B.I.G. VISION® FOR ALL

TIPS & TECHNOLOGY LENSES

RODENSTOCK

CONTENT

CONTENT

1 LENS TECHNOLOGIES BY RODENSTOCK

B.I.G. VISION® FOR ALL

B.I.G. – this stands for Biometric Intelligent Glasses by Rodenstock.
With the aid of DNEye® technology or AI technology, lenses are created which allow significantly sharper vision than is possible with standard eye measurements and calculations as these lenses are calculated on the basis of a universal biometric eye model.

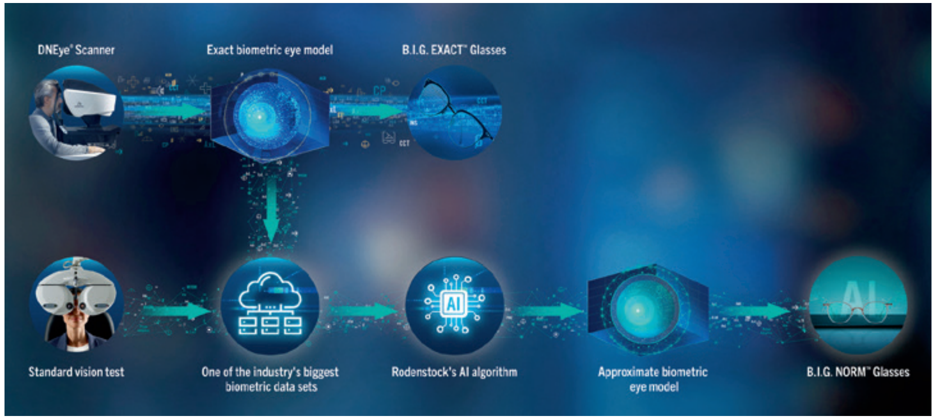


Figure 1-1: B.I.G. VISION® FOR ALL

1.1 DNEYE® TECHNOLOGY

Traditionally, a reduced standard eye model is used in ophthalmic optics, on whose basis lenses are calculated. The most well-known model is Gullstrand's eye from 1900.

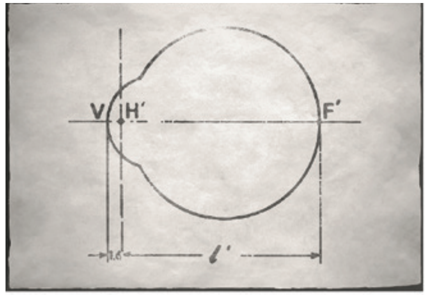


Figure 1-2: Gullstrand's eye model

However, Gullstrand's eye is calculated using an average eye length of 24 mm. In fact, only 14% of all people have eyes with this standard length.[1, 2] This means that 86% of people are wearing spectacles whose lenses are adapted to the reduced standard eye model and not the actual length of their eyes. This also means that their spectacles only provide sharp vision when looking straight ahead, and do not work perfectly for other viewing directions. This results in a blurred effect and the wearer does not have an optimal visual experience.

Sources:
1 Görsch, H. (1996). Wörterbuch der Optometrie (Optometry Dictionary), Enke Verlag, Stuttgart: Enke Ferdinand
2 Oyster, C.W. (1999). The Human Eye. Massachusetts: Sinauer Ass.

Figure 1-3 shows the dependence of the length of the eye on the ametropia and that this may vary by up to one centimetre:

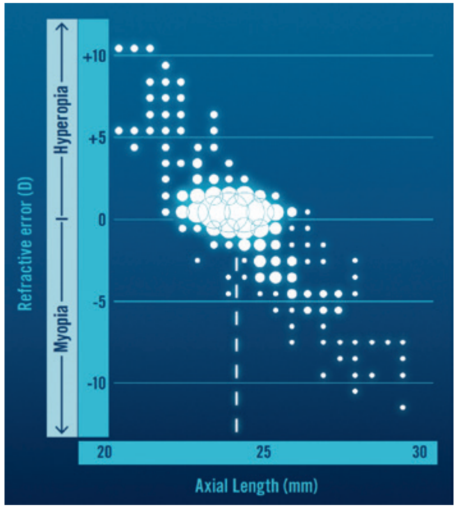


Figure 1-3: Overall length of the eye depending on the ametropia

However, the length of the eye is just one of the many parameters with which the standard eye model describes the biometry of the eye. The standard value for the spherical refractive power of the cornea only matches 27%, the astigmatic refractive power matches 16% and the anterior chamber depth matches 25% of all eyes.
This means that when all these values are combined, this standard eye model actually represents just 2% of all eyes globally.

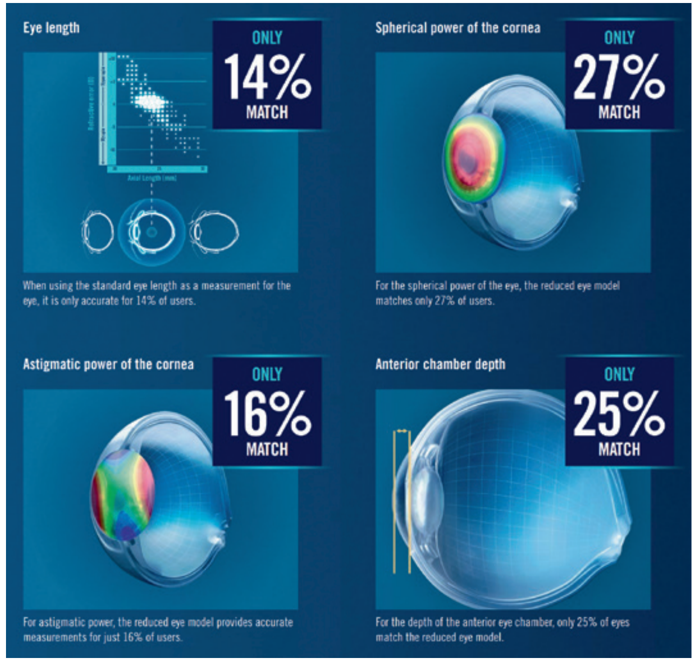


Figure 1-4: Gullstrand's eye model only matches 2% of all eyes worldwide.

Therefore, for the refraction measurement and lens calculation, it is not sufficient to be limited to the measurement of refraction data. Because lenses based on reduced eye models do not assist the entire visual system.

The DNEye® Scanner

The DNEye® Scanner enables the exact measurement of each individual eye and captures many other biometric parameters which are incorporated in the exact biometric eye model and thus in the lens calculation:

Parameter **Objective refractions far and near**	Parameter **High order aberrations far and near**
Definition of parameter	**Definition of parameter**
Measurement of sphere, cylinder and axis without patient input.	High order aberrations are more intricate refractive errors in the eye.
Reason for measurement	**Reason for measurement**
The objective refraction far measurement data serve as a comparative figure to the subjective refraction. The objective refraction near measurement adds information about cylinder and axis for near.	While glasses will not completely correct these errors, the lens can be optimised to minimise their impact on vision.
How Rodenstock's method is different	**How Rodenstock's method is different**
With the unique DNEye® Scanner's measurements, Rodenstock determines aberrations for near that are not taken into consideration by other manufacturers.	Rodenstock is the only manufacturer to use individually measured higher order abberrations for far and for near to optimise the lenses for every gaze angle and object distance.
B.I.G. EXACT™ consumer benefit	**B.I.G. EXACT™ consumer benefit**
Sharper vision at all distances and up to 40% sharper vision at intermediate and near distances.	Sharper vision at all distances and different gaze directions, better vision at dusk, sometimes less glare, halos and/or blurring.

Table 1-1: Objective refraction and high order aberrations, far and near

Parameter **Pupil size, photopic and mesopic**
Definition of parameter
The iris determines the size of the pupils according to light conditions and object distance. Pupil size varies from small in bright light to large in low light and from small at near viewing distance to large at far distance.
Reason for measurement
Pupil size can be compared with a camera aperture, which means it plays a major role in the optical system. By knowing individual pupil sizes, Rodenstock can optimise lenses accordingly.
How Rodenstock's method is different
Unique in the industry, Rodenstock measures pupils individually at near and far to optimise lenses at each and every vision point, gaze angle and object distance.
B.I.G. EXACT™ consumer benefit
Sharper vision at all distances and for different gaze directions, better vision at dusk.

Table 1-2: Pupil size

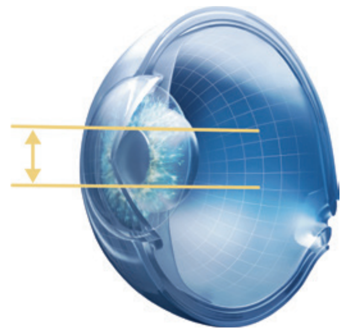


Figure 1-5: Pupil size

Parameter Corneal topography
Definition of parameter
Corneal topography is a non-invasive medical imaging technique for mapping the surface curvature of the cornea and outer structure of the eye.
Reason for measurement
Together with the individual anterior chamber depth, the individual corneal topography enables Rodenstock to determine values such as the individual eye length. We generate an individual model based on this data.
How Rodenstock's method is different
Rodenstock optimises vision based on this individual eye model, including the actual corneal topography. Others use only a reduced eye model as basis for lens calculation.
B.I.G. EXACT™ consumer benefit
People see sharply at all gaze angles and object distances. Fields of blurred vision with progressive lenses are reduced. Focus on different object distances becomes more intuitive and faster. Adaptation time is reduced.

Table 1-3: Corneal topography

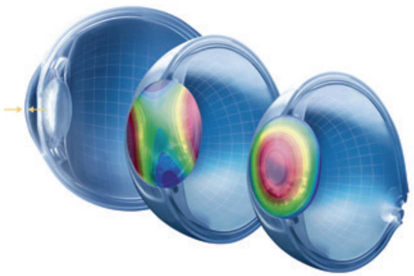


Figure 1-6: Corneal topography and corneal thickness

Parameter Anterior chamber depth
Definition of parameter
The anterior chamber is the space between the lens and the cornea's innermost surface.
Reason for measurement
Together with the individual corneal topography, the individual anterior chamber depth enables Rodenstock to determine values such as the individual eye length.
How Rodenstock's method is different
Rodenstock optimises vision based on this individual eye model, including the actual anterior chamber depth. All other manufacturers use a reduced eye model as basis for the lens calculation.
B.I.G. EXACT™ consumer benefit
People see sharply at all gaze angles and object distances. Fields of blurred vision with progressive lenses are reduced. Focus on different object distances becomes more intuitive and faster. Adaptation time is reduced.

Table 1-4: Anterior chamber depth

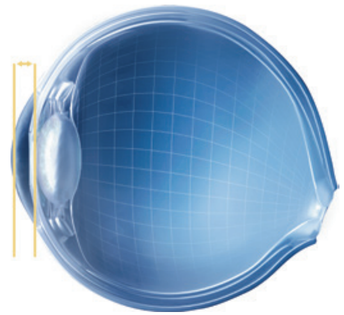


Figure 1-7: Anterior chamber depth

Parameter **Lens power, vitreous chamber depth and axial length of eye**
Definition of parameter
These eye parameters influence the refractive power and are important biometric parameters of the eye.
Reason for measurement
In addition to and based on the individually measured biometric data, the individual crystalline lens power, vitreous chamber depth and axial eye length are determined individually in order to create a complete individual biometric data set of the eye. An individual eye model is created from this data set.
How Rodenstock's method is different
Rodenstock optimises vision based on this individual eye model, including the actual crystalline lens power, vitreous chamber depth and axial eye length. All other manufacturers use a reduced eye model as basis for the lens calculation.
B.I.G. EXACT™ consumer benefit
People see sharply at all gaze angles and object distances. Fields of blurred vision with progressive lenses are reduced. Focus on different object distances becomes more intuitive and faster. Adaptation time is reduced.

Table 1-5: Lens power, vitreous chamber depth and axial length of the eye

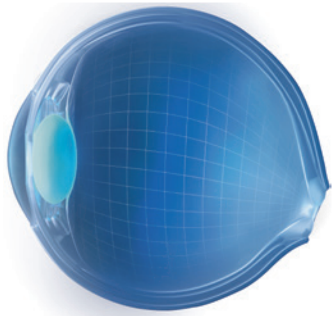


Figure 1-8: Lens power, vitreous chamber depth and axial length

All lenses for which the exact biometric eye model of the customer is integrated in the calculation are called Rodenstock B.I.G. EXACT™.

1.2 AI TECHNOLOGY

Artificial intelligence combines information technology and large data records in order to imitate intelligent human behaviour.[1] With B.I.G. NORM™, mathematical algorithms are combined with an immense biometric data pool in order to determine the biometric parameters of an individual eye, whereby the standard refraction values of the respective eye serve as an input.

The AI technology from Rodenstock is based on machine learning, a subgroup of artificial intelligence.[1] The technology was developed in cooperation with experts from the University of Sussex, who have extensive experience both in the area of artificial intelligence and optometry.

Through the combination of 500,000 individual biometric eye measurements, which were collected over a period of 10 years with the DNEye® Scanner, Rodenstock was able to create new lens calculation standards for the key eye parameters with these biometric findings. The key parameters include length of the eye, astigmatic refractive power, spherical refractive power and more. While an exact biometric eye model can be created with the DNEye® technology based on more than 7,000 data points and 80 eye parameters, AI technology allows an approximate biometric eye model to be created on the basis of predicted approximate values for the key biometric eye parameters. The diagrams in Figures 1-9 show how the new Rodenstock lens calculation standards allow individual biometric values to be calculated more accurately, even if "only" the standard refraction values are used as an input.

With the Rodenstock AI Technology several correlations can be combined in order to create an AI-based biometric eye model which is transferred to the lens manufacture process. These lenses are called B.I.G. NORM™.

Source:
1 Johner, C. (2020). Artificial intelligence in medicine. Retrieved from https://www.johner-institut.de/blog/regulatory-affairs/kuenstlicheintelligenz-in-der-medizin/ [Accessed 19 August 2021]

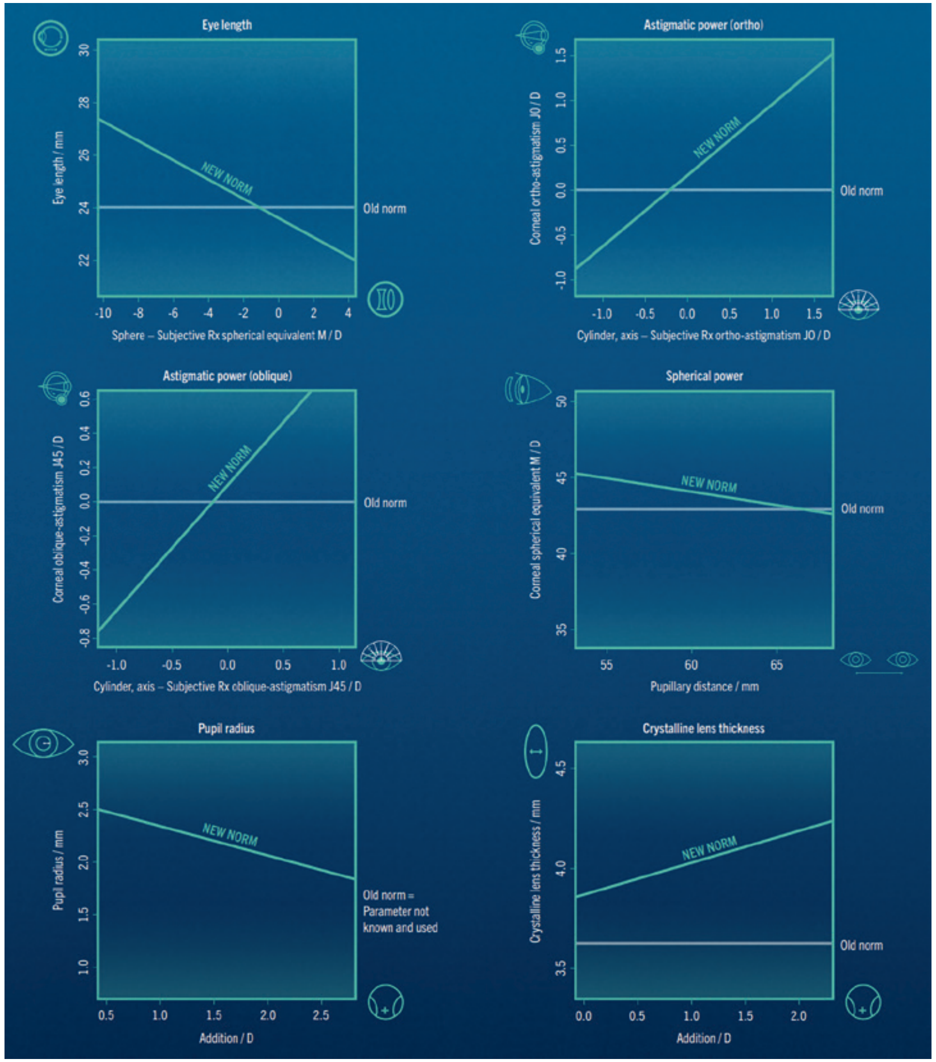


Figure 1-9: New Rodenstock standards, which are calculated by means of AI and are transferred to an eye model for every customer

1.3 STANDARD

In 1900 the Swedish ophthalmologist Alvar Gullstrand designed a physiological model of the human eye, the so-called "reduced eye", and deduced Gullstrand's equation. To this day, lens manufacturers all over the world use the so-called "reduced eye" and the deduced Gullstrand's equation for the lens calculation.

