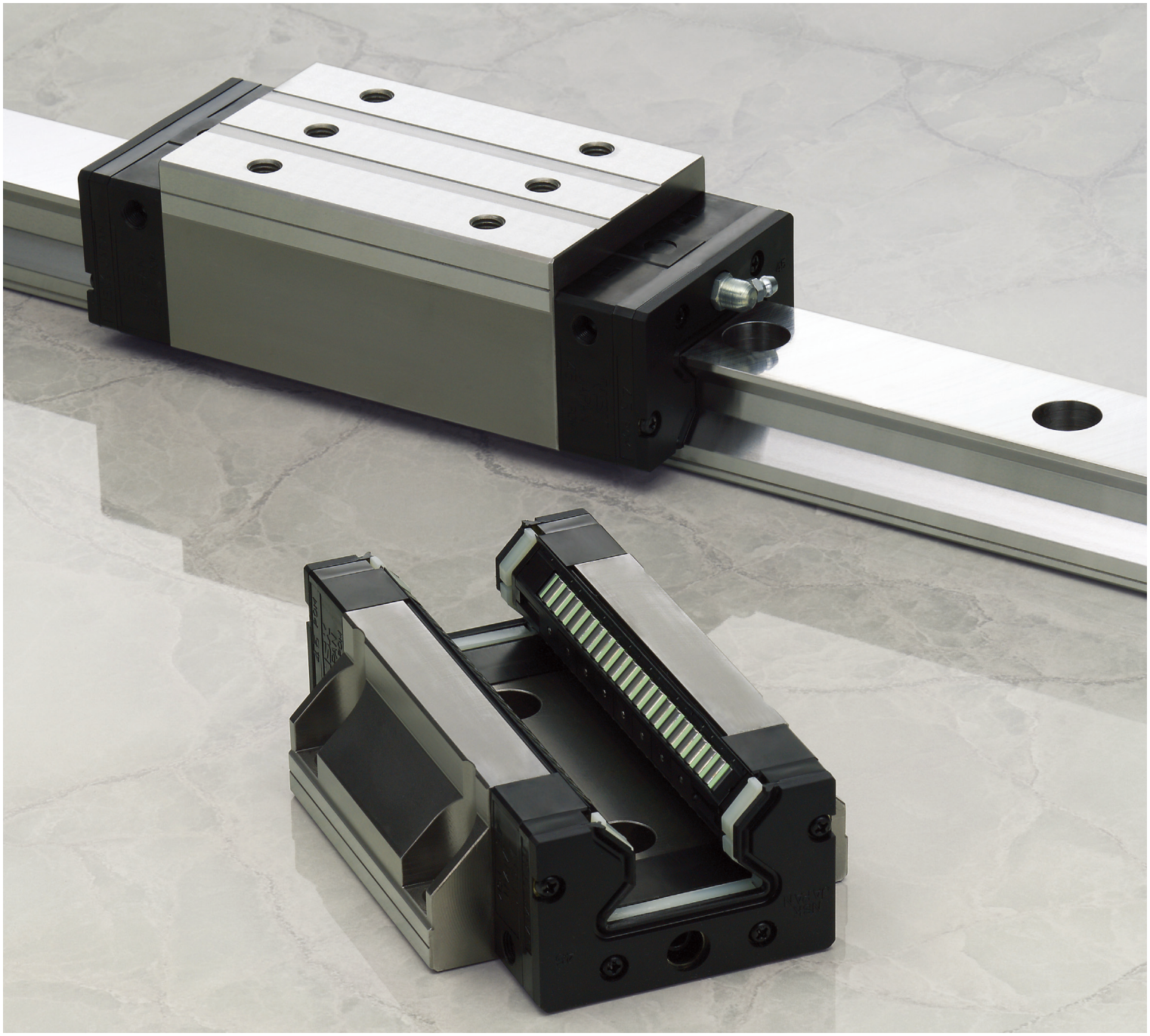
MOTION & CONTROL™

NSK

NSK Linear Guide™

Roller Guide RA Series

A roller guide series employing advanced analysis technology offers super-high load capacity and rigidity.
The latest series is now available in the random matching of rails and roller slides, which includes random matching with preload for higher accuracy and rigidity, allowing the users to select rails and roller slides in single unit quantities.



The fruits of comprehensive technology of NSK. RA series roller guides handle a diversity of applications

The RA series of roller guides is the product of a combination of NSK's extensive experience in roller bearings and linear guide technologies. The result is an optimal design that takes full advantage of NSK's unique expertise to realize super-high load capacity, rigidity and motion accuracy, plus smooth motion. Capable of handling a variety of applications, the RA series supports high machine performance.

RA series features support high machine performance

Super-long Life

Super-high load capacity
NSK has realized super-high load capacity, now the highest performance in the world, and achieved unprecedented operating life.

Maintenance-free
Installing an NSK K1™ lubrication unit assures long-term, maintenance-free operation.

Highly dust-proof
The high performance seals as standard equipment completely block the entry of foreign matter and maintain primary performance over the long term.

Contribution to High-precision Manufacturing

Super-high rigidity
Super-high rigidity provides high-precision manufacturing.

Super-high motion accuracy
Coupled with NSK's unique design approach, the vibration caused by roller passage has been substantially reduced. This will greatly contribute to improve machining quality.

Smooth motion
The installation of a retaining piece achieves smooth motion, resulting in stable positioning accuracy.

The RA series is available in eight models: RA15, 20, 25, 30, 35, 45, 55 and 65.

Used in Many Fields

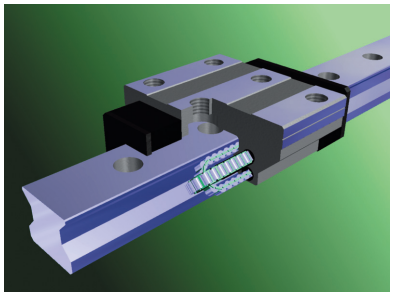
Complete series
Series includes a full lineup from small to large, including low-profile sizes. You can choose the model according to the application.

Interchangeable mounting dimensions
Outside dimensions and mounting dimensions conform to standard dimensions for the market, so RA series roller guides can be used without having to alter machine design. (See page 13 for mounting surface dimensions)

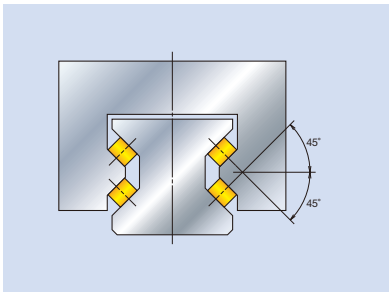
Low friction
Uses rollers for rolling elements to hold down dynamic friction.

Optimal Design

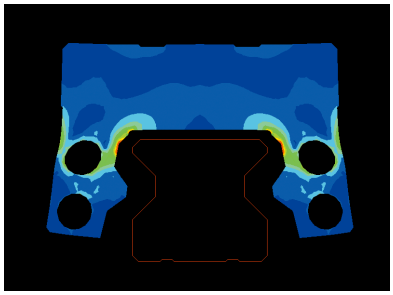
NSK executed a comprehensive, detailed performance simulation of roller guides by integrating its analysis technology and the tribology technology that the company had been developing over many years.
Down to the dimensions and shapes of component details, we have attained an optimal design completely.



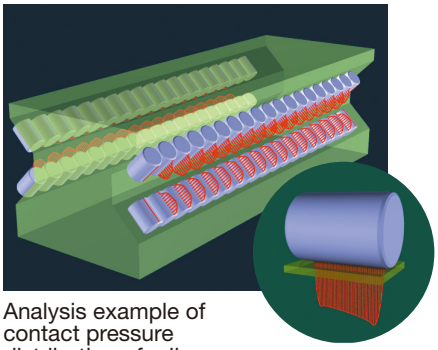
Smooth motion by use of retaining pieces



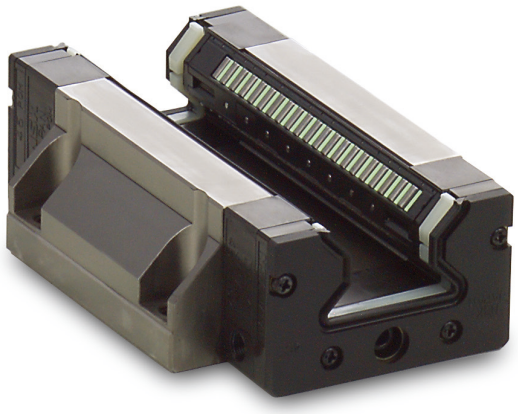
Balanced four-directional iso-load specifications



Example of roller slide deformation analysis



Analysis example of contact pressure distribution of rollers



Random-matching Type

RA25, 30, 35, 45, 55, 65

Random matching of rails and roller slides

Accuracy compatibility

The roller guides of random-matching type comply with the assembly specification of the precision grade of P6.

Random matching with preload

The random combinations of roller slide and rail provide the constant rigidity with an adequate preload. (Preload code: ZZ)

Random matching

The rails and roller slides can be selected in single unit quantities.

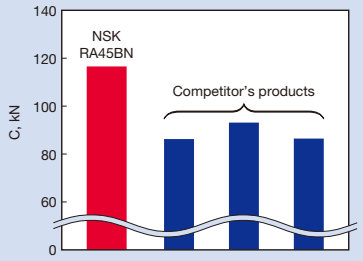
A variety of contributions to improve the performance of machine

Features

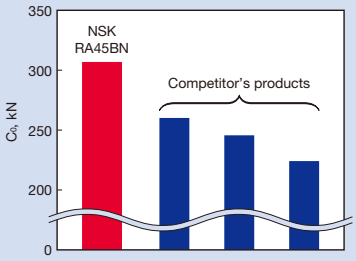
1. Super-high load capacity

By installing rollers that are the largest possible diameter and length within the existing standard cross-section dimension in a rational layout based on analysis technology, we have realized the world's highest load capacity*, far superior to conventional roller guides. Super-long life is achieved and impact load can be sufficiently handled.

* Compared with products of the same size, as of September 1, 2003, researched by NSK.



Basic dynamic load rating

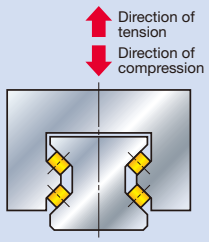


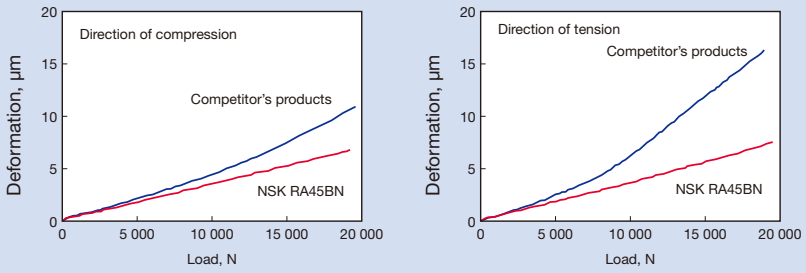
Basic static load rating

The basic load rating which is shown in the figures complies with ISO standards.
Standards for basic dynamic load rating: ISO14728-1
Standards for basic static load rating: ISO14728-2

2. Super-high rigidity

Using NSK's advanced analysis technology, we pursued a complete, optimal design, down to the detailed shape of roller slides and rails, thereby realizing super-high rigidity superior to that of competitor's roller guides.

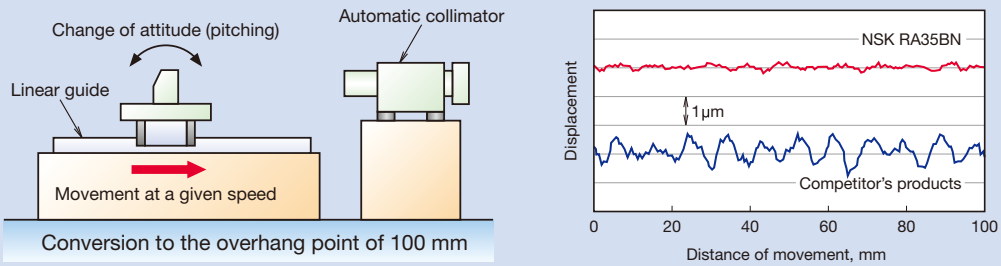




Comparison of measured rigidity

3. Super-high motion accuracy

NSK has developed its own unique method of simulating rolling element passage vibration and method of designing optimal roller slide specifications for damping roller passage vibration. These developments have dramatically enhanced roller slide motion accuracy for the RA series.



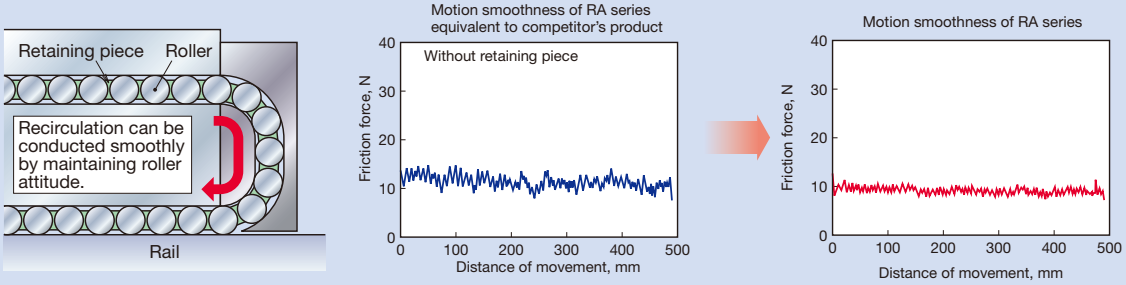
Comparison of measured motion accuracy

4. Mounting dimensions compatibility

The outer and mounting dimensions of RA series are based on market standards. RA series can be replaced without altering equipment design. (See page 13 for mounting surface dimensions)

5. Smooth motion

Installing a retaining piece between rollers and restraining the skew peculiar to roller bearings achieve smooth motion. The reduction of friction variation provides stable tracking in the complicated trajectory control.

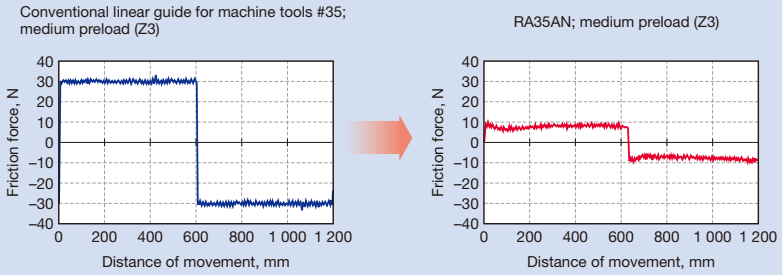


Measured motion smoothness

6. Low friction

Using rollers for rolling elements helps minimize dynamic friction.

Measurement conditions
- Lubrication: Oil (VG68)
- Feeding speed: 1 m/min

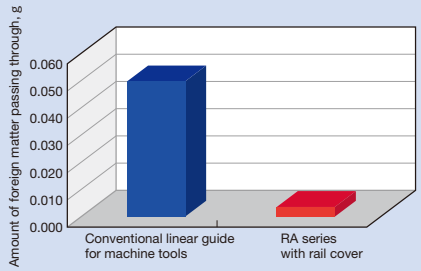


Comparison of measured dynamic friction force

7. Highly dust-proof and maintenance-free operation

Roller slides include high performance seals as standard equipment. The seal completely blocks the entry of foreign matter into the rolling surface and prevents loss of performance. In addition, rail covers* are also available for severe operating conditions. (Rail covers reduce the amount of foreign matter to 1/10 that of conventional linear guide for machine tools.)
The highly regarded NSK K1™ lubrication unit is also available to satisfy customer needs for long-term, maintenance-free operation.

* Rail covers are only available for the models of RA25 to RA65.

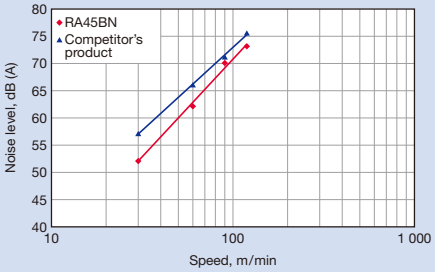


Example results of foreign matter invasion test

8. Low noise

A retaining piece is provided between rollers to prevent collision of rollers to minimize noise.

Microphone position: 500 mm above rail
Lubrication: Oil (VG68)



Example measurement of noise test

Abundant variations to meet a wide variety of needs

Specifications

1. Roller Slide Types and Shapes

- Two types of roller slides are available in this series: one with a mounting flange and a square type with tapped holes and no flange.
- A compact, low-profile square type is now available.
- On the mounting hole of the flange type, the tapped part is used to fix the roller slide from the top surface, and the minor diameter can be used as a bolt hole from the bottom. This provides mounting from both directions, top and bottom.
- Roller slide length can be specified by standard high load type or special long, super-high load type.

Fig. 1 Square type

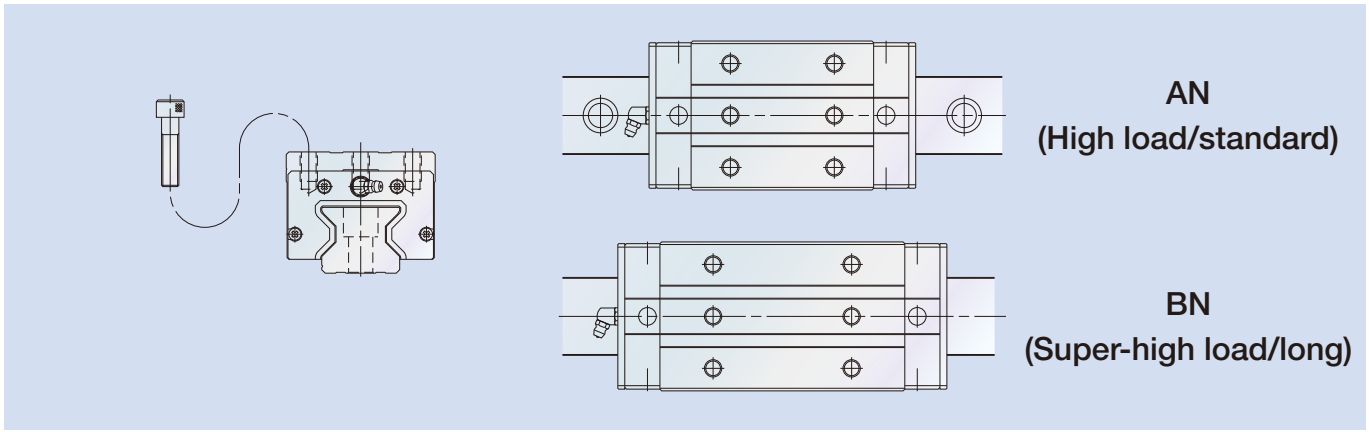


Fig. 2 Low-profile type

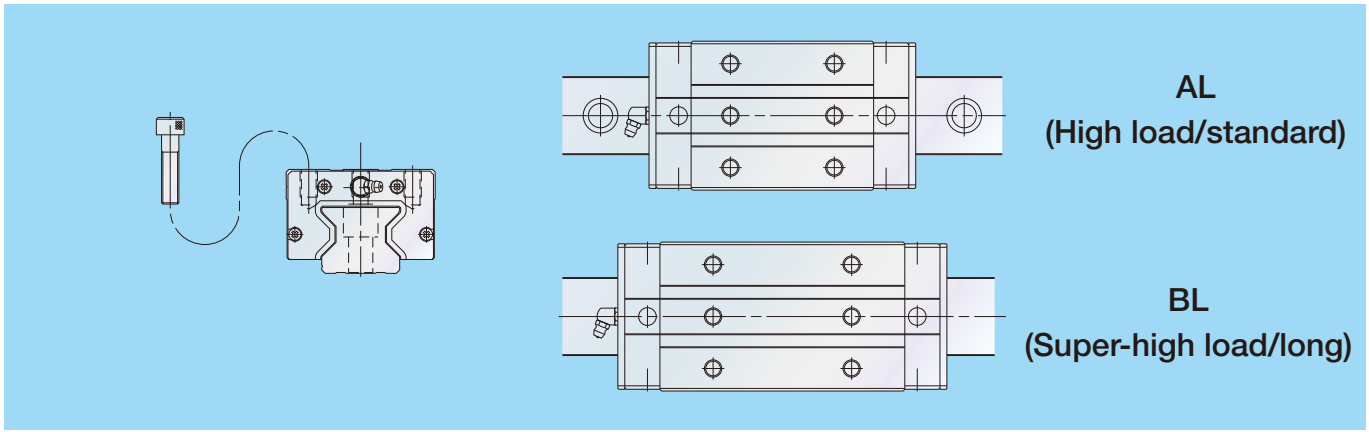
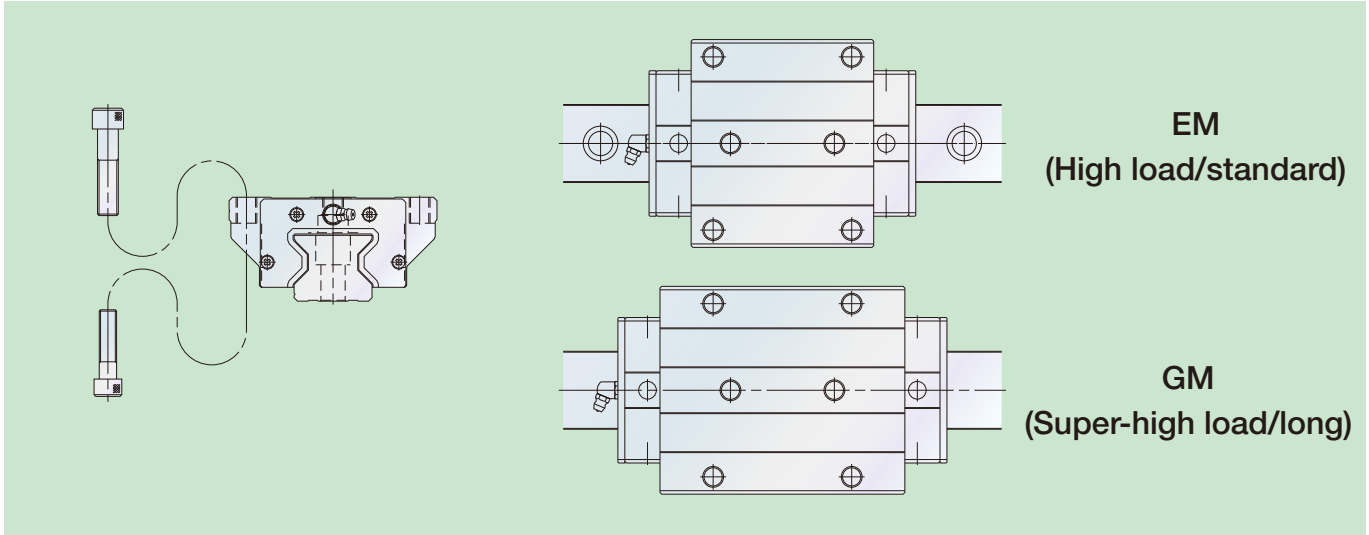