On that basis, Moritz von Rohr, who worked closely with Gullstrand, developed the vertex sphere. This allows abstraction from the details in the inner eye and thus relatively easy calculation of lenses. However, the full correction is only achieved at the vertex sphere and the individual eye is not taken into consideration. The crucial disadvantage of this calculation is that Gullstrand's eye describes the standard case, i.e., a "standard eye", which in reality is hard to find. The biometric values of the eye are not considered (Figures 1-10).

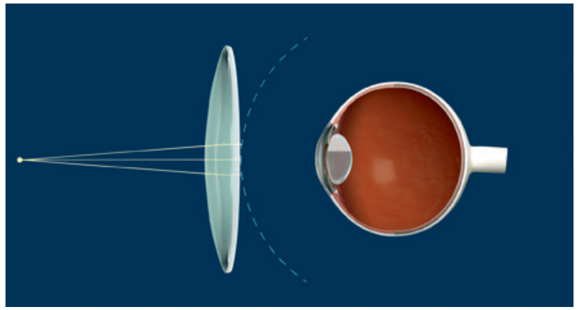


Figure 1-10: Lens calculation at the vertex sphere

The Rodenstock lenses from the standard portfolio are calculated for the vertex sphere.

1.4 EYE LENS TECHNOLOGY

The patented Eye Lens Technology offers the possibility of significantly improving the vision of spectacle wearers by compensating the near astigmatism.
The near astigmatism is a well-known and important topic in ophthalmic optics and thus also a topic in a variety of international studies and in numerous textbooks[1,2,3,4].
However, in practice the compensation of the near astigmatism played a rather minor role in the past. The reason for this was that a near astigmatism could only be corrected with corresponding single vision lenses or special multifocal lenses, but not with a progressive lens.
Thanks to the Eye Lens Technology, Rodenstock is able to implement a near cylinder independent of the far cylinder in a progressive lens.

Listing's Law

During an eye movement, the eyes adopt a torsional movement defined by the viewing direction. This is described with Listing's Law. For astigmatic eyes, there are different axial angles due to these "rollings" depending on the viewing direction, which require a corresponding adaptation of the cylinder axis of the lens. A lens that does not take into consideration these connections only achieves a match of the particular cylinder axis to that of the eye in the zero viewing direction. As a rule of thumb, a deviation of the axis position by 3° already causes a false cylindrical refraction of 10% of the initial cylindrical value. With a cylinder of +1.50 D and an axial deviation of 5°, an astigmatic error of +0.25 D arises.

Sources:
1 J. Tischer, "Die Praxis der Augenglasbestimmung", P. 128–130, DOZ-Verlag Heidelberg (2006)
2 H. Diepes, "Refraktionsbestimmung", P. 396–398, Postenrieder Verlag Pforzheim (2004)
3 H. Presser, "Brille und Auge", P. 74, 75, 116, 196, 216, CHK-Verlag Stephanskirchen (2001)
4 D. Methling, "Bestimmen von Sehhilfen", P. 117, Enke Verlag Stuttgart (1996)

In physiology a distinction is made between eye movements in the same direction (versions) and movement of both eyes in opposite directions (vergence) (Figure 1-11).
The assessment of versions alone does not correspond to the natural process of vision.
For near vision the description of Listing's Law for distance is not applicable. For a long time there has been no correct physiological description of the eye rotations here, which considers the vergences. In physiological research models have been developed in recent years, which describe the eye movements for far and near vision.[5,6,7]
As a horizontal line should also be shown in the area of corresponding retinal points for near vision, here the eyes inevitably adopt a different position than for far vision.

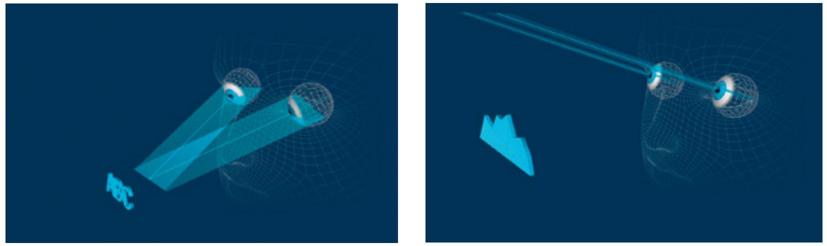


Figure 1-11: The torsion positions of the eyes differ for vergences (left: Listing's Law for near) and for versions (right: Listing's Law for distance)

If these findings are correctly interpreted and transferred to the lens, the cylinder axis positions are adapted precisely to the natural eye movements at near distances. The change in axis calculated according to Listing's Law for near vision depends on various influencing factors.

The following applies compared to Listing's Law for far:
The axis change is greater for near vision
- the smaller the near object distance is
- the greater the PD is
- the greater the gaze deflection is
- the higher the prismatic power in nasal direction is

With the additional consideration of Listing's Law for near vision, an improvement in vision at intermediate and short distances is achieved for all astigmatic refraction data.

The effective near astigmatism

In case of a toric lens that is fully corrective for far vision, image blur arises when looking into near distances due to the effective near astigmatism. (Figure 1-12). The effective near astigmatism occurs among spectacle wearers with astigmatic refraction data and with accommodation and increases the amount of the near correction cylinder. This purely geometric-optical effect is based on the distance between lens and eye. For near vision, the optical path to the eye changes due to the shorter object distance. As a result, the lens with regard to near astigmatism is no longer fully corrective at near distances.

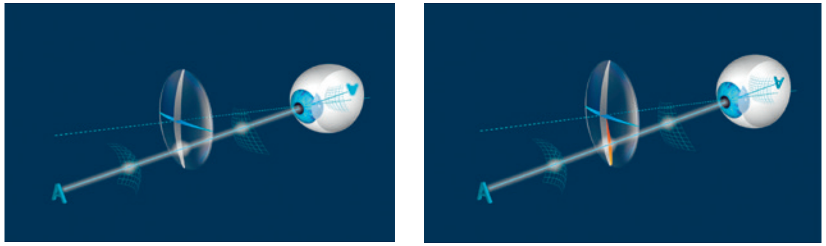


Figure 1-12: Left: Without consideration of the effective near astigmatism; Right: With consideration of the effective near astigmatism

The effective near astigmatism is dependent on different factors.
It is greater,

- the bigger the cylinder is
- the shorter the object distance is
- the smaller the addition is
- the greater the CVD is

The effective near astigmatism has an impact on the amount of the cylinder and can be up to +0.50 D. With the consideration of the effective near astigmatism, near objects are once again shown on the retina point-shaped and sharp. This leads to noticeable improvements in visual acuity and larger fields of vision at near distance.

The effective near astigmatism as well as Listing's Law for far and near vision are considered by Rodenstock as standard without the need for an additional measurement by the optician. The amount and axis of the near cylinder of the lens is adapted to natural vision with the aid of a physiological vision model.[8]

The astigmatic error for near vision is eliminated with the consideration of effective near astigmatism and Listing's Law for distance and near vision. Compared to optimisation without Eye Lens Technology, this can be more than +1.00 D.

Individual near refraction

A near astigmatism can also have anatomical causes, which in contrast to the effective near astigmatism and Listing's Law for near vision cannot be shown in a physiological model. Such a near astigmatism is caused, e.g., by:

- Astigmatic accommodation through asymmetrical curvature increase of the eye lens, particularly in the case of a severe eye lens astigmatism
- Tilting of the eye lens for accommodation and resulting aberrational astigmatism
- Position change of eye lens for accommodation
- Asymmetrical hardening of eye lens with presbyopia

The objective measurement at the DNEye® Scanner can detect the first signs of any near astigmatism by comparing the cylinder values and axis positions for near and far. In order to calculate the near astigmatism, subjective near refraction is required, which apart from determining the typical addition, also includes a check of the amount and axis position of the near cylinder. The occurrence of an anatomically caused near astigmatism is independent of the actual ametropia, i.e., customers with spherical ametropia in the distance can also be affected.

With the order option "Individual near refraction", this data is included in the progressive lens and near comfort lens calculation at Rodenstock. The spectacles wearer benefits from significantly larger fields of vision and pin-sharp vision at near distance[9].

Sources:
5 Wong, "Listings's Law: Clinical Significance and Implications for Neural Control", Survey of Ophthalmology 49. 563–575 (2004)
6 Schor, "Neuromuscular Plasticity and Rehabilitation of the Ocular Near Response", Optom. Vis. Sci. 86: 788–802 (2009)
7 Banks et al., "Perceiving slant about a horizontal axis from stereopsis", J. Vision 1. 55–79 (2001)
8 K. Nicke et al., "Brillengläser der Zukunft", Der Augenoptiker 06/2011
9 A. Welk et al., "Eye Lens Technology – Brillengläser der Zukunft – Schritt 2", Der Augenoptiker 11/2011

1.5 INDIVIDUAL LENS TECHNOLOGY

Every face is unique, as is the fit of the spectacles. This unique fit can be described exactly by using the individual parameters pupil distance, pantoscopic tilt, corneal vertex distance, face form angle and near distance.
A standard as-worn position is assumed during the lens calculation for the spectacle fit for all lenses that are not customised. Average values are used for the individual parameters. However, if the real as-worn position deviates from this standard situation, then this has a negative effect on the performance of the lens, as monocular aberrations occur which, in turn, lead to a restriction of the binocular fields of vision and thus reduce the performance of the lens.
Individual lenses therefore have significant benefits with the consideration of the real as-worn position. Thanks to the influence of the individual parameters on the lens optimisation, much better imaging properties can be achieved.

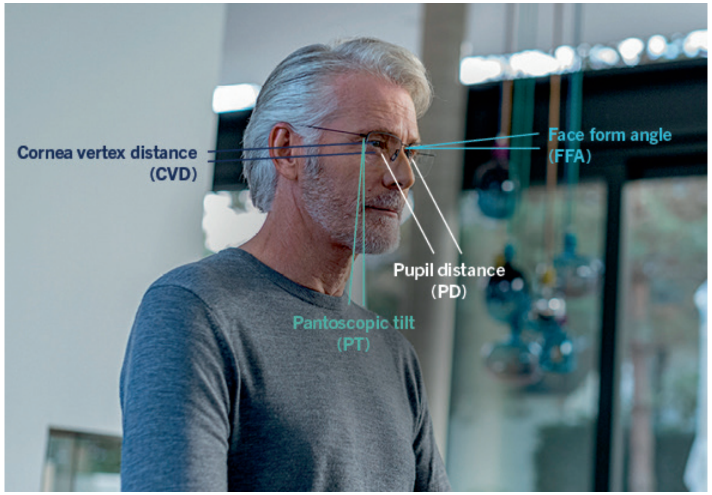


Figure 1-13: Individual parameters

The influence of the different individual parameters on the lens performance
In the following diagrams, the influence of the individual parameters on the performance of progressive lenses of different quality levels is described in more detail.

The following colours were chosen by way of illustration:
Individual progressive lens
Spherical-cylindrical and power optimised progressive lenses
Conventional progressive lens

The dependence of the performance on the pantoscopic tilt, pupil distance, face form angle and the corneal vertex distance is shown, with a power of: sph +2.50 D Add +2.00 D.
A good example for the restriction of the binocular fields of vision described above due to monocular aberrations is the deviation of the pantoscopic tilt from a standard pantoscopic tilt presumed for the optimisation. It is a right and left equal change, whereby no binocular imbalances are actually caused, but the angles of incidence of the beam change significantly.

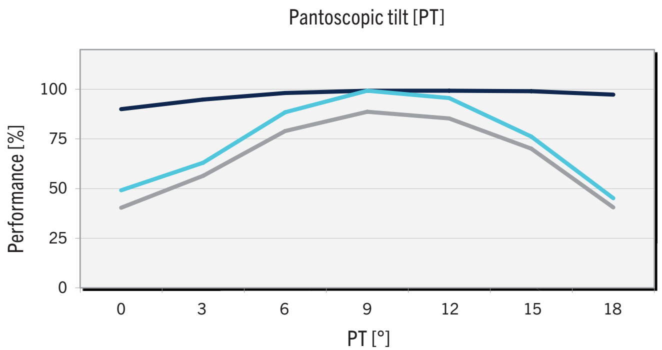


Figure 1-14: Performance depending on pantoscopic tilt

With the standard value of the pantoscopic tilt used by Rodenstock (Figure 1-14), individual progressive lenses and power-optimised progressive lenses have the same performance. If the actual pantoscopic tilt deviates from this standard value, then the performance reduces very quickly for non-customised lenses. With a pantoscopic tilt of 0°, which is not unusual for small frames or sport spectacles, all lenses calculated with standard parameters have a performance of below 50%, whereas it is still 90% for individual progressive lenses.

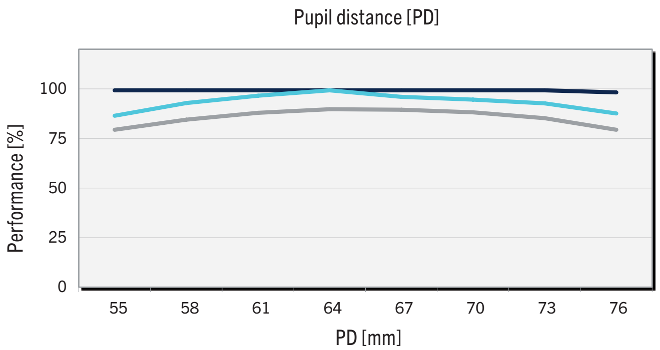


Figure 1-15: Performance depending on pupil distance

In the case of a deviation of the customer PD from the presumed standard PD, the change of the angle of incidence is very small, but due to an asymmetrical change, the fields of vision right/left are no longer congruent in the progression and near range.