Fig. 3 Flange type



2. Accuracy

Four accuracy grades are available: ultra super precision P3, super precision P4, high precision P5, and precision P6.

Table 1 Accuracy standards

Unit: mm

Accuracy standards	Accuracy grades				
	Ultra super precision P3	Super precision P4	High precision P5	Precision P6	Random-matching Precision P6
Mounting height: Dimensions in mounting height *H*	±0.008	±0.010	±0.020	±0.040	±0.020
Mounting width: Dimensions in mounting width W_2 or W_3	±0.010	±0.015	±0.025	±0.050	±0.025
Variation of mounting height dimension *H*	0.003	0.005	0.007	0.015	0.015
Variation of mounting width dimension W_2 or W_3*	0.003	0.007	0.010	0.020	0.020
Running parallelism of face C against face A Running parallelism of face D against face B	Refer to Table 2				

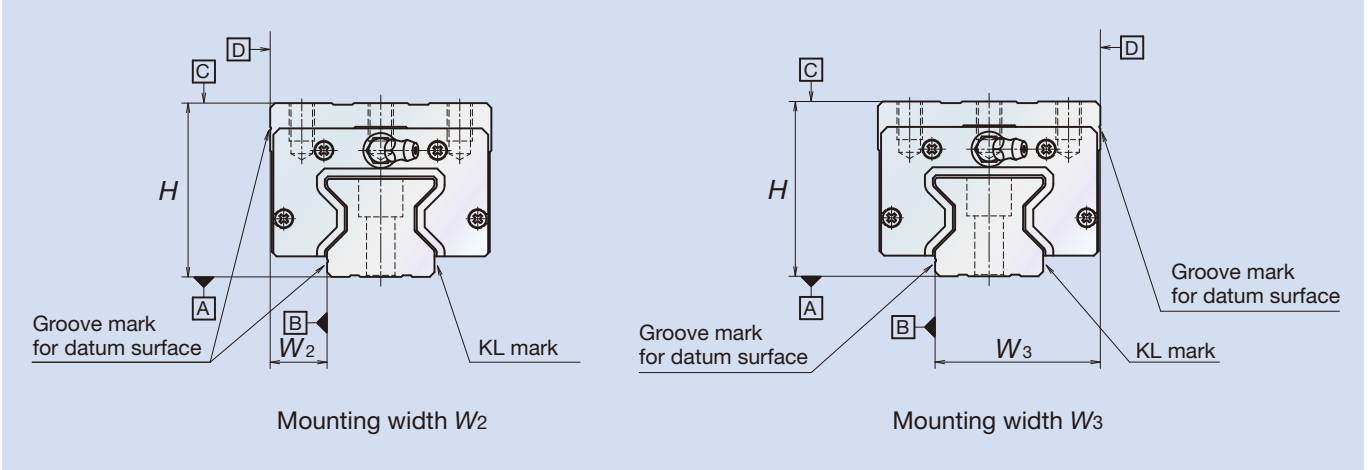
* Difference in roller slides on the reference side roller guide.

Table 2 Running parallelism

Unit: μm

Rail length (mm)	Ultra super precision P3	Super precision P4	High precision P5	Precision P6
Over – 50 or less	2	2	2	4.5
50 – 80	2	2	3	5
80 – 125	2	2	3.5	5.5
125 – 200	2	2	4	6
200 – 250	2	2.5	5	7
250 – 315	2	2.5	5	8
315 – 400	2	3	6	9
400 – 500	2	3	6	10
500 – 630	2	3.5	7	12
630 – 800	2	4	8	14
800 – 1 000	2.5	4.5	9	16
1 000 – 1 250	3	5	10	17
1 250 – 1 600	4	6	11	19
1 600 – 2 000	4.5	7	13	21
2 000 – 2 500	5	8	15	22
2 500 – 3 000	6	9.5	17	25
3 150 – 3 500	9	16	23	30

Fig. 4 Specifications of accuracy



3. Preload and Rigidity

We offer two levels of preload: Medium preload Z3 and Slight preload Z1.

Table 3 Preload

Unit: N

	Model No.	Slight preload (Z1)	Medium preload (Z3)
High-load type	RA15 AN, AL, EM	–	1 030
	RA20 AN, EM	–	1 920
	RA25 AN, AL, EM	880	2 920
	RA30 AN, AL, EM	1 170	3 890
	RA35 AN, AL, EM	1 600	5 330
	RA45 AN, AL, EM	2 780	9 280
	RA55 AN, AL, EM	3 870	12 900
	RA65 AN, EM	6 300	21 000
Super-high-load type	RA15 BN, BL, GM	–	1 300
	RA20 BN, GM	–	2 400
	RA25 BN, BL, GM	1 060	3 540
	RA30 BN, BL, GM	1 430	4 760
	RA35 BN, BL, GM	2 020	6 740
	RA45 BN, BL, GM	3 480	11 600
	RA55 BN, BL, GM	5 040	16 800
	RA65 BN, GM	8 640	28 800

Fig. 5 Direction of load

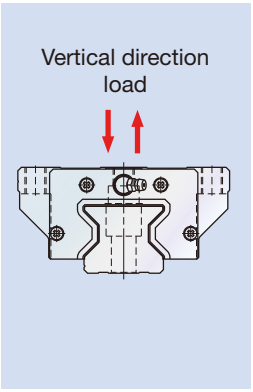
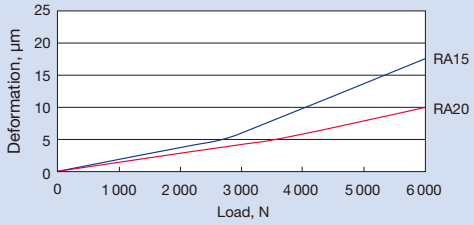
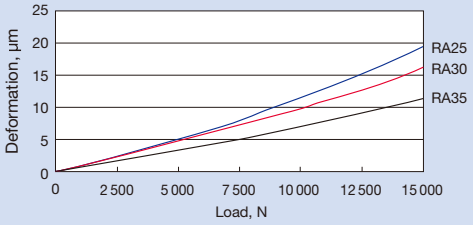


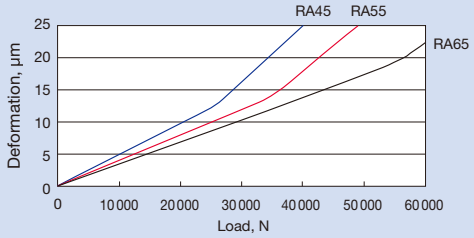
Fig. 6 Rigidity measurement data



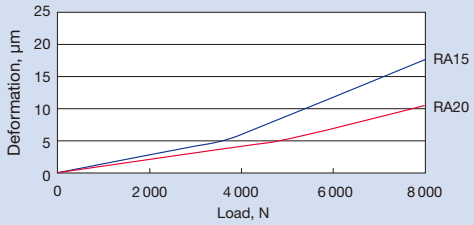
Vertical direction rigidity: High-load type/standard
(Roller slide shape: AN, AL, EM)



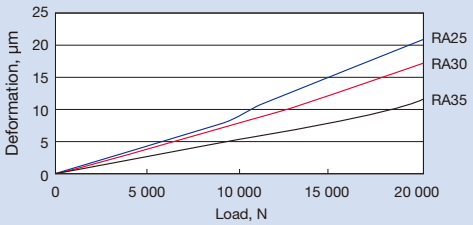
Vertical direction rigidity: High-load type/standard
(Roller slide shape: AN, AL, EM)



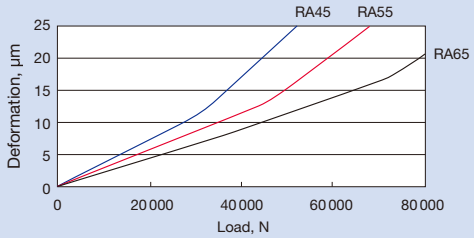
Vertical direction rigidity: High-load type/standard
(Roller slide shape: AN, AL, EM)



Vertical direction rigidity: Super-high-load type/long
(Roller slide shape: BN, BL, GM)



Vertical direction rigidity: Super-high-load type/long
(Roller slide shape: BN, BL, GM)



Vertical direction rigidity: Super-high-load type/long
(Roller slide shape: BN, BL, GM)

4. Basic Load Rating and Rated Life

Basic dynamic load rating that expresses load capacity is established by ISO standards (ISO14728-1) for linear guides. With basic dynamic load rating, direction and size do not fluctuate so that rated fatigue life is 100 km. Load rating for NSK Linear Guide complies with ISO standards. With the RA series, dynamic load rating is the same in both the vertical and horizontal directions (4-way equal load specs.). Rated fatigue life L is calculated by the following formula when load F is applied to the roller slide in the horizontal or vertical direction only.

- This life formula is different from that for linear guides with ball rolling elements.
- fw is load factor. Refer to the respective value from the following table 4 as a guideline according to potential vibration and the impact of the machine in which the linear guide is used, and select the load factor.

$$L = 100 \times \left(\frac{C}{fw \cdot F} \right)^{\frac{10}{3}} \text{(km)}$$

Table 4 Load factor fw

Impact and/or vibration	Load factor
No impact and vibration from the outside	1.0 – 1.5
With impact and/or vibration from the outside	1.5 – 2.0
With heavy impact and/or vibration from the outside	2.0 – 3.0

Load applied to the linear guide (ball slide load) comes from various directions up/down and right/left directions and/or as moment load. Sometimes more than one type of load is applied simultaneously. Sometimes volume and direction of the load may change.
Varying load cannot be used as it is to calculate life of linear guide. Therefore, it is necessary to use a hypothetical load to ball slide with a constant volume, which would generate a value equivalent to an actual fatigue life. This is called “dynamic equivalent load.” For actual calculation, use the loads of Table 5.

Fig. 7 Direction of load

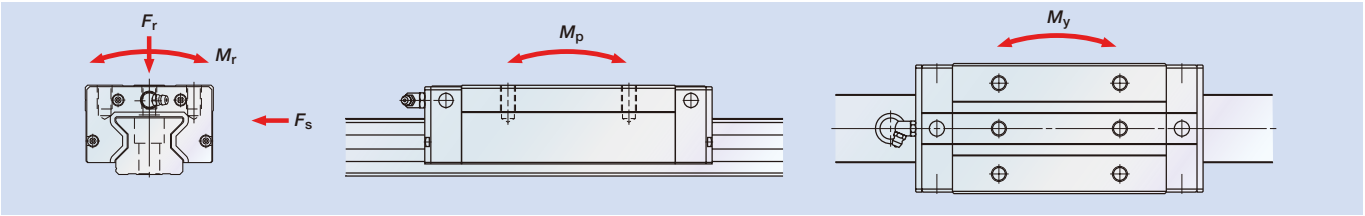


Table 5 Loads in the arrangement of linear guide

Pattern	Arrangement of linear guide	Loads necessary to calcurate dynamic equivalent load					Dynamic equivalent load
		Load		Moment load			
		Up/down (vertical)	Right/left (lateral)	Rolling	Pitching	Yawing	
1		F_r	F_s	M_r	M_p	M_y	$F_r = F_r$ $F_{se} = F_s \tan\alpha$ $F_{re} = \varepsilon_r M_r$ $F_{pe} = \varepsilon_p M_p$ $F_{ye} = \varepsilon_y M_y$ α: Contact angle (=45°) Dynamic equivalent coefficient ε_r: Rolling direction ε_p: Pitching direction ε_y: Yawing direction
2		F_r	F_s	M_r			
3		F_r	F_s		M_p	M_y	
4		F_r	F_s				

Table 6 Dynamic equivalent coefficient

Model No.	Dynamic equivalent coefficient (1/m)		
	ε_r	ε_p	ε_y
RA15 High load type	105	95	95
RA15 Super-high load type	105	70	70
RA20 High load type	79	74	74
RA20 Super-high load type	79	55	55
RA25 High load type	71	64	64
RA25 Super-high load type	71	50	50
RA30 High load type	56	58	58
RA30 Super-high load type	56	44	44
RA35 High load type	46	53	53
RA35 Super-high load type	46	39	39
RA45 High load type	37	40	40
RA45 Super-high load type	37	30	30
RA55 High load type	33	34	34
RA55 Super-high load type	33	24	24
RA65 High load type	26	28	28
RA65 Super-high load type	26	19	19

Formula is determined by the relationship of loads in terms of volume. Full dynamic equivalent load can be easily obtained by using each coefficient.
After obtaining the dynamic equivalent of the necessary load directions from Table 6, use the formulas below to calculate full dynamic equivalent loads.

- When F_r is the largest load: $F_e = F_r + 0.5F_{se} + 0.5F_{re} + 0.5F_{pe} + 0.5F_{ye}$
- When F_{se} is the largest load: $F_e = 0.5F_r + F_{se} + 0.5F_{re} + 0.5F_{pe} + 0.5F_{ye}$
- When F_{re} is the largest load: $F_e = 0.5F_r + 0.5F_{se} + F_{re} + 0.5F_{pe} + 0.5F_{ye}$
- When F_{pe} is the largest load: $F_e = 0.5F_r + 0.5F_{se} + 0.5F_{re} + F_{pe} + 0.5F_{ye}$
- When F_{ye} is the largest load: $F_e = 0.5F_r + 0.5F_{se} + 0.5F_{re} + 0.5F_{pe} + F_{ye}$

For the values of each dynamic equivalent load in the formulas above, disregard load directions and take the absolute value.

5. Lubrication Specifications

(1) Mounting position of lubrication accessories

- The standard position of grease fittings and tube fittings is the end face of the roller slide. (Fig. 8) A lubrication hole can be provided on the side or the top face of the end cap or roller slide. Mounting positions are shown in the Figs. 8 and 9, and Tables 7.1 and 7.2.
- For mounting on top of the face of end cap, an O ring is required. For the model AN and BN, two O rings as well as spacers are required.
- When using a piping unit with a thread of M6 × 1, a connector is required to connect the piping unit to a grease fitting mounting hole with M6 × 7.5. Connectors are available from NSK.

(2) Cautions for oil lubrication

- If oil lubrication is used, the oil may not pervade the rolling surface in accordance with the roller slide mounting conditions such as upside down mounting and wall mounting. In these situations, consult with NSK.
- When using an oil mist lubricating system, please confirm how much oil is needed for each outlet port.

Fig. 8 Mounting position of lubrication accessories

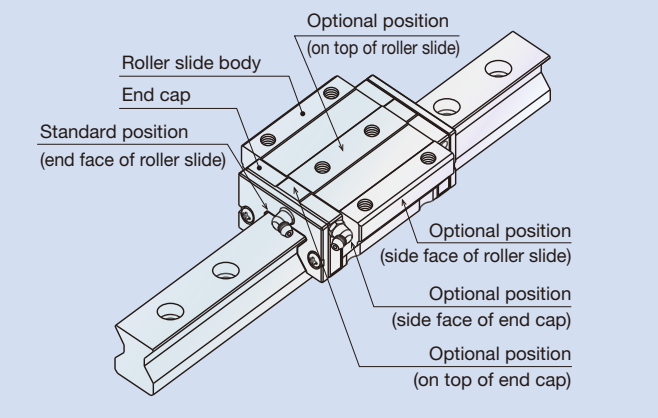


Fig. 9 Top and side lubrication hole positions

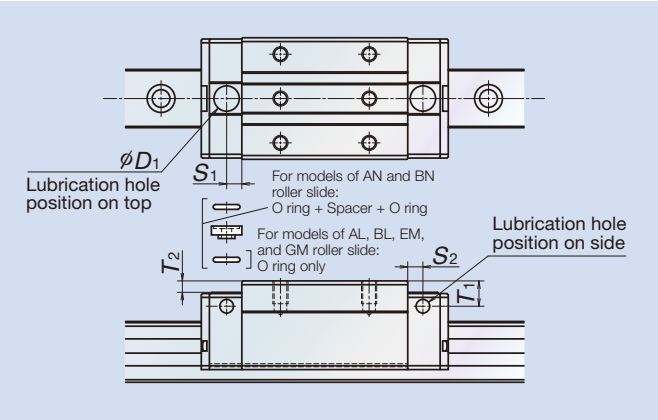


Table 7.1 Lubrication hole positions

Unit: mm

Model No.	Roller slide shape code	Grease nipple size	s_2	T_1	Spacer	D_1	s_1	T_2
RA15	AN, BN	ϕ3	4	7	Necessory	8.2	4.4	4.2
RA20		ϕ3	4	4	–	9.2	5.4	0.2
RA25		M6×0.75	6	10	Necessory	10.2	6	4.5
RA30		M6×0.75	5	10	Necessory	10.2	6	3.5
RA35		M6×0.75	5.5	15	Necessory	10.2	7	7.4
RA45		Rc 1/8	7.2	20	Necessory	10.2	7.2	10.4
RA55		Rc 1/8	7.2	21	Necessory	10.2	7.2	10.4
RA65		Rc 1/8	7.2	19	–	10.2	7.2	0.4

Table 7.2 Lubrication hole positions

Unit: mm

Model No.	Roller slide shape code	Grease nipple size	s_2	T_1	D_1	s_1	T_2
RA15	AL, BL, EM, GM	ϕ3	4	3	8.2	4.4	0.2
RA20	EM, GM	ϕ3	4	4	9.2	5.4	0.2
RA25	AL, BL, EM, GM	M6×0.75	6	6	10.2	6	0.4
RA30		M6×0.75	5	7	10.2	6	0.4
RA35		M6×0.75	5.5	8	10.2	7	0.4
RA45		Rc 1/8	7.2	10	10.2	7.2	0.4
RA55		Rc 1/8	7.2	11	10.2	7.2	0.4
RA65	EM, GM	Rc 1/8	7.2	19	10.2	7.2	0.4

Fig. 10 Grease fitting and Tube fitting

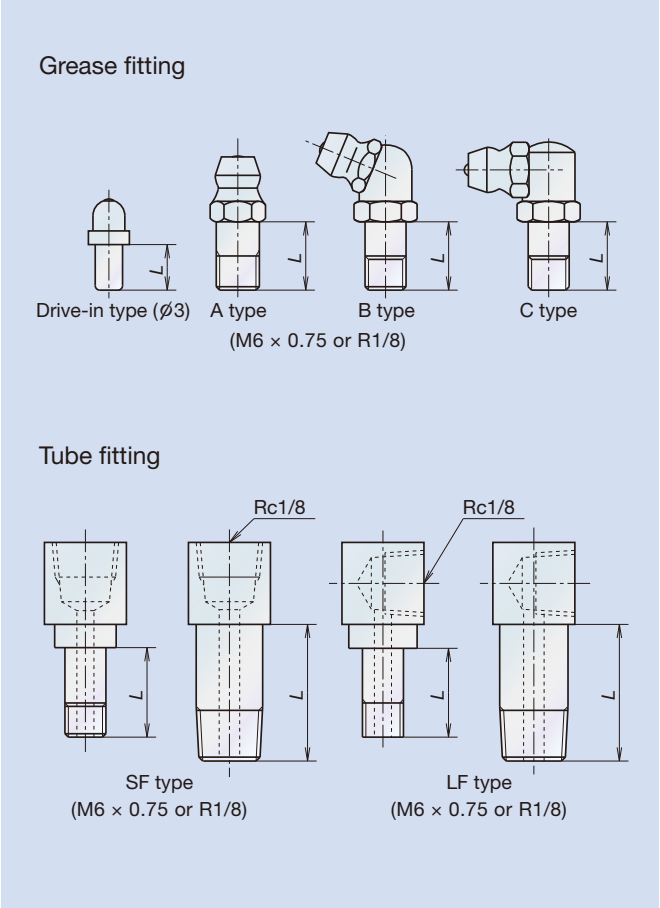


Table 8

Unit: mm

Model No.	Dust-proof specification	Grease fitting Drive-in type	Tube fitting
		Thread body length L	Thread body length L
RA15	Standard	5	–
	With NSK K1	10	–
	Double seal	8	–
	Protector	8	–
RA20	Standard	5	–
	With NSK K1	10	–
	Double seal	8	–
	Protector	8	–
RA25	Standard	5	5
	With NSK K1	12	12
	Double seal	10	9
	Protector	10	9
RA30	Standard	5	6
	With NSK K1	14	15
	Double seal	12	11
	Protector	12	11
RA35	Standard	5	6
	With NSK K1	14	15
	Double seal	12	11
	Protector	12	11
RA45	Standard	8	17
	With NSK K1	18	21.5
	Double seal	14	17
	Protector	14	17
RA55	Standard	8	17
	With NSK K1	18	21.5
	Double seal	14	17
	Protector	14	17
RA65	Standard	8	17
	With NSK K1	20	20
	Double seal	14	17
	Protector	14	17

6. Dust-proof

RA series is equipped with end, inner* and bottom seals to prevent foreign matter from entering the inside of the roller slide. Under normal applications, the RA series can be used without modification.
For severe usage conditions, optional rail covers are available. Contact NSK for information on how to mount the cover. The linear guide can also be equipped with a lubrication unit NSK K1 that has already proven its effectiveness with other NSK Linear Guide.