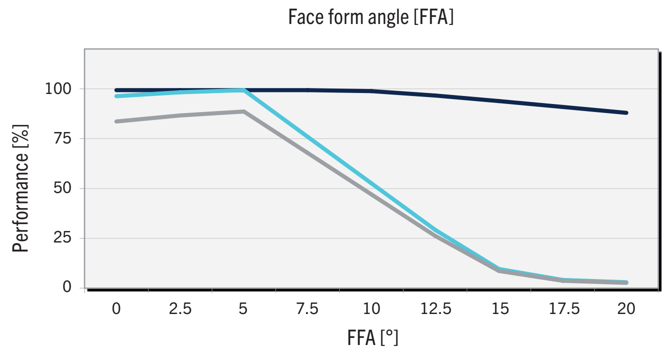
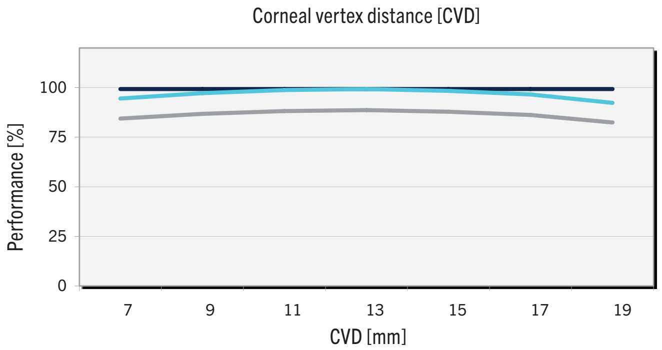


Figure 1-16: Performance depending on face form angle

The influence of the face form angle on the performance is dependent on different factors. Firstly, the angles of incidence of the beam change significantly, which leads to large monocular aberrations, and secondly, the fields of vision are asymmetrically modified due to the opposite change right and left and are therefore no longer congruent. For this reason, of all individual parameters the face form angle has the biggest influence on the performance of progressive lenses. With a face form angle of 10° the performance drops for progressive lenses, which do not take into consideration the individual parameters, to below 50%, whereas individual progressive lenses always have a performance of almost 100%.

Similar to the pupil distance, in principle the corneal vertex distance has a more reduced impact on the performance than the face form angle. In the following diagrams, this is illustrated using the two powers sph +2.50 D and sph +5.00 D, each with Add +2.00 D.



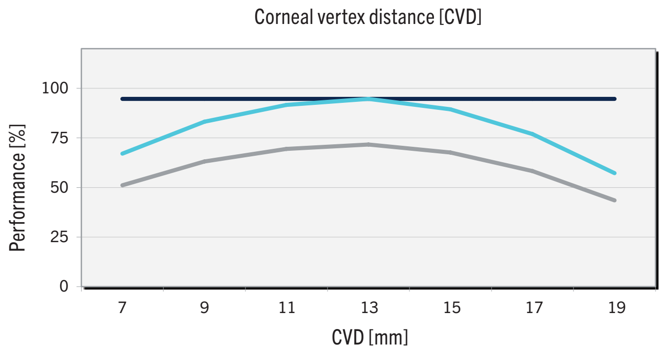


Figure 1-17: Performance depending on CVD with power of Sph +2.50 D Add +2.00 D (above) and power of Sph +5.00 D Add +2.00 D (below)

However, it is important to understand that the individual parameters also naturally influence each other. For example, the dependence of the performance on the corneal vertex distance increases considerably with an increase of the spherical power. Individual progressive lenses are the exception here again.[1]

Source:
1 G. Esser et al., "Die Performance individueller Gleitsichtgläser", DOZ 01/2006

1.6 FLEXIBLE DESIGN TECHNOLOGY

With the patented Flexible Design Technology, it is possible to produce nearly an infinite number of progressive and near comfort lens designs freely according to the requirements and preferences of the customer (also see Chapters 2.2 and 3.2. Impression B.I.G. EXACT™ and Impression B.I.G. EXACT™ Ergo).
This means that every customer receives the progressive or near comfort lens that best suits them.[1]
Two steps are required for a customisation in terms of the adaptation of the lens design to the personal visual requirements of the customer:

- **Weighting of the fields of vision**

From the anamnesis you find out which fields of vision of the customer are used very frequently and less frequently. These findings can be integrated in the optimisation with the aid of the Flexible Design Technology and the lens periphery can be influenced by design guidelines. This means that particularly high-weighted fields of vision can also be appropriately large within the framework of the theoretical-physical possibilities.

- **Position of the design points**

Apart from the design characteristic, the position of the design points far and near also influence the arrangement of the fields of vision. The amount of the power change, the length of the progression zone and the way the far power changes to the near power determine the characteristics of the progressive or near comfort lens. If this profile is variably tunable, as with Impression B.I.G. EXACT™/Impression B.I.G. NORM™ and Impression B.I.G. EXACT™ Ergo/Impression B.I.G. NORM™ Ergo, the position of the visual areas can be adjusted by varying the design points to the customer's requirements by variation of the design points. Thus, the best design can be used as basis for optimisation.

In theory and in production, the Flexible Design Technology allows this flexible design adaptation in order to provide the best design possible for every customer. The fields of vision relevant for the customer can be very large and individually positioned. Aberrations move to areas that do not play a role for the customer. In the consulting programme CNXT® select, you can specify together with your customer in the "Prioritisation" tab which viewing distances are particularly important (see Figure 1-18).

Source:
1 Kerner et al., "Was ein Gleitsichtglas einzigartig macht", FOCUS 09/2014

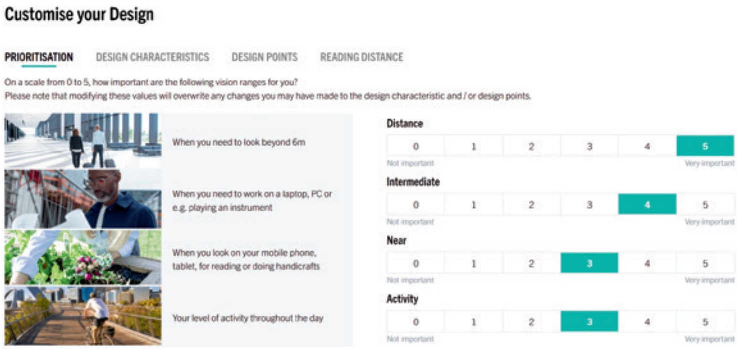


Figure 1-18: Prioritisation of viewing habits of your customer in CNXT® select

The information about the prioritisation of the viewing habits is carried over to the design characteristic. This design characteristic determines the design. If, e.g., the distance is highly weighted, the lens is optimised so that the far vision area is particularly large. In the field of vision presentation, the consulting programme shows the impact of the individual design figures of the design characteristic in the fields of vision.

The possible combinations of the design figures in the design characteristic determine the variety of designs for Impression B.I.G. EXACT™/Impression B.I.G. NORM™ and Impression B.I.G. EXACT™ Ergo/Impression B.I.G. NORM™ Ergo and are presented as a triangle (Figure 1-19). The design triangle is another way to change the design characteristic.

Figure 1-19: Design characteristic with design points far and near, design triangle and active index CNXT® select

Another key figure which indicates the suitability of the design for dynamic visual tasks and thus ascertains the image stability of the progressive lens is the active index. Lenses with a high active index (if many or all bars are filled) are perfect for dynamic visual tasks.

For each recommended design, the design points far and near are also determined based on the design characteristic and the frame and centring data. They can still be modified if required.

Figure 1-20: Design points, far and near

In order to illustrate the possibilities of the Flexible Design Technology, two customers with the same refraction as well as frame and centring data, but different visual requirements, are compared below.

Customer A (progressive): For customer A, it was noted in the medical history and consultation that a large far vision area and intermediate vision area free of aberrations are important, e.g., for driving. The customer is also very active and regularly performs dynamic activities, which often require horizontal viewing deflections. The customer selects the following settings in the prioritisation in the consulting programme CNXT® select:

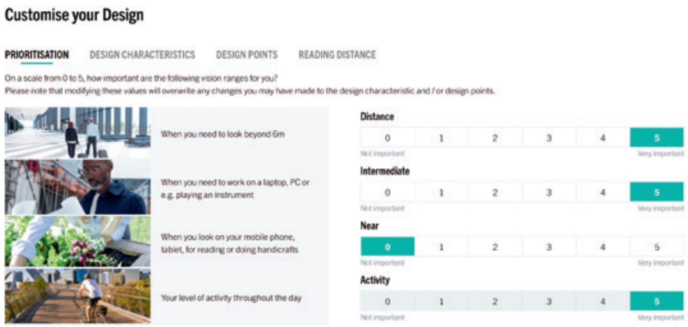


Figure 1-21: Prioritisation in CNXT® select customer A

The selected prioritisation gives a design characteristic of 47/47/5. The design characteristic also reveals certain design points for far and near depending on the frame and centring data. In this example of customer A, there is a design point far (DF) of –1.7 mm and a design point near (DN) of –19.8 mm (see Figure 1-22).

There is a very large far vision area due to the weighting of the far and intermediate fields of vision and the subsequent power increase (DF = –1.7 mm). With the weighting of the field of vision for intermediate distance and the activity, the position of the design point for near (DN) is set at –19.8 mm. The result is a large field of vision for the intermediate distances and a soft transition from far to near, which is very important for active customers.

Figure 1-22: Design characteristic, design triangle and active index for customer A in CNXT® select

Customer B (near comfort): This customer regularly works on the computer or laptop and requires a very large intermediate and near vision area. During the medical history, it was determined that an additional pair of near comfort spectacles is the best correction option for customer B.
The customer decides on the following prioritisation in CNXT® select:

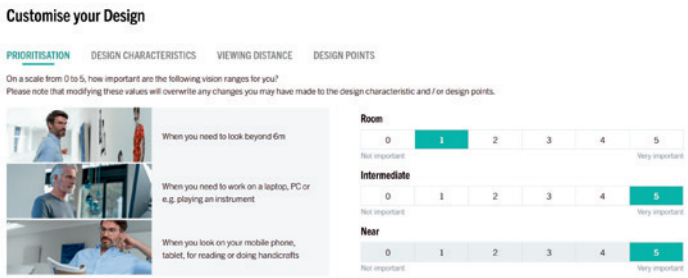


Figure 1-23: Prioritisation in CNXT® select customer B

The selected prioritisation gives a design characteristic of 13/43/43 for customer B. Also, for the near comfort lenses, the design characteristic reveals certain design points for intermediate and near determined depending on the frame and centring data. In this example of customer B, there is a design point middle (DM) of 0 mm and a design point near (DN) of –18.3 mm (see Figure 1-24).

The weighting on the intermediate and near vision area is shown in the field of vision presentation. The distance between the design point middle and design point near is relatively large. There are large fields of vision for the intermediate and near distances.

Figure 1-24: Design characteristic and design triangle for customer B in CNXT® select

In CNXT® select, there are more options available to optimally tune the lens design to your customer's viewing habits. For near comfort lenses, you see, e.g., in the "Viewing distance" tab, whether the viewing distances stored for the design also match your customer's requirements. If required, you can also change the viewing distances here (Figure 1-25).

Figure 1-25: Viewing distances for customer B in CNXT® select

Perfectly adapted to the personal lifestyle, the Flexible Design Technology offers the perfect lens for every spectacles wearer with an almost infinite number of designs. For instance, the customer receives customised solutions, for 100% natural vision and full utilisation of their personal vision potential.

1.7 POWER OPTIMISATION

The performance of lenses is significantly influenced by the quality of the optimisation, the individual lens geometry and the amount of parameters that can be considered.

Individual power optimisation
For all Rodenstock Impression B.I.G. EXACT™ and Impression B.I.G. NORM™ lenses, the calculation of the freeform back surface is carried out online by means of individual power optimisation. Apart from the biometry of the individual customer's eye and the individual lens geometry, all ordered refraction data (sphere, cylinder, axis, prism, base) as well as the individual parameters for the as-worn position (pupil distance, corneal vertex distance, pantoscopic tilt and face form angle) are included in the optimisation. For the individual power optimisation, the optimisation takes place not only at individual reference points, but is calculated across the entire surface of the lens. This ensures that every customer receives optimally large and symmetrical fields of vision independent of their biometry, their refraction data and the fit of the frame on the face, even in the case of anisometropia.

Spherical-cylindrical power optimisation
All Rodenstock Multigressiv B.I.G. EXACT™ and Multigressiv B.I.G. NORM™ lenses are calculated online by means of spherical-cylindrical power optimisation. Also here, the individual lens geometry and all ordered refraction data (sphere, cylinder, axis, prism, base) are included in the optimisation. The difference to the individual power optimisation is that a standard as-worn position is presumed for pupil distance, corneal vertex distance, pantoscopic tilt and face form angle. Also for the spherical-cylindrical power optimisation, the optimisation takes place not only at individual reference points, but is calculated across the entire surface of the lens.

Spherical optimisation
For progressive and near comfort lenses of the Rodenstock Progressiv Portfolio (B.I.G. and Standard) as well as for the B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses Cosmolit Mono/Mono+, the calculation of the freeform back surface is carried out online by means of the spherical optimisation. The optimal lens design is calculated by taking into consideration the individual lens geometry and the spherical equivalent after receipt of order. With this approach, the performance of the lenses with spherical refraction data is comparable to that of spherical-cylindrical and power optimised lenses and the restrictions in the fields of vision for toric powers are reduced considerably compared to conventional lenses.

Conventional lenses
Apart from the B.I.G. portfolio, Rodenstock also offers conventional progressive and near comfort lenses. Conventional progressive lenses generally have a progressive front surface, whereas the prescription surface is made after receipt of order. With all conventional progressive lenses, prefabricated and thus standardized semi-finished products (blanks) are used in the production according to the base curve system.
A certain power range is covered with one and the same blank per addition, e.g., from one blank (Index Mineral 1.6) with the base curve 3.50 D and addition 2.50 D, all powers from sph –1.25 D to –4.0 D are made. The optimisation of the semi-finished product before production is adjusted to the average spherical power per base curve. If the refraction data correspond to the optimised power (e.g., sph –3.00 D), the progressive lens offers optimal imaging properties. If the prescription values of the customer in sphere, cylinder and/or prism differ from this average power, then this results in more or fewer severe restrictions in the fields of vision depending on the size of the deviation. This is known as the base curve effect.
Figure 1-26 shows the fields of vision of two conventional progressive lenses. The picture on the left shows a significant base curve effect as the power of this lens deviates greatly from the optimised average power of the blank. The picture on the right shows no restrictions in the fields of vision. Here the power of the lens matches the optimised average power of the blank.

Figure 1-26: Restrictions in the fields of vision by the base curve effect (left), no restrictions (right)

The imaging quality of conventional progressive lenses largely depends on the customer's refraction data. The finer the base curve system of conventional progressive lenses is classified, the smaller the power ranges for which a blank is used and the smaller the maximum base curve effect (see Figure 1-27).

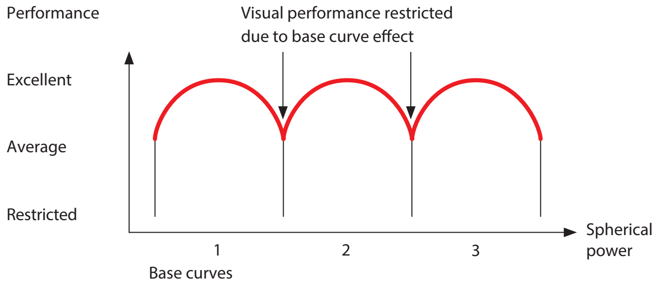


Figure 1-27: Performance of a conventional progressive lens with base curve effect

These restrictions can in principle also occur with freeform back surface designs. Using the freeform technology, almost any surface can be realised in theory, but the actual challenge is the endless variety of power combinations and the complexity of the surface calculation.