Fig. 11 Rail cover

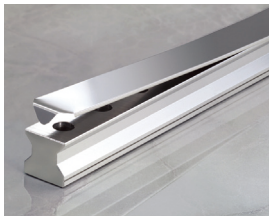
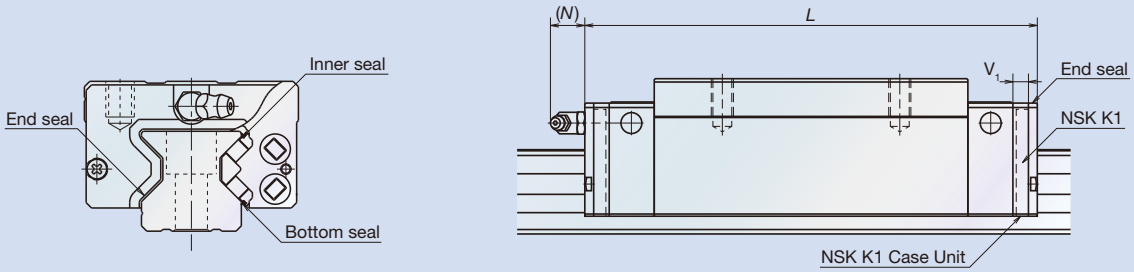


Table 9 Optional parts for dust-proofing

Name	Objective
NSK K1	Porous part containing oil enhances lubrication function.
Double seal	Sealing effect is enhanced by using pairs of side seals.
Protector	Removes large dust particles and protects side seals from hot and hard dust particles.
Rail cover**	Covers top of rail to prevent foreign matter from getting in the rail mounting holes.
Bolt hole cap	Prevents foreign matter such as cutting dust from collecting in the rail mounting holes.

* Inner seals for RA15 and RA20 are available as options. ** Rail cover is applicable to RA25 to RA65.

Fig. 12 View of the roller slide equipped with the dust-proof parts



Installed with NSK K1

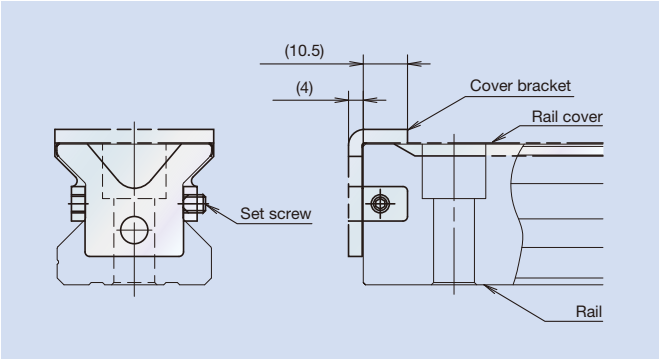
Table 10 Dimensions of roller slide assembly equipped with the optional parts

Unit: mm

Model No.	Roller slide shape code	Roller slide length			
		Standard roller slide length	Roller slide length installed with NSK K1	Length of NSK K1 Case Unit V_1	Protruding area of the grease fitting N
RA15	AN, AL, EM	70	79	4.5	(3)
	BN, BL, GM	85.4	94.4		
RA20	AN, EM	86.5	95.5	4.5	(3)
	BN, GM	106.3	115.3		
RA25	AN, AL, EM	97.5	107.5	5	(11)
	BN, BL, GM	115.5	125.5		
RA30	AN, AL, EM	110.8	122.8	6	(11)
	BN, BL, GM	135.4	147.4		
RA35	AN, AL, EM	123.8	136.8	6.5	(11)
	BN, BL, GM	152	165		
RA45	AN, AL, EM	154	168	7	(14)
	BN, BL, GM	190	204		
RA55	AN, AL, EM	184	198	7	(14)
	BN, BL, GM	234	248		
RA65	AN, EM	228.4	243.4	7.5	(14)
	BN, GM	302.5	317.5		

Above dimensions are for the assembly length of a roller slide equipped with one of the optional dust-proof parts on each end. Please consult with NSK for the dimensions when more than one kind of optional parts are used.

Fig. 13 End configuration of rail equipped with the rail cover



When the rail cover is used, use the cover bracket to secure the rail cover. Fig. 13 shows the dimensions for the cover bracket. The required room at the end of the rail is:

- Inside: 10.5 mm or less
- Outside: 4 mm or less
  (Common to the models of RA25 to RA65)

Please confirm the interference with your machine at the stroke end.

- Machine stroke
- Room for the end of the rail

Table 11 Height of rails equipped with rail cover Unit: mm

Model No.	Standard rail height H_1	Rail height installed with rail cover
RA25	24	24.25
RA30	28	28.25
RA35	31	31.25
RA45	38	38.3
RA55	43.5	43.8
RA65	55	55.3

The height of the rail with the rail cover is shown in Table 11.

Table 12 Cap to plug rail mounting bolt hole

Model No.	Bolt to secure rail	Cap reference No.	Quantity/case
RA15	M4	LG-CAP/M4	20/case
RA20	M5	LG-CAP/M5	20/case
RA25	M6	LG-CAP/M6	20/case
RA30, RA35	M8	LG-CAP/M8	20/case
RA45	M12	LG-CAP/M12	20/case
RA55	M14	LG-CAP/M14	20/case
RA65	M16	LG-CAP/M16	20/case

Bolt size for rail mounting and cap reference number are shown in Table 12.

7. Installation

(1) Mounting tolerance

Mounting tolerance results in harmful effects such as shortened operating life, deterioration in motion accuracy, and friction variation.
NSK particularly focuses on operating life, and sets an operating life value of more than 10 000 km calculated under the following conditions as mounting tolerance:

- The load per roller slide is 10% of basic dynamic load rating *C*.
- The rigidity of machine is infinite.

The tolerance in Fig. 14 is shown in the Table 13 as typical tolerance.

Fig. 14 Mounting tolerance

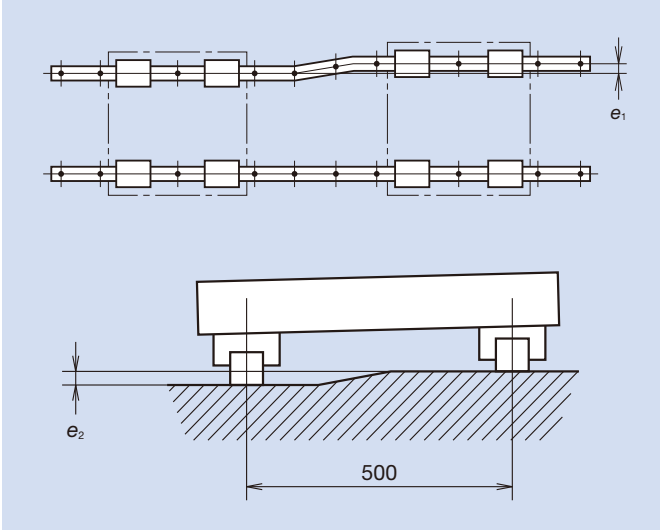


Table 13 Mounting tolerance of RA series

Unit: μm

Model No.	Parallelism tolerance of two roller guides e_1		Height tolerance of two roller guides e_2	
	Z1	Z3, ZZ	Z1	Z3, ZZ
RA15	–	5	–	150 μm / 500 mm
RA20	–	7		
RA25	14	9	290 μm / 500 mm	
RA30	18	11		
RA35	21	13		
RA45	27	17		
RA55	31	19		
RA65	49	30		

(2) Shoulder height and corner radius of mounting surface

When using the shoulders, which rise perpendicularly to the mounting surface, for accurate installation of a roller guide, refer to Fig. 15 and Table 14 for the dimensions.

Fig. 15 Datum face of roller guide and shoulder

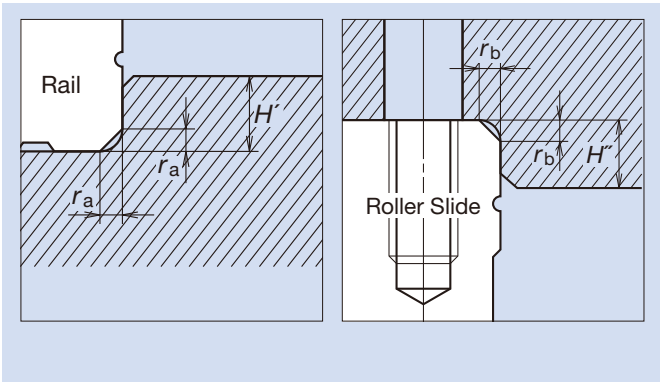


Table 14 Shoulder height and corner radius of attachment

Unit: mm

Model No.	Shoulder Height		Chamfer (maximum)	
	H'	H''	r_a	r_b
RA15	3	4	0.5	0.5
RA20	4	5	0.5	0.5
RA25	4	5	0.5	1.0
RA30	5	6	1.0	1.0
RA35	5	6	1.0	1.0
RA45	6	8	1.5	1.0
RA55	7	10	1.5	1.5
RA65	11	11	1.5	1.5

8. Maximum rail length

Table15 shows the limitations of rail length. However, the limitations vary by accuracy grades.

Table 15 Length limitation of rails

Unit: mm

Size	RA15	RA20	RA25	RA30	RA35	RA45	RA55	RA65
Length	2 000	3 000	3 000	3 500	3 500	3 500	3 500	3 500

Note: Rails can be butted if user requirement exceeds the rail length shown in the table.
Please consult NSK.