Rodenstock found a solution for this. It ensures the enormous computing power required for the complex wavefront optimisation and makes it possible to calculate and optimise each individual B.I.G. lens in real time.

1.8 PROGRESSION LENGTHS

Apart from the design characteristic, the progression length also has an impact on the design of a progressive lens. Not only is the length decisive, but also the position of the reference points distance/near or the design points.
The progression length is not firmly defined in the various ophthalmic optics standards and is often interpreted differently by the lens manufacturers.
In accordance with ISO 13666 from December 2019, the "corridor" is defined as follows:

Corridor
Portion of a power-variation lens providing the intended change in focal power.
Note 1 to entry: The corridor denotes either a zone in the lens (the progression zone) or the line of minimum cylindrical surface power on the power-variation surface, often called the "umbilical line".

At Rodenstock, the specification of the progression length refers to different reference points in the lens (see Chapter 2 Progressive lenses).

Progression length = **Distance design point far (DF)** – **design point near (DN)**

This definition refers to all individual progressive lenses for which the design point far can be ordered. In the current portfolio, this includes the Impression B.I.G. EXACT™ and Impression B.I.G. NORM™ lenses as an individual design and Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport.

Through the variability of the design points far/near, the minimum progression length for progressive lenses is 13 mm and the maximum progression length is 24 mm.
For Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport, the minimum is 18 mm and the maximum is 22 mm.

Progression length = **Distance centring point** – **design point near/reference point near**

This definition refers to all other progressive lenses.
For the products for which the design point far (DF) cannot be ordered, the minimum progression length is 14 mm and the maximum progression length is 20 mm.

Please note the following when selecting the progression length:
Short progression lengths generally offer greater freedom in the selection of the frame and require a smaller gaze reduction for near vision. However, they have the disadvantage that the peripheral astigmatism is higher and the intermediate vision area is narrower than with progressive lenses with average or long progression. Therefore, you should not base the selection of the progression length on the fitting height alone, but weigh up as the case arises which choice is the best for your customer.

At Rodenstock, you can choose between the following progression lengths:

Variable Progression V
Taking into consideration the pantoscopic tilt, CVD, as well as the frame and centring data, the position of the design point near (DN) is calculated by Rodenstock so that your customer can adopt their most favourable gaze reduction and optimal use of the frame size is guaranteed.
The influence of the CVD and the pantoscopic tilt on the gaze reduction is shown in the images below.

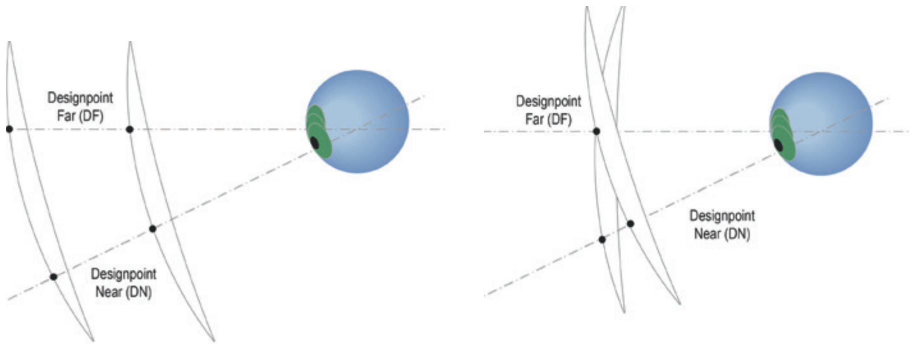


Figure 1-28: Influence of different CVDs (left) and pantoscopic tilts (right) on the position of the design point near (DN)

You can order all B.I.G. EXACT™ and B.I.G. NORM™ progressive lenses (except Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport) and near comfort lenses with variable DN. If you do not transfer frame and centring data or the position of DN, the design point near for the progressive design types Active, Allround, Expert and Road is positioned by default –18 mm below the centring cross.

Short progression
The short progression (S) offers greater freedom in the selection of the frame due to a small minimum fitting height. With the short progression, the design point near is –14 mm below the centring cross. In order to use the full addition, Rodenstock recommends a minimum fitting height of 16 mm. Your customer can adopt a smaller gaze reduction for near vision compared to long progression.
Another advantage of short progression is that the vertical-prismatic load is reduced with anisometropia (also see Chapter 6.1.7). However, the disadvantages are higher peripheral astigmatism and the resulting narrower intermediate vision area.

Medium progression
Medium progression (M) is a good compromise between the progression lengths S and L. It has a lower astigmatism increase compared to the short progression length and offers a smaller gaze reduction compared to long progression. With the medium progression, the design point near is –16 mm below the centring cross. In order to use the full addition, Rodenstock recommends a minimum fitting height of 18 mm.

Long progression
With the long progression (L), the design point near is –18 mm below the centring cross. In order to use the full addition, Rodenstock recommends a minimum fitting height of 20 mm. With long progression, the astigmatism increase in the periphery can be smaller and the swim effect is minimised. Other advantages include wider intermediate vision areas.

A changeover from long to short progression can lead to compatibility problems, especially when combined with an increase in addition. This is due to the higher astigmatism.

1.9 INSET

The better the course of the main viewing line of the progression zone is aligned to the natural convergence behaviour of the customer, the wider the fields of vision in the intermediate and near vision area and the better the binocular imaging properties are across the entire lens. Rodenstock progressive and near comfort lenses are made with a variable inset. In accordance with ISO 13666, the inset describes the horizontal offset between centration point and near reference point.
For plus powers, the increased convergence is considered in the calculation of the progression of the main viewing line, which occurs when looking at near due to the resulting base-outside-effect. As a result, the inset is greater than the standard of 2.5 mm. In contrast, for minus powers, a prismatic effect with base inside occurs when looking at near, a consequence of which is reduced convergence for the spectacles wearer. This means that the inset is smaller than 2.5 mm. Depending on the optimisation and the permissible order parameters, the following differences also arise for the offset of the near vision area:

Standard
For the spherically optimised standard progressive and near comfort lenses, the inset is determined on the basis of the spherical equivalent of the respective refractive data and the individual lens geometry and adapted to the progression of the main viewing line. For conventional progressive lenses, the inset is predetermined on the basis of the optimised power of the blank used.

Progressiv B.I.G. EXACT™ and Progressiv B.I.G. NORM™
For the spherical optimised B.I.G. EXACT™/B.I.G. NORM™ progressive and near comfort lenses, the inset is optimised on the basis of the spherical equivalent of the respective refraction data and the individual lens geometry and the progression of the main viewing line is calculated accordingly.

Multigressiv B.I.G. EXACT™ and Multigressiv B.I.G. NORM™
Through the spherical-cylindrical power optimisation, the lenses are optimised on the basis of the spherical-cylindrical refraction data and the individual lens geometry and the progression of the main viewing line is adapted accordingly. In addition, the pupil distance of the spectacles wearer is included in the inset optimisation. The main viewing line of the lens is thus optimally aligned to the natural convergence behaviour of the customer when the as-worn position corresponds to the assumptions of the calculation. This guarantees optimal overlapping of the monocular fields of vision on the right and left and perfect binocular vision in the standard as-worn position.

Impression B.I.G. EXACT™ and Impression B.I.G. NORM™
Apart from the biometry of the eye, the customer's refraction data and the individual lens geometry, the individual parameters are also included in the calculation of the inset. The customer's PD, CVD, pantoscopic tilt, as well as face form angle have an additional impact on the ideal main viewing line of the lens. This guarantees an exact overlapping of the monocular fields of vision on the right and left and perfect binocular vision for every as-worn position.

Inset for prismatic B.I.G. lenses
The inset specification may vary if for prismatic B.I.G. EXACT™ and B.I.G. NORM™ orders, the inset specification on the lens bag is compared to an order without prism, but otherwise has identical order parameters.

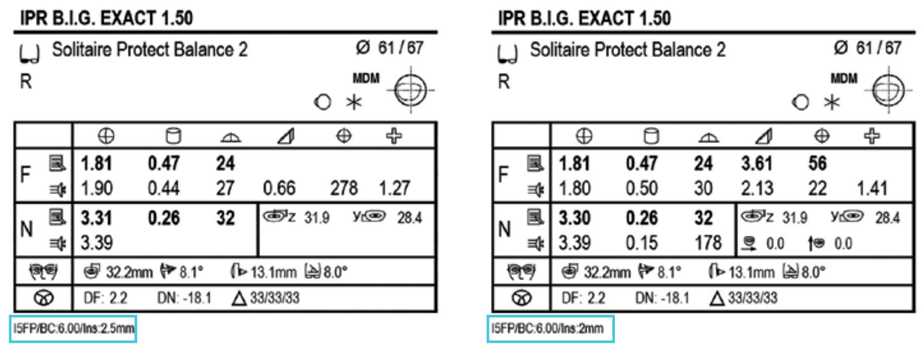


Figure 1-29: Varying inset for prismatic B.I.G. lenses

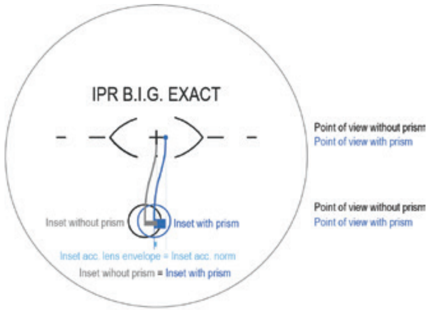


Figure 1-30: Inset for prismatic B.I.G. lenses

For orders without prism, the centring point and the far reference point overlap. In contrast, for prismatic orders, the back surface of the lens is shifted in the optimisation so that the far reference point and the centring point are at different locations.
As in accordance with ISO 13666, the inset describes the distance between centring point and near reference point, there may be seemingly different inset values, but upon closer examination of the distance between the far reference point and near reference point, they are the same (see Figure 1-30).

Inset ordering
Customers with functional monocular vision can accommodate when looking at near, but converge less frequently or not at all and therefore need lenses with a reduced inset. For the calculation of all B.I.G. EXACT™/B.I.G. NORM™ progressive and near comfort lenses, the gaze behaviour of the less or non-converging eye can be considered and the progression of the main viewing line individually aligned. Inset orders are possible in the range from 0% to 100%.

1.10 WAVEFRONT CALCULATION IN AS-WORN POSITION

Wavefront calculation
In order to describe and/or calculate the imaging properties of lenses in the as-worn position, two calculation methods are known in geometric optics:

Calculation with light rays (Ray Tracing)
The term “ray tracing” is made up of the two words “ray” and “tracing”. In geometric optics, the ray tracing method is used to describe optical images. The calculation of a lens using ray tracing is very time-consuming as, for each point in the lens outside the actual ray, an “accompanying” bundle of neighbouring rays must also be simulated through the lens.

Calculation with wavefronts (Wave tracing)
The term “wave tracing” is made up of the two words “wave” and “tracing”. Just like rays, wavefronts can be used to describe or calculate optical images. A wavefront is the area of equal phase of a propagating wave. Each wavefront combines all properties of a bundle of neighbouring rays in a single object.
One of the special innovations by Rodenstock is to further develop a special description with local wavefronts. Due to the significant saving achieved in computing time, the individual optimisation of each individual lens, as it is performed in the case of the individual power optimisation, is possible in the first place. Rodenstock developed a highly complex process which, in addition to the physiological models, also includes a flexible surface description of the lens at several thousand assessment points. A separate local wavefront is calculated at each of these points.

With the DNEye® technology, the wavefront calculation is not only performed for the front and back surface of the lens, but also taking into consideration the biometry of the eye. Thanks to highly efficient calculation methods, it is possible to realise the calculation through the eye in a short time.

As-worn position
Optimal vision can only be guaranteed when lenses are calculated for the as-worn position. For this reason, all Rodenstock lenses are calculated according to this. Depending on the product, this calculation of as-worn position is incorporated in the optimisation of the lenses.

For all individual lenses, in addition to the refraction data and the design, for example, all individual parameters and the biometry of the eye are considered for the as-worn position. For the other B.I.G. Vision® lenses, this calculation is performed similarly, however, on the assumption that, instead of the individual parameters pantoscopic tilt, corneal vertex distance and face form angle, so-called standard values are also included in the optimisation.

For the Rodenstock lenses in the Standard portfolio, the calculation of as-worn position takes place at the vertex sphere. Standard values are also included in the optimisation here instead of the individual parameters pantoscopic tilt, CVD and FFA.

The consideration of the as-worn position inevitably leads to differences between the order and reference values which are printed on the lens bag. The extent of these differences depends on the refraction data, the individual parameters, any CVD conversion, the desired main viewing distance, the progression length and the lens geometry.

Why are there differences between the order values and the reference values on the lens bag?
The order value corresponds to the dioptric power in the reference point of the lens, which the spectacles wearer should actually experience when looking through their spectacles. It generally corresponds to the value determined in the subjective refraction or the B.I.G. EXACT™ order values. Figure 1-31 should show that the trial lenses during the refraction are only used for a defined distance (generally far and near). They are also very small and thin.

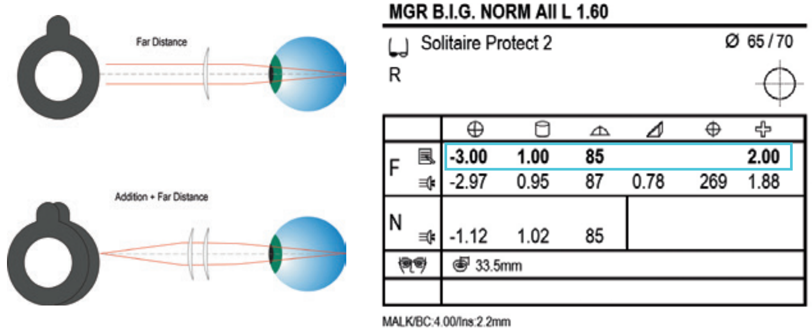


Figure: 1-31: Calculation of order value for far (above) and near (below) with subjective refraction

The data from the refraction are combined during the optimisation with lots of other data in relation to the as-worn position. The manufactured lens has a completely different geometry compared to the trial lens. In addition, different viewing distances (from far to near) are used for progressive lenses. However, the aim is that the values calculated during the refraction also work in the as-worn position in front of the customer’s eyes (Figure 1-32).

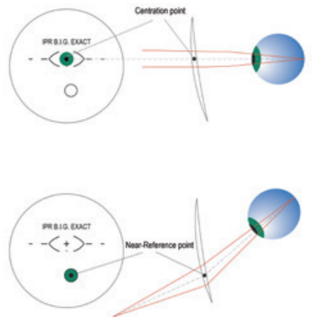


Figure: 1-32: Schematic ray path for far (above) and near (below) in as-worn position

The reference value specified on the lens bag is the dioptric power in the marking point of the lens, which can be checked in the lensmeter.
During the measurement in the lensmeter, the rays always run parallel and perpendicular to the lens level. The posterior surface of the lens has an additional impact on how the lens rests on the lensmeter, e.g., high or prismatic powers, and thus also on the path of the ray through the lens.