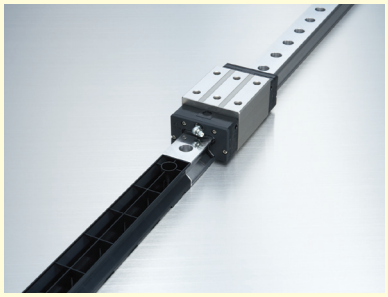
Handling Precautions

① Operating temperature limits should normally be less than 80˚C.

② If using NSK K1™, service temperature should not exceed 50˚C (or 80˚C instantaneously). Make sure the unit does not come in contact with organic solvents with that can be used for degreasing. Do not place the unit in a location exposed to white kerosene or rust prevention oil containing white kerosene.

③ When transferring the roller slide onto the rail, or vice versa:

- Do not remove an unnecessary roller slide from the rail as much as you can.
- Use the provided provisional rail to prevent dents or scratches on the raceways caused by the roller slide that is jammed into the one from the other. It also prevents the rollers from dropping.
- When transferring the roller slide onto the rail, or vice versa, butt the provisional rail up against the rail and slide it directly from one onto the other.
- Use a clean provisional rail. Do not use the provisional rail that is contaminated with particles or uses different grease from that of the relevant roller slide.



RA Series dimension table

Square type (tapped mounting holes)
RA–AN (High-load type/standard), RA–BN (Super-high-load type/long)

Assembly

Example of specification number: **RA 35 1000 AN C 2 - ** P6 Z**

- RA: Series code
- 35: Size No.
- 1000: Rail length (mm)
- AN: Roller slide shape code AN, BN
- C: Material and surface treatment code, C: Special high carbon steel (NSK standard)
- 2: Number of roller slides per rail
- **: Design serial number
- P6: Accuracy grade*1 (Without NSK K1): P3, P4, P5, P6 (With NSK K1): K3, K4, K5, K6
- Z: Preload code 1: Z1 Slight preload, 3: Z3 Medium preload, Z: Random matching with preload

*1 Only P6 and K6 grades are available for the random-matching type.

Random-matching rail

Example of specification number: **R1A 35 1000 L C N - ** P6 Z**

- R1A: RA Series random-matching rail code
- 35: Size No.
- 1000: Rail length (mm)
- L: Rail shape code L: Standard
- C: Material and surface treatment code, C: Special high carbon steel (NSK standard)
- N: Butting specification N: Non-butting specification L: Butting specification
- **: Design serial number
- P6: Accuracy grade P6: Precision
- Z: Preload code Z: Random matching with preload

Random-matching roller slide

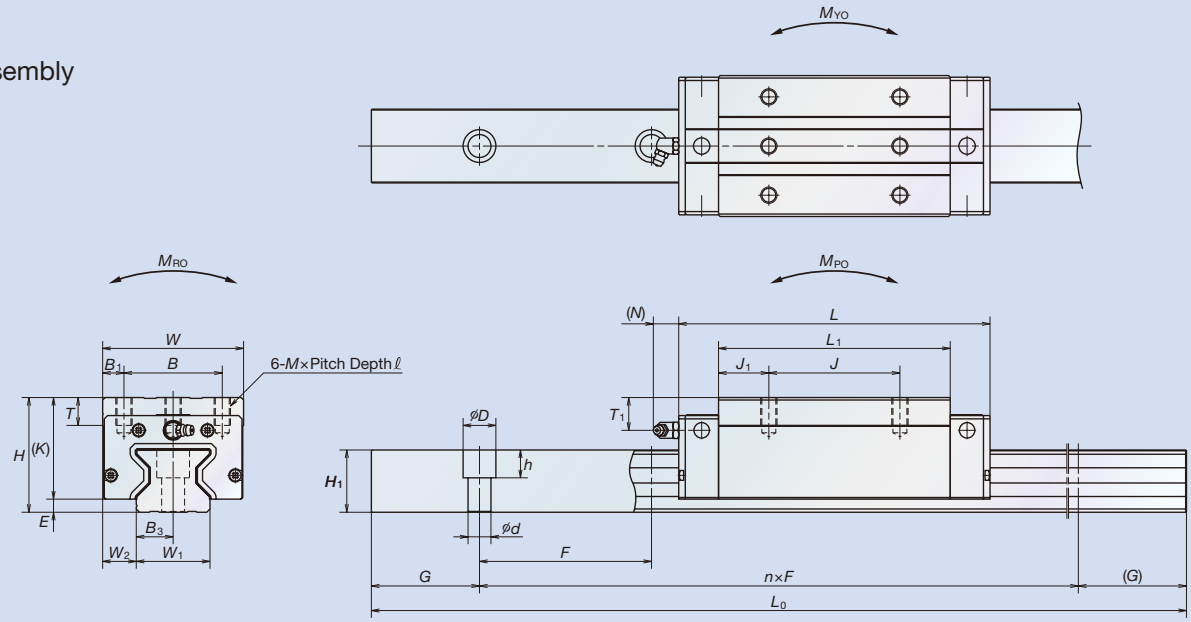
Example of specification number: **RAA 35 AN P6 Z - F**

- RAA: RA Series random-matching roller slide code
- 35: Size No.
- AN: Roller slide shape code AN, BN
- P6: Accuracy grade P6: Precision
- Z: Z: Random matching with preload
- F: Option code No code: No surface treatment, F: Fluoride low temperature chrome plating, C: No surface treatment + rail cover, CF: Fluoride low temperature chrome plating + rail cover

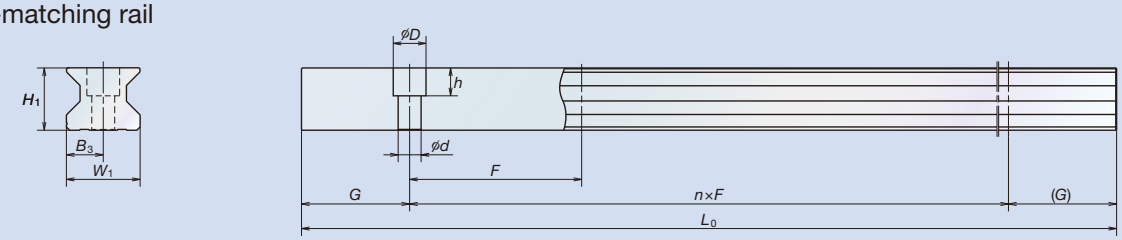
Model No.	Assembly			Roller slide												
	Height			Width	Length	Mounting hole								Grease fitting		
	H	E	W_2	W	L	B	J	M ×Pitch× ℓ	B_1	L_1	J_1	K	T	Mounting hole	T_1	N
RA15AN RA15BN	28	4	9.5	34	70 85.4	26	26	$M4\times0.7\times6$	4	44.8 60.2	9.4 17.1	24	8	$\phi3$	8	3
RA20AN RA20BN	30	5	12	44	86.5 106.3	32	36 50	$M5\times0.8\times6$	6	57.5 77.3	10.75 13.65	25	12	$\phi3$	4	3
RA25AN RA25BN	40	5	12.5	48	97.5 115.5	35	35 50	$M6\times1\times9$	6.5	65.5 83.5	15.25 16.75	35	12	$M6\times0.75$	10	11
RA30AN RA30BN	45	6.5	16	60	110.8 135.4	40	40 60	$M8\times1.25\times11$	10	74 98.6	17 19.3	38.5	14	$M6\times0.75$	10	11
RA35AN RA35BN	55	6.5	18	70	123.8 152	50	50 72	$M8\times1.25\times12$	10	83.2 111.4	16.6 19.7	48.5	15	$M6\times0.75$	15	11
RA45AN RA45BN	70	8	20.5	86	154 190	60	60 80	$M10\times1.5\times17$	13	105.4 141.4	22.7 30.7	62	17	$R_C1/8$	20	14
RA55AN RA55BN	80	9	23.5	100	184 234	75	75 95	$M12\times1.75\times18$	12.5	128 178	26.5 41.5	71	18	$R_C1/8$	21	14
RA65AN RA65BN	90	13	31.5	126	228.4 302.5	76	70 120	$M16\times2\times20$	25	155.4 229.5	42.7 54.75	77	22	$R_C1/8$	19	14

* Select either one of two F dimensions, the standard or the parenthesized semi-standard dimensions, for the pitch of rail fixing bolt holes. If not specified, the standard dimension of F is applied.
* The random-matching type is available for the model of RA25 to RA65.

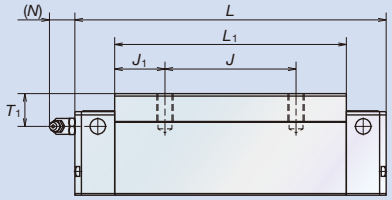
Assembly



Random-matching rail



Random-matching roller slide



Unit: mm

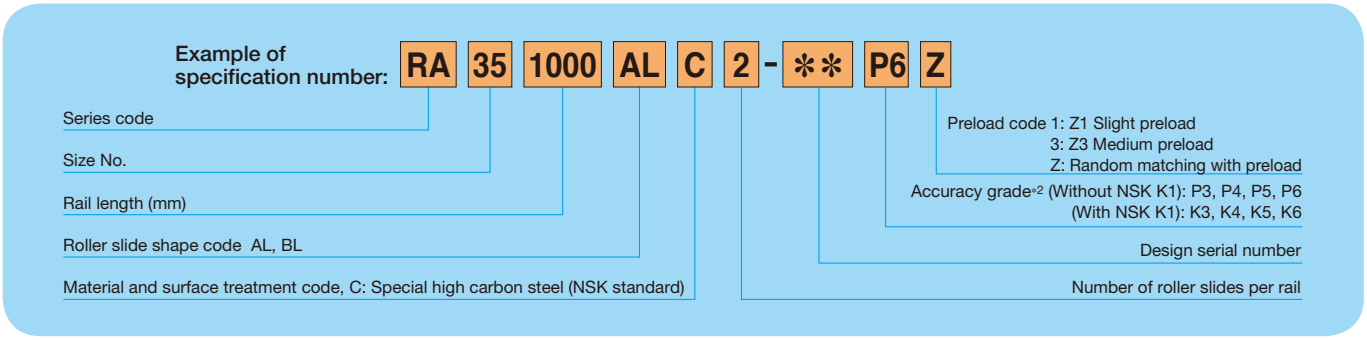
Rail							Basic load rating					Weight	
Rail width	Rail height	Bolt pitch	Bolt hole		G	Maximum length	Dynamic	Static	Static moment (N·m)			Roller slide	Rail
W_1	H_1	F	$d \times D \times h$	B_3	(recommended)	L_{0max}	C (N)	C_0 (N)	M_{R0}	M_{P0}	M_{Y0}	(kg)	(kg/m)
15	16.3	60 (30)	4.5×7.5×5.3	7.5	20	2 000	10 300 13 000	27 500 37 000	260 350	210 375	210 375	0.21 0.30	1.6
20	20.8	60 (30)	6×9.5×8.5	10	20	3 000	19 200 24 000	52 500 70 000	665 890	505 900	505 900	0.38 0.50	2.6
23	24	30	7×11×9	11.5	20	3 000	29 200 35 400	72 700 92 900	970 1 240	760 1 240	760 1 240	0.60 0.91	3.4
28	28	40	9×14×12	14	20	3 500	38 900 47 600	93 500 121 000	1 670 2 170	1 140 1 950	1 140 1 950	1.0 1.3	4.9
34	31	40	9×14×12	17	20	3 500	53 300 67 400	129 000 175 000	2 810 3 810	1 800 3 250	1 800 3 250	1.6 2.1	6.8
45	38	52.5	14×20×17	22.5	22.5	3 500	92 800 116 000	229 000 305 000	6 180 8 240	4 080 7 150	4 080 7 150	3.0 4.1	10.9
53	43.5	60	16×23×20	26.5	30	3 500	129 000 168 000	330 000 462 000	10 200 14 300	7 060 13 600	7 060 13 600	4.9 6.7	14.6
63	55	75	18×26×22	31.5	35	3 500	210 000 288 000	504 000 756 000	19 200 28 700	12 700 28 600	12 700 28 600	9.3 12.2	22.0

* The basic load rating complies with ISO standards (ISO14728-1, ISO14728-2).
If the above basic dynamic load rating (100 km rating) is converted into 50 km rating, use the following formula:
$C_{50\,km} = 1.23 \times C_{100\,km}$

RA Series dimension table

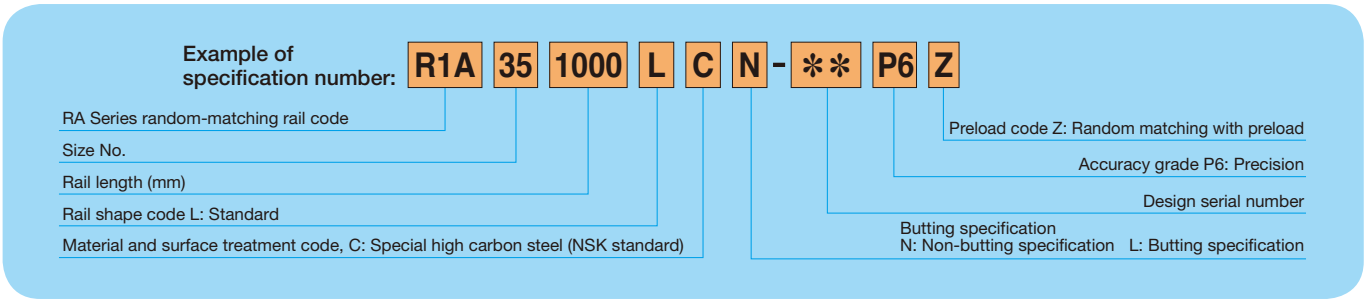
Low profile type (tapped mounting holes)
RA–AL (High-load type/standard), RA–BL (Super-high-load type/long)

Assembly

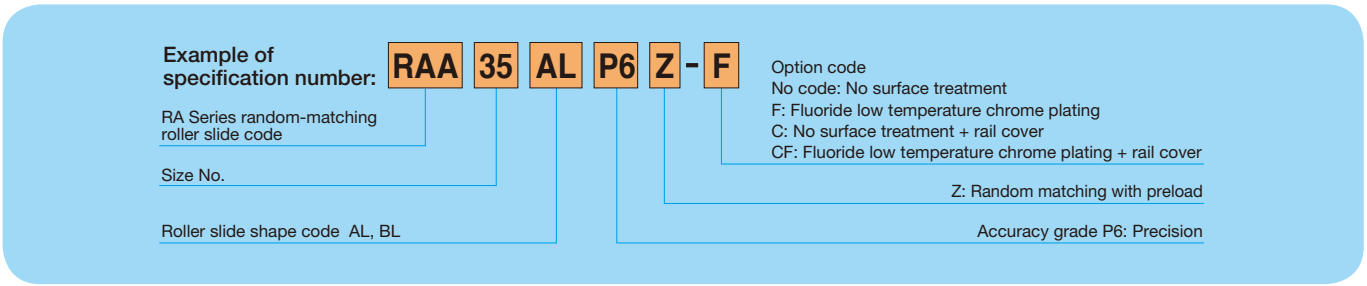


*1 Only P6 and K6 grades are available for the random-matching type.

Random-matching rail



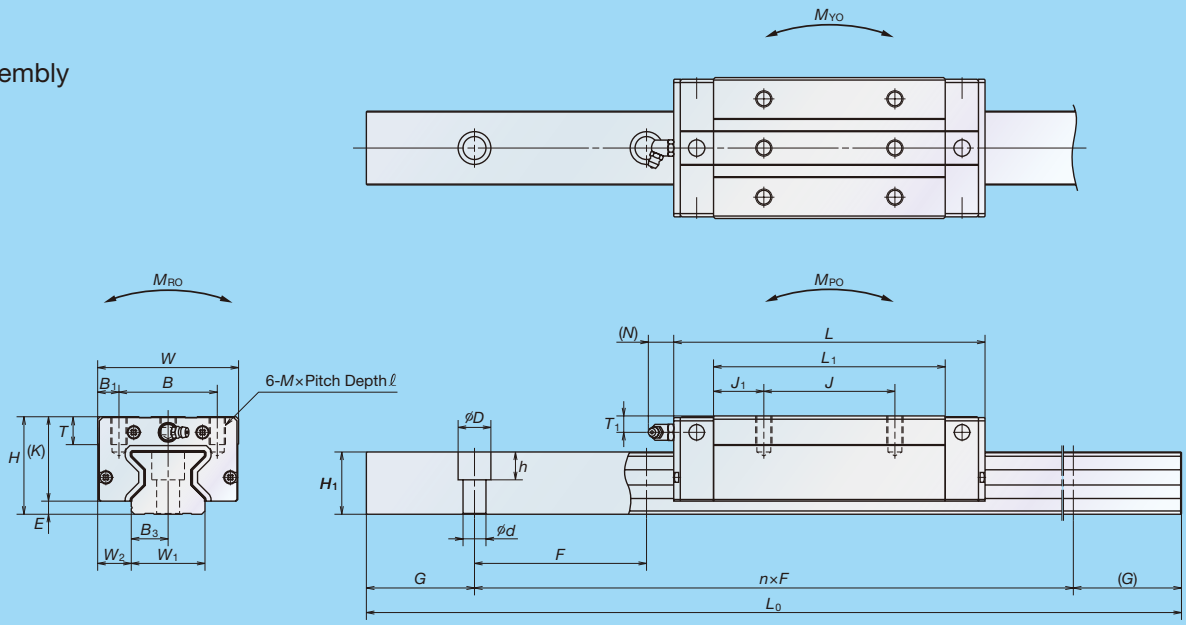
Random-matching roller slide



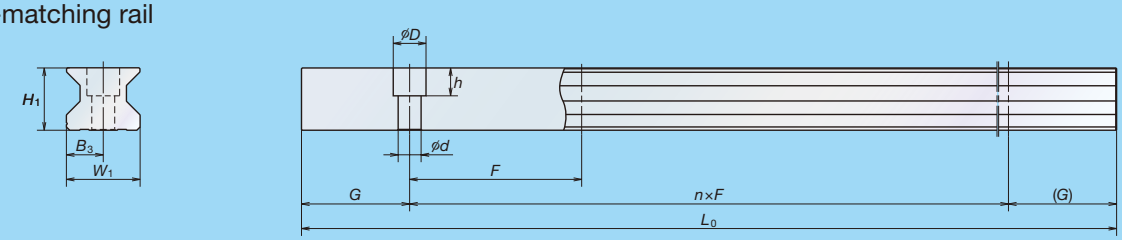
Model No.	Assembly			Roller slide												
	Height			Width	Length	Mounting hole								Grease fitting		
	H	*E*	W_2	*W*	*L*	*B*	*J*	*M* ×Pitch× *ℓ*	B_1	L_1	J_1	*K*	*T*	Mounting hole	T_1	*N*
RA15AL **RA15BL**	24	4	9.5	34	70 85.4	26	26	*M*4×0.7×5.5	4	44.8 60.2	9.4 17.1	20	8	ϕ3	4	3
RA25AL **RA25BL**	36	5	12.5	48	97.5 115.5	35	35 50	*M*6×1×8	6.5	65.5 83.5	15.25 16.75	31	12	*M*6×0.75	6	11
RA30AL **RA30BL**	42	6.5	16	60	110.8 135.4	40	40 60	*M*8×1.25×11	10	74 98.6	17 19.3	35.5	14	*M*6×0.75	7	11
RA35AL **RA35BL**	48	6.5	18	70	123.8 152	50	50 72	*M*8×1.25×12	10	83.2 111.4	16.6 19.7	41.5	15	*M*6×0.75	8	11
RA45AL **RA45BL**	60	8	20.5	86	154 190	60	60 80	*M*10×1.5×16	13	105.4 141.4	22.7 30.7	52	17	R_C1/8	10	14
RA55AL **RA55BL**	70	9	23.5	100	184 234	75	75 95	*M*12×1.75×18	12.5	128 178	26.5 41.5	61	18	R_C1/8	11	14

* Select either one of two F dimensions, the standard or the parenthesized semi-standard dimensions, for the pitch of rail fixing bolt holes.
If not specified, the standard dimension of F is applied.
* The random-matching type is available for the model of RA25 to RA65.