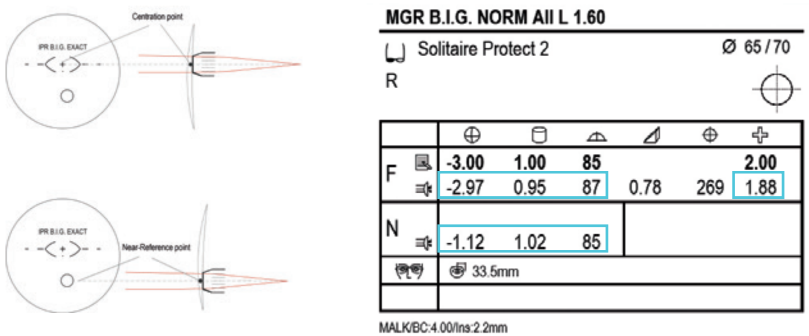


Figure: 1-33: The reference values printed on the lens bag can be checked on the lensmeter

In contrast, when looking through the lens in the real wear situation, the rays run diagonally. This is achieved firstly by pantoscopic tilt and face form angle, but also by the gaze reduction as well as the modified object distance when looking through the near reference point of a progressive lens.

The reference values generally differ significantly for the near values or the addition due to the different ray paths from the order values than for the distance values.

The following example shows how the reference value for the addition is influenced when an order with otherwise identical order data is made with and without corrective prism.

Order values	Order value for addition [D]		Reference value for addition [D]	
R/L sph -6.00 D Add 2.50 D	**R**	**L**	**R**	**L**
without prism	2.50	2.50	2.27	2.27
with prism 5 cm/m	2.50	2.50	2.42	2.10

Table 1-6: Different reference values for addition with and without prism

The order without prism gives a reference value for the lensmeter of R/L 2.27 D for the ordered addition. For the order with prism, the posterior surface of the lens changes in addition to the lens geometry, and therefore also the beam path of the measuring instrument.
As a result, there are other reference values for the addition for this order: R 2.42 D/ L 2.10 D.
In front of the spectacle wearer’s eye, both lenses have the same value for the addition despite different reference values.
Through the optimisation for the as-worn position, a true depiction of the refraction on the retina is guaranteed for all distances.

1.11 FREEFORM TECHNOLOGY

Rodenstock has accumulated a vast amount of knowledge and experience in the area of freeform technology because, since the introduction of Impression^{ILT} and Multigressiv^{ILT} in the year 2000, millions of individual lenses have been sold. Now almost every major lens manufacturer advertises their top products with the term “3D freeform technology”. However, the term “freeform” cannot automatically be compared to power optimisation or customisation. Only the combination of real-time optimisation and freeform technology makes it possible to calculate power-optimised and individual lenses.
Therefore, conventional lenses which are manufactured in production with freeform technology are not yet individual products. Also the position of the progression (anterior or posterior surface of lens) does not reveal anything about whether these lenses belong to the power-optimised and/or individual progressive lenses. At Rodenstock, the surfaces of the lenses are optimised using optimised mathematical methods and formulas within a very short time by high-performance computers directly after receipt of the order.
For this, Rodenstock developed its own software with complex mathematical optimisation and wavefront methods. This software makes it possible to optimise the lens at several thousand visual points, instead of determining the curvature of the spherical/toric prescription area at only one point, as done previously. With the success that the largest possible fields of vision are guaranteed for all refraction data and wearing situations.

Apart from the optimisation, precision machines are also required for the manufacture of 3D freeform lenses for even more exact implementation of the theoretical surfaces in the lens. Rodenstock has been using in-house developed precision CNC-machines since the introduction of Multigressiv 2 in 1999. However, for high-precision optical areas, the technical challenge lies in the CNC-polishing, which is implemented for all freeform products by Rodenstock with excellent quality and precision.

Since 2009, Rodenstock has been manufacturing its entire brand portfolio (progressive lenses, near comfort lenses and sport spectacles) in freeform technology. With the introduction of the B.I.G. Vision lenses, all B.I.G. single vision lenses are now also manufactured in freeform technology.

CONTENT

2 PROGRESSIVE LENSES

PORTFOLIO

Every individual is unique - just like the requirements they place on vision. From the quality-conscious who attaches importance to an attractive price-performance ratio to the discerning for whom the desire for proven brand quality as well as a significant improvement in visual comfort are to the fore, through to the perfectionist who wants to make no compromises when it comes to vision and always wants the most innovative and effective product. The Rodenstock lenses reflect these claims and demands. Every customer finds the product that best suits them.

B.I.G. VISION® LENS PORTFOLIO – TECHNOLOGIES

			B.I.G. EXACT™			B.I.G. NORM™			Standard
			Impression B.I.G. EXACT™	Multigressiv B.I.G. EXACT™	Progressiv B.I.G. EXACT™	Impression B.I.G. NORM™	Multigressiv B.I.G. NORM™	Progressiv B.I.G. NORM™	Progressiv Life
Rodenstock Proprietary Technologies	DNEye® Technology	Exact biometric eye model	✓	✓	✓				
	AI Technology	AI-based biometric eye model				✓	✓	✓	
	Eye Lens Technology	Effective near astigmatism	✓	✓	✓	✓	✓	✓	✓
		Listing's Law for far and near	✓	✓	✓	✓	✓	✓	✓
		Individual near refraction (optional)	✓	✓	✓	✓	✓	✓	
Rodenstock Innovation Technologies	Individual Lens Technology	CVD, PT, FFA	✓			✓			
		Near distance	✓	✓	✓	✓	✓	✓	
		PD	✓	✓	✓	✓	✓	✓	
	Flexible Design Technology	Individual design	✓			✓			
		Active/Expert/Road	✓	✓		✓	✓		
		Allround	✓	✓	✓	✓	✓	✓	
	Power optimisation	Quality level for power optimisation	Individual	Spherical-cylindrical	Spherical	Individual	Spherical-cylindrical	Spherical	Spherical
Rodenstock Core Technologies	Progression	Variable/frame-optimised	✓	✓	✓	✓	✓	✓	
		L, M, S	✓	✓	✓	✓	✓	✓	✓
	Inset	Individual	✓			✓			
		PD-optimised	✓	✓		✓	✓		
		Power-dependent	✓	✓	✓	✓	✓	✓	✓
	Wavefront calculated in as-worn position		✓	✓	✓	✓	✓	✓	✓
	Freeform produced from finely graduated base curve system		✓	✓	✓	✓	✓	✓	✓
	Simple prism handling		✓	✓	✓	✓	✓	✓	

Table 2-1: Overview of the product properties of the Rodenstock progressive lenses

2.1 DESIGN TYPES

With the B.I.G. EXACT™ and B.I.G. NORM™ progressive lenses, you can offer your customers a lens that matches their individual lifestyle and is optimally adjusted to their personal requirements. The B.I.G. EXACT™ and B.I.G. NORM™ progressive lens portfolio is offered in the design types Active, Allround, Expert and Road. For Impression B.I.G. EXACT™ and Impression B.I.G. NORM™, you can also create an individual design yourself.

Active

The Active design type was adapted specially to the viewing behavior and needs of active customers. This lens impresses in dynamic activities thanks to an extra-large far vision area as well as reduced peripheral distortion and magnifying effects.

Figure 2-1: Active design type

Allround

The Allround design type was developed specially for people who use all three fields of vision equally – distance, intermediate and near. The design was structured so that it offers the best possible performance for the customer at all distances.

Figure 2-2: Allround design type

Expert

The Expert design type is characterised by a wide intermediate vision area for medium distances. This design is perfect, e.g., for people whose daily life is strongly influenced by travelling and also requires work on the laptop.

Figure 2-3: Expert design type

For even greater visual comfort at intermediate and near distances, spectacles with near comfort lenses are recommended in addition to the progressive lenses. They are designed specially for vision at near and intermediate distances. Thanks to the ergonomically arranged fields of vision, they allow relaxed and natural head and body posture at the screen. With the smaller increase in power, they offer even wider fields of vision for intermediate distances compared to a progressive lens and also guarantee maximum visual comfort after hours at a PC (see Chapter 3).

Road

The Road design type was developed mainly for requirements when driving and is also suitable for day-to-day life. The large area for far vision enables unlimited vision even when glancing sideways through the lenses. With the area of the lens designed for intermediate vision being widened, the dashboard and navigation can be easily viewed.

Figure 2-4: Road design type

2.2 IMPRESSION B.I.G. EXACT™ AND IMPRESSION B.I.G. NORM™

The Impression B.I.G. EXACT™ and Impression B.I.G. NORM™ progressive lenses offer the greatest freedom and flexibility when it comes to adapting them to the needs of the spectacle wearer. Be it in relation to the biometrics of the eye, the fit of the frame on the customer's face or the design and optimisation of the lens.

Impression B.I.G. EXACT™ and Impression B.I.G. NORM™ progressive lenses are offered in two versions: You can choose between the fixed design types Active, Allround, Expert and Road, as well as the individual design. For the individual design, the patented Flexible Design Technology allows an almost unlimited number of progressive lens designs to be freely produced according to the requirements and preferences of your customer.

Thanks to the individual power optimisation, with Impression B.I.G. EXACT™ and B.I.G. NORM™, the individual refraction data are optimised directly online on receipt of order and for the entire lens. Therefore, the largest possible fields of vision and unique visual comfort are guaranteed.

The other technologies used for Impression B.I.G. EXACT™ and B.I.G. NORM™ can be found in the overview (Table 2-1) and the chapter on technologies (Chapter 1).

The individual design
The individual design offers complete design flexibility and can be perfectly adapted to the personal lifestyle of the customer. In order to adapt the lens design perfectly to the personal vision requirements of the spectacles wearer, they must be measured and analysed. The Rodenstock consulting programme CNXT® select is available for this purpose.

Figure 2-5: Individual design with focus on far and intermediate vision areas (Figure from CNXT® select)

The design triangle
The design triangle in CNXT® select signifies the design flexibility of Impression B.I.G. EXACT™ and Impression B.I.G. NORM™. Using the position of the circle in the triangle, it is clear where the application focus of your customer and thus also the recommended lens design lies.
Figure 2-5 shows a design whose focus lies in the distance and intermediate vision area. Therefore, the far vision area range is very large and the design point far is moved down slightly.

The design characteristic
Each lens design has its own design characteristic which reflects the layout, size and weighting of the three fields of visions to each other in the lens.

Far	Middle	Near
39	35	25

Figure 2-6: The design characteristic

The left number represents the far vision area, the middle number indicates the intermediate vision area and the right number is the near vision area of the progressive lens.

The design number can have a minimum value of 0 per distance range and a maximum value of 99. The total of the three design numbers is always 99. The higher the respective design number is, the greater the weighting on the corresponding field of vision. For a balanced design without application focus, the three design figures would be the same or roughly the same, e.g. 33 / 33 / 33.

Based on your specifications, CNXT® select calculates the design characteristic which best matches your customer's requirements. You can modify these specifications if required.

Active index
The higher the active index of the selected design, the lower the swim effect and the better the design is suited for dynamic visual tasks. In CNXT® select, the display for the active index is under the design triangle. The active index is not an order parameter.

The design points
The design points far (DF) and near (DN) can be moved in defined ranges – for right and left. The design points define the position of the fields of vision and also influence their size.

The value range of the design points refers to the vertical distance to the centring cross. If required, you can modify the position of the design points recommended by Rodenstock at a later stage.

Please note the following conditions for the position of the design points:
– DN at least 2 mm above the lower frame edge,
– DF at least 8 mm below the upper frame edge,
– Progression zone length |DN–DF| ≥13.0 mm

Based on your specifications as well as the frame- and centring data, in addition to the design characteristic, CNXT® select also calculates the design points and automatically takes them into consideration. The design points can also be further modified (Figure 2-7).

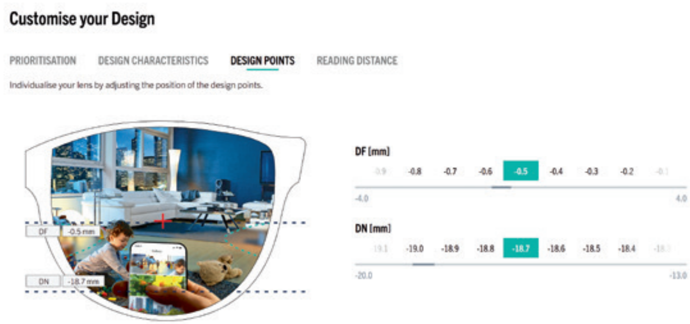


Figure 2-7: Design points, individual design

Design point far DF
This parameter describes the vertical shift of the design point far, i.e., the point through which the customer is optimally corrected for far vision. The DF can be in a range from –4.0 mm to +4.0 mm.

If you move the design point far over the centring cross in order to make the progression zone wider, a “blur” effect may occur in the centring cross of up to +0.25 D due to the progression already starting farther up in the lens.

Design point near DN
This parameter describes the vertical shift of the design point near, i.e., the point through which the customer is optimally corrected for near visual tasks. This should be selected so that your customer can adopt a pleasant gaze reduction. The DN can be in a range from –13.0 mm to –20.0 mm.

Rodenstock calculates the ideal position of the design point near DN based on the frame and centring data you have specified as well as the individual parameters (see Chapter 1.3.1). You also have the option to explicitly state the DN in order to make the head position and gaze reduction ergonomic for the near visual field.

With an increase in the addition, the steep increase in power causes higher aberrations in the periphery of the lens. Therefore, in such a case, it is recommended where possible to base the positioning of DF and DN on the progression zone length (distance DF–DN) of the previous spectacles. Because a parallel reduction of the progression length would also increase the peripheral aberrations.

2.3 MULTIGRESSIV B.I.G. EXACT™ AND MULTIGRESSIV B.I.G. NORM™

In addition to the biometry of the eye, Multigressiv B.I.G. EXACT™ and Multigressiv B.I.G. NORM™ also consider the customer’s lifestyle thanks to the four design types: Active, Allround, Expert and Road.

Standard values are assumed for the individual parameters corneal vertex distance, pantoscopic tilt or face form angle.

The design types have the same design as Impression B.I.G. EXACT™ and Impression B.I.G. NORM™.

Thanks to the spherical-cylindrical power optimisation, with Multigressiv B.I.G. EXACT™ and Multigressiv B.I.G. NORM™, the individual refraction data are directly online on receipt of order and for the entire lens. Therefore, the largest possible vision areas and excellent visual comfort are guaranteed. The other technologies used for Multigressiv B.I.G. EXACT™ and Multigressiv B.I.G. NORM™ can be found in the overview (Table 2-1) and the chapter on technologies (Chapter 1).

2.4 PROGRESSIV B.I.G. EXACT™ AND PROGRESSIV B.I.G. NORM™

The biometry of the eye is also taken into account for Progressiv B.I.G. EXACT™ and Progressiv B.I.G. NORM™. These progressive lenses are offered as design type Allround and are optimised directly online on receipt of order and for the entire lens.

Due to the spherical power optimisation, customers with spherical refraction data in particular benefit from the largest possible fields of vision. The other technologies used for Progressiv B.I.G. EXACT™ and Progressiv B.I.G. NORM™ can be found in the overview (Table 2-1) and the chapter on technologies (Chapter 1).

2.5 PROGRESSIV LIFE

With Progressiv Life you obtain a progressive lens in the entry-level segment which is calculated for the vertex sphere. The basis is a balanced design. For all spherical refraction data, your customers benefit from the largest possible fields of vision thanks to the spherical power optimisation.

The technologies used can be found in the overview (Table 2-1) and the chapter on technologies (Chapter 1).

2.6 FITTING HEIGHT AND LENS DEPTH

There are different fitting heights and lens depths for the individual products due to the variable position of DF (only for the individual design of Impression B.I.G. EXACT™ and Impression B.I.G. NORM™) and variable position of the design point near (DN). Generally for all progressive lenses, attention should be paid that the distance between near reference point and bottom frame edge is at least 2 mm. The distance between centring cross and top frame edge should be at least 8 mm.

This gives the following minimum fitting heights and lens depths:

	Individual design	Design types			
		V	S	M	L
Design point far (DF) [mm]	+4 to –4				
Near reference point (BN) [mm]	–13 to –20	–14 to –20	14	16	18
Progression length [mm][1]	13 to 24	14 to 20	14	16	18
Minimum fitting height [mm]	15 to 22	16 to 22	16	18	20
Minimum lens depth [mm]	23 to 34	24 to 30	24	26	28

Table 2-3: Minimum fitting height and minimum lens depth of Rodenstock progressive lenses

For Impression B.I.G. EXACT™ and Impression B.I.G. NORM™ you can calculate the minimum fitting height and minimum lens depth depending on the position of the design points DF and DN as follows:

Minimum fitting height: |DN| +2 mm
Minimum lens depth: progression length +10 mm

[1] For products for which DF can be ordered: Distance DF to BN.
For products without DF: Distance centring point BZ to BN.

CONTENT

3 NEAR COMFORT LENSES

WHY NEAR COMFORT LENSES?

There are different ways to correct presbyopia. The correction options described below (reading spectacles or progressive lenses) have advantages and disadvantages for near and/or intermediate vision. Only a pair of spectacles with special near comfort lenses offer optimal imaging properties and the best visual comfort for vision at these distances.

Reading spectacles
The easiest way to correct presbyopia is with reading spectacles. However, with reading spectacles, the spectacles wearer can only see sharply in a defined distance range, which decreases with increasing addition.

Figure 3-1: Vision area with reading spectacles at monitor-based workplace

Progressive lenses
Progressive lenses are universal because they make clear vision possible at all distances. The far vision area is particularly large and designed for infinite distances. However, the fields of vision for near and intermediate distances are slightly restricted. This can cause discomfort when working at the computer, for example, as the relatively small field of vision must be compensated by increased head movements.

Figure 3-2: Vision area with progressive lenses at monitor-based workplace

Near comfort lenses
A special near comfort lens offers comfortable vision at near distances. The individual fields of vision of the lens are large enough and ideal for seeing in the different near vision areas. As a result, they make relaxed and fatigue-free vision possible with natural head and body posture.

Figure 3-3: Vision area with near comfort lenses at monitor-based workplace

PORTFOLIO

With the Ergo near comfort lenses from Rodenstock you can optimally assist your customer with computer work, but also with all other near vision activities.

Overview of the Rodenstock near comfort lenses:

The special feature of the Ergo near comfort lenses is the flexibility of the design and the design- and addition-dependent degression. This ensures that the customer, irrespective of their addition, is always guaranteed to be able to see sharply in the same distance ranges with an ergonomic head and body posture.[1,2]

B.I.G. VISION® LENS PORTFOLIO – TECHNOLOGIES

			B.I.G. EXACT™			B.I.G. NORM™			Standard
			Impression B.I.G. EXACT™ Ergo	Multigressiv B.I.G. EXACT™ Ergo	Progressiv B.I.G. EXACT™ Ergo	Impression B.I.G. NORM™ Ergo	Multigressiv B.I.G. NORM™ Ergo	Progressiv B.I.G. NORM™ Ergo	Progressiv Ergo
Rodenstock Proprietary Technologies	DNEye® Technology	Exact biometric eye model	✓	✓	✓				
	AI Technology	AI-based biometric eye model				✓	✓	✓	
	Eye Lens Technology	Effective near astigmatism	✓	✓	✓	✓	✓	✓	✓
		Listing's Law for far and near	✓	✓	✓	✓	✓	✓	✓
		Individual near refraction (optional)	✓	✓	✓	✓	✓	✓	
Rodenstock Innovation Technologies	Individual Lens Technology	CVD, PT, FFA	✓			✓			
		Near distance	✓	✓	✓	✓	✓	✓	
		PD	✓	✓	✓	✓	✓	✓	
	Flexible Design Technology	Individual design	✓			✓			
		Book/PC/Room	✓	✓	✓	✓	✓	✓	✓
	Power optimisation	Quality level for power optimisation	Individual	Spherical-cylindrical	Spherical	Individual	Spherical-cylindrical	Spherical	Spherical
Rodenstock Core Technologies	Degression	Variable/frame-optimised	✓	✓	✓	✓	✓	✓	
		Addition- and design-dependent	✓	✓	✓	✓	✓	✓	✓
	Inset	Individual	✓			✓			
		PD-optimised	✓	✓		✓	✓		
		Power-dependent	✓	✓	✓	✓	✓	✓	✓
	Wavefront calculated in as-worn position		✓	✓	✓	✓	✓	✓	✓
	Freeform produced from finely graduated base curve system		✓	✓	✓	✓	✓	✓	✓
	Simple prism handling		✓	✓	✓	✓	✓	✓	

Table 3-1: Overview of the product properties of the Rodenstock near comfort lenses

Sources:
1 Schwarz, "Nahkomfortgläser – Eine Innovation zum Erleben", Optometrie 03/2009;
2 Schwarz et al., "Mehr Nähe erleben", DOZ 04/2009

3.1 THE DESIGN TYPES OF THE ERGO FAMILY

With the Rodenstock Ergo near comfort lenses, you can offer your customer a lens that matches their individual lifestyle and is optimally adapted to their personal requirements. With all products in the Ergo family, you have the option to choose between the three design types: Book, PC and Room. For Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo, you can also create an individual design yourself.

The following figures show which fields of vision your customer can use with the Ergo design types based on the design, viewing distances and degression. The blue area describes the field of vision which is achieved irrespective of your customer's addition. The grey area is addition-dependent and in the examples is the result of the addition 2.00 D. This area is larger with lower additions. Table 3-4 provides an overview of the maximum distance ranges of the three design types for different reference points and different additions.

Design type Book
The design type Book offers a very wide field of vision when looking at near distances. The fields of vision are ergonomically arranged, thus allowing a comfortable gaze reduction.

Figure 3-4: Design type Book

The design type Book is the right choice for all customers who want an optimal visual experience, e.g., when reading, doing handicrafts or manual work. The design is chosen so that it offers very wide fields of vision in the lens for a working distance of approx. 40 cm to approx. 60 cm. Irrespective of the addition, the customer can see clearly up to approx. 1 m in the upper area of the lens (blue area in Figure 3-5). This is even more with lower additions (grey area in Figure 3-5).

Figure 3-5: Viewing distances with design type Book

Figure 3-5 shows that, with design type Book, occasional work on the PC is also possible.

Design type PC

The design type PC is the right choice for all customers whose focus is in screen distance when working. The design offers very wide fields of vision in the lens for screen distances from approx. 60 cm to approx. 80 cm. Irrespective of the addition, the customer can see clearly up to approx. 1.30 m in the upper area of the lens (blue area in Figure 3-7). This is even more with lower additions (grey area in Figure 3-7).

Figure 3-6: Design type PC

With the design type PC your customer experiences noticeable relief in the neck area and the cervical spine thanks to a physiological and ergonomic design.

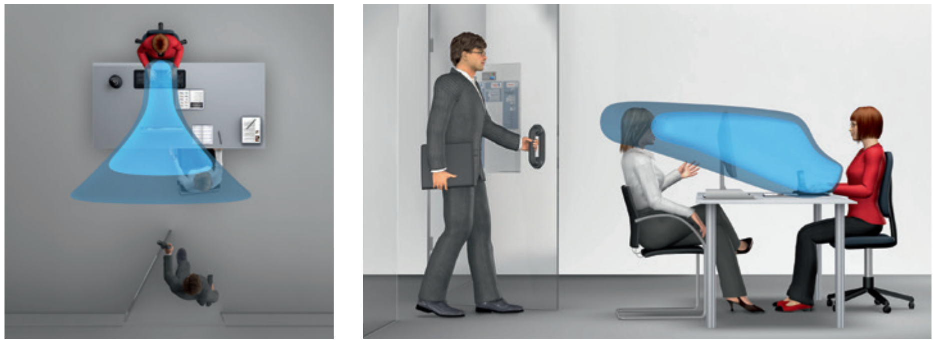


Figure 3-7: Viewing distances with design type PC

Figure 3-7 shows that the entire monitor is seen clearly and also a person sitting opposite (e.g. colleague opposite the desk) is also seen clearly.

Design type Room

The design type Room is the right choice for all customers who want an optimal visual experience indoors. The design is chosen so that it offers the widest fields of vision in the lens for working distances in the room from approx. 1.2 m to 2 m. Irrespective of the addition, the customer can see clearly up to approx. 2.50 m in the upper area of the lens (blue area in Figure 3-9). This is even greater with lower additions (grey area in Figure 3-9).

Figure 3-8: Design type Room

In contrast to the Book and PC design types, the design type Room offers more spatial depth and comfortable vision thanks to wider fields of vision at intermediate distances. Your customer experiences relaxed and fatigue-free vision in the entire room.

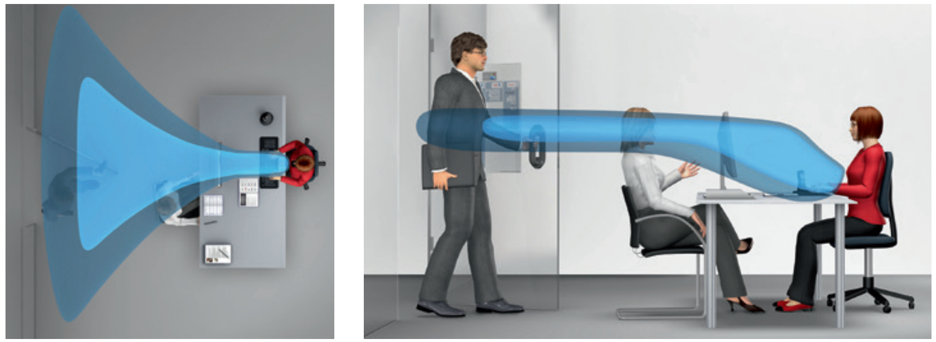


Figure 3-9: Viewing distances with design type Room

3.2 IMPRESSION B.I.G. EXACT™ ERGO AND IMPRESSION B.I.G. NORM™ ERGO

With Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo your customer obtains the maximum fields of vision for near distances as all requirements of the spectacles wearer can be taken into consideration. In addition to the biometry of the eye, the fit of the frame on the customer's face and the personal preferences are also included in the optimisation of the lenses. Thanks to the individual power optimisation, with Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo, the individual refraction data are optimised directly online on receipt of order and for the entire lens. Therefore, the largest possible fields of vision and unique visual comfort are guaranteed. Thanks to the ergonomic arrangement of the fields of vision, relaxed and fatigue-free vision with a natural head and body posture can be guaranteed. You have the option to choose from either the three design types (Book, PC or Room) or decide on an individual design.
Rodenstock CNXT® select helps you to optimally adapt the near comfort lens to your customer's requirements and preferences.

The design triangle
The design triangle in the consulting tool signifies the design flexibility of Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo. Using the position of the circle in the triangle, it is clear where the application focus of the recommended lens design lies. In the following example, a design is shown whose focus is equally in the intermediate and near vision area, i.e., that this customer uses their spectacles mainly at intermediate and short distances. For this reason, the intermediate and near vision areas are particularly generously sized.

Figure 3-10: Individual design of Impression B.I.G. EXACT™ Ergo with focus in intermediate and near vision areas (Image from CNXT® select)

The design characteristic
The main application of Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo is reflected in the design characteristic. It describes the arrangement and size of the fields of vision in the lens. At the same time, the design characteristic also has an impact on the distance ranges and the respective spatial depth. The left number represents the room vision area, the middle number indicates the intermediate vision area and the right number represents the near vision area of the near comfort lens (see Figure 3-10).

The design number can have a minimum value of 0 per distance range and a maximum value of 99. The total of the three design numbers is always 99. The higher the respective design number is, the greater the weighting on the corresponding field of vision.

For a balanced design without application focus, the three design figures would be the same or roughly the same, e.g., 33 / 33 / 33. If there is a clear application focus, this results in a design characteristic, e.g., of 99 / 00 / 00. In the design triangle, this design would be in the "Room" corner. Such "extreme" designs are suitable for special applications and are therefore used rather rarely.
Based on the personal viewing specifications, CNXT® select calculates the design characteristic which best matches your customer's requirements. You can modify this if required.

The design points
The design points middle (DM) and near (DN) can be moved in defined ranges – for right and left together. This has an impact on the size and position of the fields of vision. The size of the design points that can be ordered is the vertical distance relative to the centring cross. If required, you can modify the position of the design points recommended by Rodenstock at a later stage (Figure 3-11).

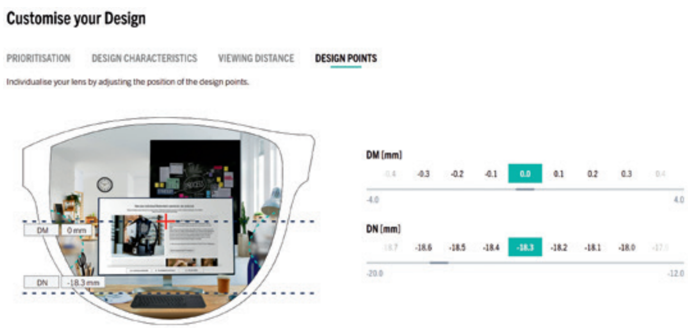


Figure 3-11: The design points DM and DN

Design point Middle
The design point Middle corresponds to the customer's vision point when looking at intermediate distances, e.g., the monitor. In this range the customer is optimally corrected for the intermediate distance.

Design point Near
The design point Near corresponds to the customer's vision point when looking into near. In this range the customer is optimally corrected for near visual tasks and can adopt a pleasant gaze reduction.

Information about the design points:
In the following examples the design points can be moved (relative to the centring cross):
• Design point Middle: +4.0 mm to –4.0 mm
• Design point Near: –12.0 mm to –20.0 mm

The following conditions should be observed:
• DN at least 2 mm above lower frame edge
• Minimum distance DM–DN: 13 mm
• Recommendation: DM ideally 10 mm below top frame edge

The change of the position of the "Middle" and "Near" design points is reflected in a reduction or extension of the degression. This also has impacts on the size of the fields of vision and the transitions between the central and peripheral fields of vision. If your customer prefers, e.g., a particularly wide intermediate vision area, in addition to the weighting of the intermediate range by means of the design characteristic, the DM can also be moved up and the DN down. The majority of the power decrease takes place between DN and DM. A further power decrease takes place above the DM, until the corresponding power is achieved for the main viewing distance "Room".

Based on the personal viewing preferences, in addition to the design characteristic, CNXT® select also calculates the design points and automatically takes them into consideration depending on the frame and centring data entered. The design points can also be further modified.

The main viewing distances
The main viewing distances Room, Middle, Near are the result of the selected design and addition. In addition, for Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo, the main viewing distances can be flexibly adapted to the needs of your customer. Two of three distances are variable, the third distance is automatically determined. Therefore, the individual ergonomic aspects, such as the monitor-based workplace, can be taken into consideration.

The three main viewing distances Room, Middle and Near are variable in the following value ranges:
Main viewing distance Near: 20 to 60 cm
Main viewing distance Middle: 40 to 150 cm
Main viewing distance Room: 60 to 300 cm

The main viewing distances, Middle and/or Near, are assigned to the design points DM and DN, with the corresponding power taking place there in the lens. The main viewing distance Room is achieved in the uppermost area of the lens, 8 mm above the design point Middle.

Further information about the scope of performance of Impression B.I.G. EXACT™ Ergo and Impression B.I.G. NORM™ Ergo can be found in Table 3-1: Overview of the product properties of the Rodenstock near comfort lenses.