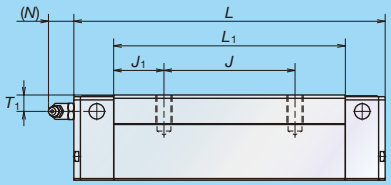
Assembly



Random-matching rail



Random-matching roller slide



Unit: mm

Rail							Basic load rating					Weight	
Rail width	Rail height	Bolt pitch	Bolt hole		G	Maximum length	Dynamic	Static	Static moment (N·m)			Roller slide	Rail
W_1	H_1	F	$d \times D \times h$	B_3	(recommended)	L_{0max}	C (N)	C_0 (N)	M_{R0}	M_{P0}	M_{Y0}	(kg)	(kg/m)
15	16.3	60 (30)	4.5×7.5×5.3	7.5	20	2 000	10 300 13 000	27 500 37 000	260 350	210 375	210 375	0.17 0.25	1.6
23	24	30	7×11×9	11.5	20	3 000	29 200 35 400	72 700 92 900	970 1 240	760 1 240	760 1 240	0.45 0.80	3.4
28	28	40	9×14×12	14	20	3 500	38 900 47 600	93 500 121 000	1 670 2 170	1 140 1 950	1 140 1 950	0.85 1.1	4.9
34	31	40	9×14×12	17	20	3 500	53 300 67 400	129 000 175 000	2 810 3 810	1 800 3 250	1 800 3 250	1.2 1.7	6.8
45	38	52.5	14×20×17	22.5	22.5	3 500	92 800 116 000	229 000 305 000	6 180 8 240	4 080 7 150	4 080 7 150	2.5 3.4	10.9
53	43.5	60	16×23×20	26.5	30	3 500	129 000 168 000	330 000 462 000	10 200 14 300	7 060 13 600	7 060 13 600	4.1 5.7	14.6

* The basic load rating complies with ISO standards (ISO14728-1, ISO14728-2).
If the above basic dynamic load rating (100 km rating) is converted into 50 km rating, use the following formula:
$C_{50\,km} = 1.23 \times C_{100\,km}$

RA Series dimension table

Flange type (for both tapped and bolt mounting holes)
RA–EM (High-load type/standard), RA–GM (Super-high-load type/long)

Assembly

Example of specification number: RA 35 1000 EM C 2 - ** P6 Z

- Series code
- Size No.
- Rail length (mm)
- Roller slide shape code EM, GM
- Material and surface treatment code, C: Special high carbon steel (NSK standard)
- Number of roller slides per rail
- Design serial number
- Accuracy grade*2 (Without NSK K1): P3, P4, P5, P6 (With NSK K1): K3, K4, K5, K6
- Preload code 1: Z1 Slight preload, 3: Z3 Medium preload, Z: Random matching with preload

*1 Only P6 and K6 grades are available for the random-matching type.

Random-matching rail

Example of specification number: R1A 35 1000 L C N - ** P6 Z

- RA Series random-matching rail code
- Size No.
- Rail length (mm)
- Rail shape code L: Standard
- Material and surface treatment code, C: Special high carbon steel (NSK standard)
- Butting specification N: Non-butting specification L: Butting specification
- Design serial number
- Accuracy grade P6: Precision
- Preload code Z: Random matching with preload

Random-matching roller slide

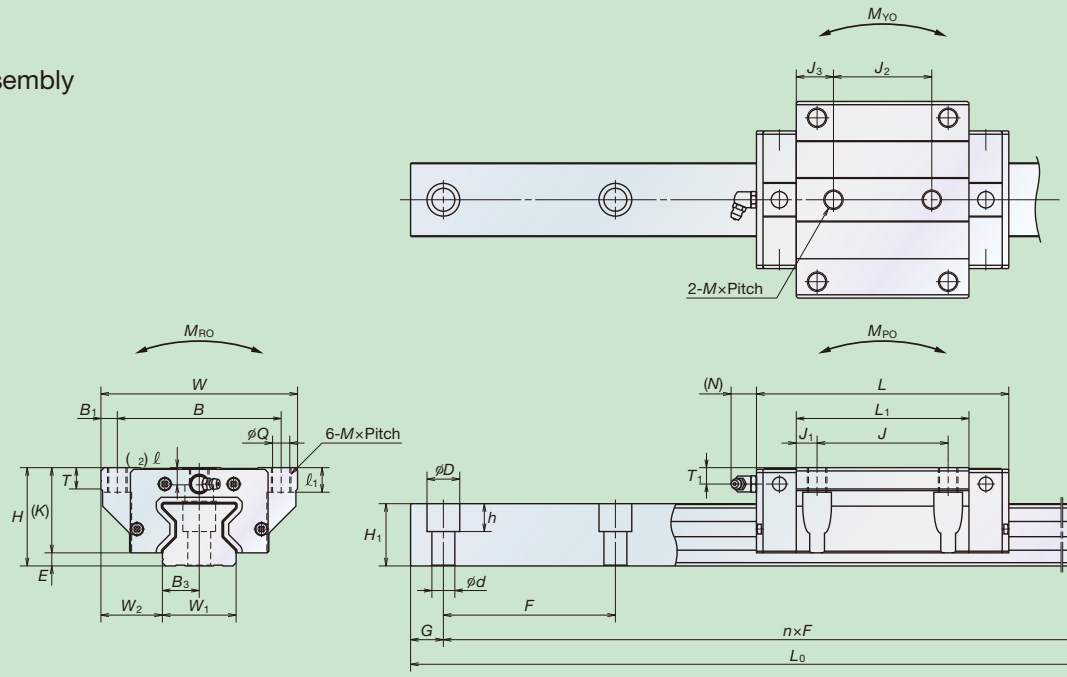
Example of specification number: RAA 35 EM P6 Z - F

- RA Series random-matching roller slide code
- Size No.
- Roller slide shape code EM, GM
- Accuracy grade P6: Precision
- Z: Random matching with preload
- Option code: No code: No surface treatment; F: Fluoride low temperature chrome plating; C: No surface treatment + rail cover; CF: Fluoride low temperature chrome plating + rail cover

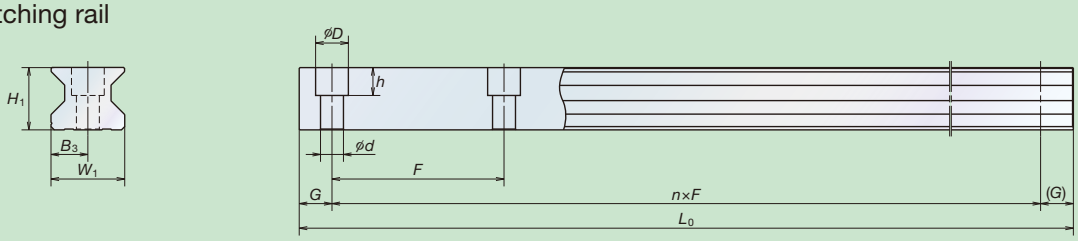
Model No.	Assembly			Roller slide													
	Height			Width	Length	Mounting hole											
	H	*E*	W_2	*W*	*L*	*B*	*J*	J_2	*M*×Pitch×ℓ_1(ℓ_2)	*Q*×ℓ_1(ℓ_2)	B_1	L_1	J_1	J_3	*K*	*T*	
RA15EM **RA15GM**	24	4	16	47	70 85.4	38	30	26	*M*5×0.8×8.5 (6.5)	4.4×8.5 (6.5)	4.5	44.8 60.2	7.4 15.1	9.4 17.1	20	8	
RA20EM **RA20GM**	30	5	21.5	63	86.5 106.3	53	40	35	*M*6×1×9.5 (8)	5.3×9.5 (8)	5	57.5 77.3	8.75 18.65	11.25 21.15	25	10	
RA25EM **RA25GM**	36	5	23.5	70	97.5 115.5	57	45	40	*M*8×1.25×10 (11)	6.8×10 (11)	6.5	65.5 83.5	10.25 19.25	12.75 21.75	31	11	
RA30EM **RA30GM**	42	6.5	31	90	110.8 135.4	72	52	44	*M*10×1.5×12 (12.5)	8.6×12 (12.5)	9	74 98.6	11 23.3	15 27.3	35.5	11	
RA35EM **RA35GM**	48	6.5	33	100	123.8 152	82	62	52	*M*10×1.5×13 (7)	8.6×13 (7)	9	83.2 111.4	10.6 24.7	15.6 29.7	41.5	12	
RA45EM **RA45GM**	60	8	37.5	120	154 190	100	80	60	*M*12×1.75×15 (10.5)	10.5×15 (10.5)	10	105.4 141.4	12.7 30.7	22.7 40.7	52	13	
RA55EM **RA55GM**	70	9	43.5	140	184 234	116	95	70	*M*14×2×18 (13)	12.5×18 (13)	12	128 178	16.5 41.5	29 54	61	15	
RA65EM **RA65GM**	90	13	53.5	170	228.4 302.5	142	110	82	*M*16×2×24 (18.5)	14.6×24 (18.5)	14	155.4 229.5	22.7 59.75	36.7 73.75	77	22	

* Select either one of two F dimensions, the standard or the parenthesized semi-standard dimensions, for the pitch of rail fixing bolt holes. If not specified, the standard dimension of F is applied.
* The random-matching type is available for the model of RA25 to RA65.

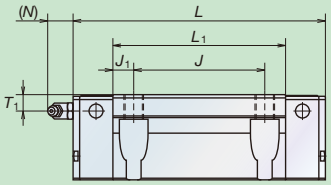
Assembly



Random-matching rail



Random-matching roller slide



Unit: mm

Grease fitting			Rail width	Rail height	Bolt pitch	Bolt hole		G	Maximum length	Basic load rating					Weight	
			Rail							Dynamic	Static	Static moment (N·m)			Roller slide	Rail
Mounting hole	T_1	N	W_1	H_1	F	d×D×h	B_3	(recommended)	L_{0max}	C (N)	C_0 (N)	M_{R0}	M_{P0}	M_{Y0}	(kg)	(kg/m)
ϕ3	4	3	15	16.3	60 (30)	4.5×7.5×5.3	7.5	20	2 000	10 300 13 000	27 500 37 000	260 350	210 375	210 375	0.21 0.28	1.6
ϕ3	4	3	20	20.8	60 (30)	6×9.5×8.5	10	20	3 000	19 200 24 000	52 500 70 000	665 890	505 900	505 900	0.45 0.65	2.6
M6×0.75	6	11	23	24	30	7×11×9	11.5	20	3 000	29 200 35 400	72 700 92 900	970 1 240	760 1 240	760 1 240	0.80 1.1	3.4
M6×0.75	7	11	28	28	40	9×14×12	14	20	3 500	38 900 47 600	93 500 121 000	1 670 2 170	1 140 1 950	1 140 1 950	1.3 1.7	4.9
M6×0.75	8	11	34	31	40	9×14×12	17	20	3 500	53 300 67 400	129 000 175 000	2 810 3 810	1 800 3 250	1 800 3 250	1.7 2.3	6.8
R_C1/8	10	14	45	38	52.5	14×20×17	22.5	22.5	3 500	92 800 116 000	229 000 305 000	6 180 8 240	4 080 7 150	4 080 7 150	3.2 4.3	10.9
R_C1/8	11	14	53	43.5	60	16×23×20	26.5	30	3 500	129 000 168 000	330 000 462 000	10 200 14 300	7 060 13 600	7 060 13 600	5.4 7.5	14.6
R_C1/8	19	14	63	55	75	18×26×22	31.5	35	3 500	210 000 288 000	504 000 756 000	19 200 28 700	12 700 28 600	12 700 28 600	12.2 16.5	22.0

* The basic load rating complies with ISO standards (ISO14728-1, ISO14728-2).
If the above basic dynamic load rating (100 km rating) is converted into 50 km rating, use the following formula:
$C_{50\,km} = 1.23 \times C_{100\,km}$

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