3.3 MULTIGRESSIV B.I.G. EXACT™ ERGO AND MULTIGRESSIV B.I.G. NORM™ ERGO

The Multigressiv B.I.G. EXACT™ Ergo and Multigressiv B.I.G. NORM™ Ergo near comfort lenses are available in the design types: Book, PC and Room. Apart from the biometry of the eye, the customer's pupil distance is also included in the optimisation of the lenses. For the fit of the frame on the customer's face, standard values are assumed for face form angle, pantoscopic tilt and corneal vertex distance. Thanks to the spherical-cylindrical power optimisation, with Multigressiv B.I.G. EXACT™ Ergo and Multigressiv B.I.G. NORM™ Ergo, the individual refraction data are optimised directly online on receipt of order and for the entire lens. Therefore, the largest possible viewing ranges and excellent visual comfort are guaranteed. Thanks to the ergonomic arrangement of the fields of vision, relaxed and fatigue-free vision with a natural head and body posture can be guaranteed.

The other technologies used for Multigressiv B.I.G. EXACT™ Ergo and Multigressiv B.I.G. NORM™ Ergo can be found in the overview (Table 3-1) and the chapter on technologies (Chapter 1).

3.4 PROGRESSIV B.I.G. EXACT™ ERGO AND PROGRESSIV B.I.G. NORM™ ERGO

Like all lenses in the Ergo family, Progressiv B.I.G. EXACT™ Ergo and Progressiv B.I.G. NORM™ Ergo are also available in the three design types: Book, PC and Room. In addition to the biometry of the eye, the customer's pupil distance is also taken into account for Progressiv B.I.G. EXACT™ Ergo and Progressiv B.I.G. NORM™ Ergo. For the fit of the frame on the customer's face, standard values are assumed for face form angle, pantoscopic tilt and corneal vertex distance.
Due to the spherical power optimisation, customers with spherical refraction data in particular benefit from the largest possible fields of vision.
The other technologies used for Progressiv B.I.G. EXACT™ Ergo and Progressiv B.I.G. NORM™ Ergo can be found in the overview (Table 3-1) and the chapter on technologies (Chapter 1).

3.5 PROGRESSIV ERGO

With Progressiv Ergo, you obtain a near comfort lens in the entry-level segment which is calculated for the vertex sphere. Progressiv Ergo is also offered in the three design types: Book, PC and Room. For all spherical refraction data, your customers benefit from the largest possible fields of vision thanks to the spherical power optimisation.

The technologies used can be found in the overview (Table 3-1) and the chapter on technologies (Chapter 1).

3.6 FITTING HEIGHT AND LENS DEPTH

The distance from the design point middle to the top edge of the frame should ideally be 10 mm for all Ergo near comfort lenses. The distance from the near reference point or design point near to the lower edge of the frame should be at least 2 mm.

This gives the following minimum fitting heights and lens depths:

	B.I.G.				Standard		
	Near comfort lenses				Near comfort lenses		
	Individual design	Design types			Design types		
		Book	PC	Room	Book	PC	Room
Design point middle [mm]	+4 to -4						
Near reference point [mm]	–12 to –20	–14 to –20	–14 to –20	–14 to –20	–14	–18	–18
Minimum fitting height [mm]	14 to 22	16 to 22	16 to 22	16 to 22	16	20	20
Minimum lens depth [mm]	25 to 36	26 to 32	26 to 32	26 to 32	26	30	30

Table 3-2: Recommended minimum fitting height and minimum lens depth of Rodenstock near comfort lenses

3.7 ADVANTAGES OF A DESIGN- AND ADDITION-DEPENDENT DEGRESSION

Viewing height for near comfort lenses

Near comfort lenses which have few fixed degressions for the entire addition range have a decisive disadvantage: Depending on the age or the addition of the spectacles wearer, there are different viewing heights in the lens for certain viewing distances. This means that, for example, the main viewing distance to the monitor does not always overlap with the originally designed, widest field of vision in the lens. In addition, head posture and gaze reduction must be adapted to the lens. An ergonomic head and body posture can thus not always be guaranteed.

Figure 3-12: Difference between fixed and design- and addition-dependent degression

Figure 3-12 shows the different viewing heights for a customer, which may occur with a change of lens. In the example the customer changes from addition 1.00 D to 1.50 D and orders the same degression of 0.80 D, as this lens is only offered in this degression. For the low addition of 1.00 D the degression 0.80 D is too high; as a result, your customer already achieves the desired viewing distance of 80 cm in the intermediate vision area. In this viewing height the customer has significant restrictions in the fields of vision (Figure 3-12). In addition, you customer may not be able to adopt a relaxed head and body posture.

The degression of 0.80 D matches the addition 1.50 D better as the viewing height for 80 cm overlaps with the widest fields of vision in the lens. As a result, a pleasant head and body posture is also guaranteed at the desired working distance. However, the customer must get used to the modified viewing height.

With their variable degression the lenses in the Ergo family ensure that the fields of vision are ergonomically arranged for every addition and the spectacles wearer can always adopt their natural head and body posture.

The variable degression is calculated on the basis of the customer's addition and depends on the selected design type. It is maximum 2.50 D depending on the addition in order to ensure larger fields of vision compared to progressive lenses.
The different degressions are shown in the following table:

Addition [D]	1.25	1.5	1.75	2	2.25	2.5	2.75	3
Design type Book								
Degression [D]	0.7	0.8	0.9	1.1	1.2	1.4	1.6	1.9
Design type PC								
Degression [D]	0.8	1	1.1	1.3	1.5	1.6	1.9	2.1
Design type Room								
Degression [D]	1	1.2	1.4	1.6	1.8	2	2.3	2.5

Table 3-3: Degression table of Ergo design types Book, PC and Room

The degressions of the three Ergo design types are designed so that at the main working distances, maximum field of vision widths are achieved and the peripheral aberrations are reduced to a minimum. The degressions correspond to the power difference in as-worn position between the near reference point and the viewing height 8 mm above the centring cross. Therefore, minor deviations to the reference values on the lens envelope are possible.

The distance ranges of the Ergo design types

With the design- and addition-dependent degression of the Ergo near comfort lenses, your customer benefits from ergonomic head and body posture, while the same viewing heights as well as the same viewing distance ranges are always guaranteed for the selected focal point of the work.

When viewing at finite distances, the spectacles wearer converges to the near object. This is also accompanied by the accommodation which is linked to the convergence via the convergence reflex. With higher additions, the accommodation that your customer can apply becomes smaller. For higher additions from 2.50 D, you can simply calculate the power that you need for the simulation of the field of vision by using the reciprocal value. For additions less than 2.50 D, it is necessary to subtract the amount of the accommodation from the power in the reciprocal value. The new value can then be used to simulate the field of vision.

At what distances your customer can see clearly with the Ergo near comfort lenses depends on the design and addition. Table 3-4 shows the addition-dependent distance ranges which can be achieved with the three design types Book, PC and Room.
The following assumptions are made for the fields of vision shown:

In the upper area of the lens
The low accommodation in the room area is ignored for the specified distances in the upper area of the lens.

At height of centring cross
At the height of the centring cross, a low accommodation is considered in the room area for the specified distances, which result from the stored object distance.

In the near vision area
The distances in the near vision area relate to the fact that your customer accommodates to the maximum level.

Addition [D]	1.25	1.5	1.75	2	2.25	2.5	2.75	3
Design type Book								
In the upper area of the lens up to (max.) [m]	1.8	1.4	1.2	1.1	1	1	1	1
At height of centring cross up to [m]	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
In near vision area up to (min.) [m]	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3
Design type PC								
In the upper area of the lens up to (max.) [m]	2.2	1.9	1.6	1.4	1.3	1.3	1.3	1.3
At height of centring cross up to [m]	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
In near vision area up to (min.) [m]	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3
Design type Room								
In the upper area of the lens up to (max.) [m]	3.8	3.2	2.7	2.5	2.5	2.5	2.5	2.5
At height of centring cross up to [m]	1	1	1	1	1	1	0.9	0.9
In vision area up to (min.) [m]	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3

Table 3-4: Maximum distance ranges of the three design types

When it comes to determining powers at certain reference points for near comfort lenses, the design type, addition and object distance, as well as the accommodation used, must always be considered. The following example should clarify this connection:

Design type PC, Addition 1.50 D

Table 3-4 shows that a customer with the design type PC and an addition of 1.50 D can see clearly at the height of the centring cross (BZ) up to approx. 0.8 m. If the power is now calculated from this distance of 0.8 m by means of a reciprocal value, the result is a value of 1.25 D. If this value is used for the simulation, the customer would also still accommodate and the power would be too high. Therefore, an amount for the residual accommodation must be subtracted from the 1.25 D.

How can the residual accommodation be estimated?
Unless otherwise specified in the order, the near vision area is designed for additions up to 2.50 D for a near object distance of 40 cm. The power for this near object distance is 2.50 D. In the above example, the customer receives an addition of 1.50 D. If this value is subtracted from the power required for the near object distance, a residual accommodation to be applied by the spectacles wearer for near vision of 1.00 D remains. For the optimisation of the lenses, a linear model for the respective object distances is stored in the lens. For the calculation of the residual accommodation at the height of the centring cross (BZ), you can assume approximately half of the residual accommodation for near vision area for the underlying intermediate distance. For the example above, this would be approx. 0.50 D.

Residual accommodation for near = Near object distance [D] – Addition [D]
Residual accommodation for near = 2.50 D – 1.50 D = 1.00 D

Residual accommodation at height of centring cross:

$$\frac{\text{Near object distance [D]} - \text{Addition [D]}}{2}$$

$$\frac{2.50\ \text{D} - 1.50\ \text{D}}{2} = 0.50\ \text{D}$$

The residual accommodation of 0.50 D must now be subtracted from the value of 1.25 D, which has already been calculated. The result is a value of 0.75 D. You can use this power for the simulation of the viewing distance.

Power for the simulation at height of centring cross

$$\frac{1}{\text{Distance range BZ [m]}} - \text{Residual accommodation BZ [D]}$$

$$\frac{1}{0.80\ \text{m}} - 0.50\ \text{D} = 0.75\ \text{D}$$

You can estimate the respective power for the simulation based on this method for all Ergo near comfort lenses. The distances for the individual design are displayed in CNXT® select.

3.8 SCREEN WORK

3.8.1 Ergonomics at monitor-based workplace
The ideal lens for the monitor-based workplace offers accommodation support for looking at the keyboard and screen and guarantees a natural head posture and gaze reduction as well as adequately large fields of vision for all relevant distances. Individual near comfort lenses can be specially adapted to the respective workplace situation with regard to the main focus at work, main viewing distances and viewing direction. The anti-reflection coating of the lenses is particularly important in office environments as many annoying reflections can occur from the numerous different light sources.

Information for ergonomic screen work:

- Set the position of the monitor so that the top character row is well below eye height and the monitor level is perpendicular to the line of view. This relieves your shoulders and neck. In addition, it is easier for your eyes to adapt to close objects when your head is lowered slightly.
- Adapt the font size on your monitor so that you can read everything comfortably and without strain.
- Look away from the screen now and again, e.g., out the window. Short breaks are important for relaxing the eye muscles and the ciliary body and have been proven to increase productivity.
- The blink rate lowers for near work by up to 40%. Therefore, make sure you blink regularly to avoid dry eyes. 15–20 blinks per minute can be used as a benchmark.
- Drink adequate fluids! Also regular and deliberate closing of the eyes for a few seconds helps as the eyes are well moistened again.

3.9 INFORMATION ABOUT ROADWORTHINESS

All Rodenstock near comfort lenses are not suitable for use on the road as they do not provide full correction for distance.

CONTENT

4 SINGLE VISION LENSES

The following table provides an overview of the Rodenstock single vision lenses:

B.I.G. VISION® LENS PORTFOLIO – TECHNOLOGIES			B.I.G. EXACT™			B.I.G. NORM™			Standard	
			Impression B.I.G. EXACT™ Mono / Mono+	Multigressiv B.I.G. EXACT™ Mono / Mono+	Cosmolit B.I.G. EXACT™ Mono / Mono+	Impression B.I.G. NORM™ Mono / Mono+	Multigressiv B.I.G. NORM™ Mono / Mono+	Cosmolit B.I.G. NORM™ Mono / Mono+	Cosmolit	Perfalit
Rodenstock Proprietary Technologies	DNEye® Technology	Exact biometric eye model	✓	✓	✓					
	AI Technology	AI-based biometric eye model				✓	✓	✓		
	Eye Lens Technology	Effective near astigmatism	✓	✓	✓	✓	✓	✓		
		Listing's Law for far and near	✓	✓	✓	✓	✓	✓		
Rodenstock Innovation Technologies	Individual Lens Technology	CVD, PT, FFA	✓			✓				
		PD	✓	✓	✓	✓	✓	✓		
	Power optimisation	Quality level for power optimisation	Individual	Spherical-cylindrical	Spherical	Individual	Spherical-cylindrical	Spherical		
Rodenstock Core Technologies	Accommodation support (Mono+)	0.5 D/0.8 D/1.1 D	✓	✓	✓	✓	✓	✓		
	Surface design	Sph. front surface/atoric back surface	✓	✓	✓	✓	✓	✓		
		Asph. front surface/sph or toric back surface							✓	
		Sph. front surface/sph or toric back surface								✓
	Wavefront calculated in as-worn position		✓	✓	✓	✓	✓	✓		
	Freeform produced with finely graduated base curve system		✓	✓	✓	✓	✓	✓		
	Simple prism handling		✓	✓	✓	✓	✓	✓		

Table 4-1: Overview of the product properties of the Rodenstock single vision lenses

4.1 OPTIMISATION OF B.I.G. EXACT™ AND B.I.G. NORM™ SINGLE VISION LENSES

Far and near
Most conventional single vision lenses are calculated for a defined object distance in the distance reference point. This is generally the object distance for far (infinite). The spectacles wearer is fully corrected when looking through the distance reference point. However, there are aberrations when looking through the peripheral zone of the lens or the near vision area, which may be annoying due to blurred effects, especially in the case of people with very high ametropia.

The optimisation of the Rodenstock B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses is realised for different object distances from far to near. The effective near astigmatism and Listing's Law for far and near vision can also be taken into consideration. This results in the largest possible error-free vision areas, even when looking at near distances.

Consideration of the pantoscopic tilt
The pantoscopic tilt is considered for the optimisation of B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses. The individually measured pantoscopic tilt is included in the calculation of the single vision lenses of the Impression® family. Standard values are used for the pantoscopic tilt for the Multigressiv® Mono/Mono+ and Cosmolit Mon /Mono+ single vision lenses.

All B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses are fitted for zero gaze direction and habitual head and body position.

4.2 IMPRESSION B.I.G. EXACT™ MONO/MONO+ IMPRESSION B.I.G. NORM™ MONO/MONO+

The individual single vision Impression B.I.G. EXACT™ Mono/Mono+ and Impression B.I.G. NORM™ Mono/Mono+ also take into account the fit of the frame on the customer's face in addition to the biometry of the eye. In addition, the refraction data are optimised directly online on receipt of order and for the entire lens thanks to the individual power optimisation.
The Impression B.I.G. EXACT™ Mono/Mono+ and Impression B.I.G. NORM™ Mono/Mono+ single vision lenses are also optimised for far and near vision. The different gaze reductions and object distances are considered, looking from far to near. For instance, the lens can be optimally calculated with regard to effective near astigmatism and Listing's Law for far and near. The results are the largest possible fields of vision and unique visual comfort.

The Mono+ version has slight accommodation support of either +0.50 D, +0.80 D or +1.10 D in the lower area of the lens and is therefore perfect for spectacles wearers between 25 and 45 years old who want greater visual comfort at near distances. Mono+ customers in the pre-presbyopia age or at the start of presbyopia benefit from the consideration of the near effective astigmatism. This effect is all the greater, the stronger the accommodation is. Furthermore, the axes of the lens are adapted to the natural eye movements for distance and near vision according to Listing's Law. This leads to up to 25% better vision at near and intermediate distances.

With the Mono+ demo box from Rodenstock (Order No. 70009517), your customer can easily find out themselves which version is more pleasant for them. The demo box includes a reading test as well as a special spectacle tool with +0.50 D, +0.80 D and +1.10 D, which is used in combination with the customer's distance spectacles.

In accordance with EN ISO 21987:2017 (D), the Mono+ lenses are power-variable lenses with one reference point.

The other technologies used for Impression B.I.G. EXACT™ Mono/Mono+ and Impression B.I.G. NORM™ Mono/Mono+ can be found in the overview (Table 4-1) and the chapter on technologies (Chapter 1).

Figure 4-1: Impression B.I.G. NORM™ Mono

4.3 MULTIGRESSIV B.I.G. EXACT™ MONO/MONO+ MULTIGRESSIV B.I.G. NORM™ MONO/MONO+

The single vision lenses Multigressiv B.I.G. EXACT™ Mono/Mono+ and Multigressiv B.I.G. NORM™ Mono/Mono+ take into account the biometry of the eye. Thanks to the spherical-cylindrical power optimisation, your customer's refraction data are only optimised online on receipt of order and for the entire lens. For the fit of the frame on the customer's face, standard values are assumed for face form angle, pantoscopic tilt and corneal vertex distance.

Through the optimisation for far and near vision, the different gaze reductions and distances resulting from looking at near distances are taken into consideration for Multigressiv B.I.G. EXACT™ Mono/Mono+ and Multigressiv B.I.G. NORM™ Mono/Mono+. The largest possible fields of vision and superb visual comfort are guaranteed as the effective near astigmatism and Listing's Law for far and near vision can also be taken into consideration.

The Mono+ version has slight accommodation support of either +0.50 D, +0.80 D or 1.10 D in the lower area of the lens.

The other technologies used for Multigressiv B.I.G. EXACT™ Mono/Mono+ and Multigressiv B.I.G. NORM™ Mono/Mono+ can be found in the overview (Table 4-1) and the chapter on technologies (Chapter 1).

Figure 4-2: Multigressiv B.I.G. NORM™ Mono

4.4 COSMOLIT B.I.G. EXACT™ MONO/MONO+ COSMOLIT B.I.G. NORM™ MONO/MONO+

The single vision lenses Cosmolit B.I.G. EXACT™ Mono/Mono+ and Cosmolit B.I.G. NORM™ Mono/Mono+ also take into account the biometry of the eye like all B.I.G. EXACT™ and B.I.G. NORM™ lenses. Due to the spherical power optimisation, customers with spherical refraction data in particular benefit from the largest possible fields of vision. For the fit of the frame on the customer's face, standard values are assumed for face form angle, pantoscopic tilt and corneal vertex distance.
Through the optimisation for far and near vision, the different gaze reductions and distances resulting from looking at near distances are taken into consideration for Cosmolit B.I.G. EXACT™ Mono/ Mono+ and Cosmolit B.I.G. NORM™ Mono/Mono+. As a result, the Cosmolit B.I.G. EXACT™ Mono/Mono+ and Cosmolit B.I.G. NORM™ Mono/Mono+ lenses are also optimised with regard to effective near astigmatism and Listing's Law for far and near.

The Mono+ version also has slight accommodation support of either +0.50 D, +0.80 D or +1.10 D in the lower area of the lens.

The other technologies used for Cosmolit B.I.G. EXACT™ Mono/Mono+ and Cosmolit B.I.G. NORM™ Mono/Mono+ can be found in the overview (Table 4-1) and the chapter on technologies (Chapter 1).

Figure 4-3: Cosmolit B.I.G. NORM™ Mono

4.5 COSMOLIT/COSMOLUX AND PERFALIT/PERFALUX

Cosmolit/Cosmolux and Perfalit/Perfalux are designed for far vision and are calculated for the vertex sphere. Your customer's refraction data are calculated in the reference point. The periphery of the lens is not optimised.

Cosmolit (organic) and Cosmolux (mineral) are proven single vision lenses with aspherical front surface and spherical/toric back surface. For plus powers, the self-magnification is reduced up to 30% compared to a spherical lens due to the special surface design. Aspheres not only offer better imaging properties than spheres, but are also slimmer and have cosmetic advantages.

Perfalit (organic) and Perfalux (mineral) are the proven single vision lenses in the entry-level segment from Rodenstock. They are available in a comprehensive range of materials as well as in a very large power range.

Figure 4-4: Cosmolit (left) and Perfalit (right)

Cosmolit/Cosmolux as well as Perfalit/Perfalux have to be fitted according to the eye rotation requirement.

4.6 FITTING HEIGHT AND LENS DEPTH

A minimum fitting height of 18 mm is recommended on the basis of the optimisation of the B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses. For Mono+, the full accommodation support is achieved 18 mm below the centring cross.

CONTENT

5 SPORT

The Rodenstock sport lenses are designed so that they also achieve the best possible imaging properties during dynamic activities.

B.I.G. VISION® LENS PORTFOLIO – TECHNOLOGIES

			B.I.G. EXACT™		B.I.G. NORM™		Standard	
			Impression B.I.G. EXACT™ Sport	Impression B.I.G. EXACT™ Mono Sport	Impression B.I.G. NORM™ Sport	Impression B.I.G. NORM™ Mono Sport	Progressiv Sport	Perfalit Sport
Rodenstock Proprietary Technologies	DNEye® Technology	Exact biometric eye model	✓	✓				
	AI Technology	AI-based biometric eye model			✓	✓		
	Eye Lens Technology	Effective near astigmatism	✓		✓		✓	
		Listing's Law for far and near	✓		✓		✓	
		Individual near refraction (optional)	✓		✓			
Rodenstock Innovation Technologies	Individual Lens Technology	PD, CVD, PT, FFA	✓	✓	✓	✓		
		PD and FFA					✓	✓
	Flexible Design Technology	Individual DF	✓	✓	✓	✓		
	Power optimisation	Quality level for power optimisation	Individual	Individual	Individual	Individual	Spherical-cylindrical	Spherical-cylindrical
Rodenstock Core Technologies	Inset	Individual	✓		✓			
		PD - optimised	✓		✓			
		Power-dependent	✓		✓		✓	
	Wavefront calculated in as-worn position		✓	✓	✓	✓	✓	✓
	Freeform produced with finely graduated base curve system		✓	✓	✓	✓	✓	✓
	Simple prism handling		✓	✓	✓	✓		

Table 5-1: Overview of the product properties of the Rodenstock sport spectacles

5.1 SPECIAL FEATURES OF SPORT SPECTACLES

For functional reasons, sport spectacles are generally more curved than normal spectacles. The frame plane does not overlap with the lens plane. The resulting angle between the two planes is called the face form angle (FFA) (see Figure 5-1).

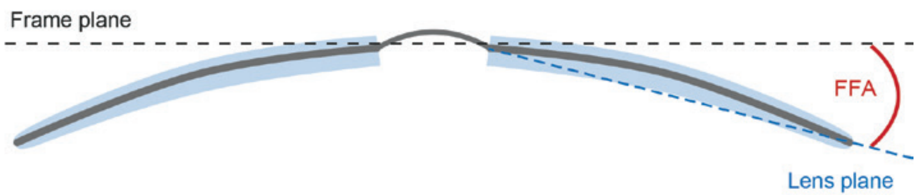


Figure 5-1: The face form angle

Due to the larger face form angle, the stronger curvature of the lenses and depending on the frame and centring data, there is a certain tilt angle of the lenses in front of the customer's eyes. The tilt angle corresponds approximately to the face form angle when the viewing point coincides with the geometric centre of the lens. The greater the distance between these two points, the greater the difference is between the tilt angle of the lenses and the face form angle (see Figure 5-2). If the tilt angle is not considered, prismatic side effects, aberrational astigmatism and refraction errors occur.

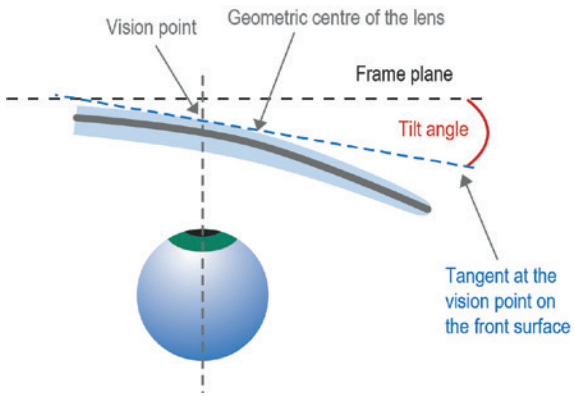


Figure 5-2: The tilt angle

There is also a different ray path for tilted lenses than for non-tilted lenses. The main ray is not perpendicular to the anterior surface of the lens in the zero gaze direction sight line. This results in modified dioptric power at the main viewing point. In order for the visual axis to run through the reference point of the lens, the lens is made with a prism depending on the tilt and the vertex power of the lens (see Figure 5-3).

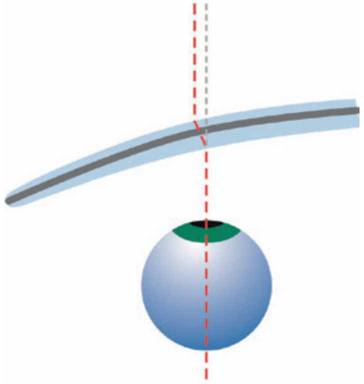


Figure 5-3: Main ray through sport lens

As this prism, as well as the thickness reduction prism, are not used to correct the eye position errors, the lens cannot be decentred, but must be centred exactly for z and y according to the values specified on the lens bag (also see Chapter 6).

The aberrations are reduced to a minimum through the consideration of these particular circumstances for spectacles with increased curvature. As a result, the sport lenses from Rodenstock offer your customers optimal visual comfort and aesthetics[1].

Source:
1 I. I. Schwarz et al., “Was unterscheidet Sportbrillengläser von normalen Brillengläsern”, Optometrie 03/2005

5.2 SPORT PROGRESSIVE LENSES

5.2.1 Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport

Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport are individual progressive lenses, which were developed specially for dynamic visual requirements and for which it comes down to large, wide fields of vision free of distortion. In addition to the biometry of the eye, the fit of the frame on the customer’s face is also included in the optimisation of the lenses. Thanks to the individual power optimisation, with Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport the individual refraction data are optimised directly online on receipt of order and for the entire lens. Therefore, the largest possible fields of vision and unique visual comfort are guaranteed.

For most sports activities, short viewing distances play a minor role. But medium viewing distances up to approx. 60 cm (e.g., distance from eye to tachometer when cycling) are important. For this reason, the near vision area of Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport is designed for a near distance of approx. 60 cm. The larger near distance results in a smaller addition. This has a positive effect on the amount of peripheral aberrations and leads to an increase in the fields of vision as well as significantly reduced swing movements. Ordering is realised like for a normal progressive lens with the refraction data for distance and addition (calculated for 40 cm). With the design for near distance of approx. 60 cm, the reference values for the addition on the lens bag may deviate more from the order values than for normal progressive lenses (see Chapter 6).

Figure 5-4: Fields of vision using the example of Impression B.I.G. NORM™ Sport

The technologies used can be found in the overview (Table 5-1) and the chapter on technologies (Chapter 1).

The design point far (DF)
With Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport you have the option to adapt the progressive lens to the vision requirements for your customer's respective sport. The design point far describes the point through which the customer is optimally corrected when looking into the distance and which corresponds to their personal viewing habits. The DF can be ordered in a range from 0 mm to +4.0 mm. If you do not submit any DF with your order, it is included as 0 mm in the further calculation of the sport spectacles.

The anamnesis plays a huge role in determining the position of the design point far. If your customer rides a racing bike, for example, the head posture is completely different to that when jogging or playing golf. Ask your customer to simulate their head and body posture when practising their sport. Then you can assess by what amount the design point far should be shifted.

Figure 5-5: Example of deviating DF when racing a bike

The near reference point (BN)
The near reference point is at a fixed position at –18 mm below the centring point for Impression B.I.G. EXACT™ Sport and Impression B.I.G. NORM™ Sport and is not variable.

The fixed position of the near reference point at –18 mm results in a longer progression when you move the DF. As a result, the peripheral astigmatic peripheral astigmatism in the lens and any perceived "swim" effects are less. The longer progression thus guarantees good compatibility of the sport lenses.

5.2.2 Progressiv Sport

With Progressiv Sport, you obtain a sport progressive lens in the entry-level segment, which is calculated for the vertex sphere. The design of Progressiv Sport is characterised by a large far vision area. In addition, the intermediate vision area is wider in order to ensure a distortion-free transition to the periphery and minimise “swim” effects. Owing to the special features of the sport spectacles (high FFA, high base curve, etc.), the refraction data both for the reference points and for the entire lens are included in the optimisation online for Progressiv Sport. This ensures the largest possible fields of vision during sport activities.

Ordering is also realised for Progressiv Sport with the refraction data for distance and addition (calculated for 40 cm). As also for Progressiv Sport, the near vision area is designed for a near distance of approx. 60 cm, the addition in the lens is smaller and the reference values for the addition on the lens bag may deviate more from the order values than for normal progressive lenses (further information can be found in Chapter 6).

Figure 5-6: Fields of vision using the example of Progressiv Sport

The technologies used can be found in the overview (Table 5-1) and the chapter on technologies (Chapter 1).

5.3 SPORT SINGLE VISION LENSES

5.3.1 Impression B.I.G. EXACT™ Mono Sport and Impression B.I.G. NORM™ Mono Sport

The individual single vision lenses Impression B.I.G. EXACT™ Mono Sport and Impression B.I.G. NORM™ Mono Sport also take into account the fit of the frame on the customer’s face in addition to the biometry of the eye. The freeform back surface is calculated at every single viewing point and taking into consideration the individual parameters. As a result, Impression B.I.G. EXACT™ Mono Sport and Impression B.I.G. NORM™ Mono Sport offer the best imaging quality across the entire surface through to the frame edge and maximum visual comfort for all discerning and active spectacles wearers with curved sporty frames.

The Impression B.I.G. EXACT™ Mono Sport and Impression B.I.G. NORM™ Mono Sport lenses are calculated for distance. The far vision area can be optimised for these products for a sport-dependent main viewing direction. For this, you can use the variability of the design point far.

The design point far

The design point far describes the point through which the customer is optimally corrected when looking into the distance and which corresponds to their personal viewing habits. Also for Impression B.I.G. EXACT™ Mono Sport and Impression B.I.G. NORM™ Mono Sport, the design point far can be shifted in a range from 0 mm to +4.0 mm. If you do not submit any design point far with your order, it is included as 0 mm in the further calculation of the sport spectacles.

Figure 5-7: Fields of vision using the example of Impression B.I.G. NORM™ Mono Sport

5.3.2 Perfalit Sport

With Perfalit Sport Rodenstock has a proven single vision lens in the portfolio for active spectacles wearers. This lens was adapted to the special geometry of sport lenses and is therefore more curved than normal single vision lenses. The Perfalit sport lenses are designed for far vision and are calculated for the vertex sphere.

With the Perfalit Sport lenses, the refraction data are optimised directly online on receipt of order and for the entire lens thanks to the power optimisation. This ensures the largest possible fields of vision during sport activities.

5.4 FITTING HEIGHT AND LENS DEPTH

Please ensure that the distance between near reference point and lower edge of the frame is at least 2 mm. The distance between design point far (DF) and top frame edge should be at least 8 mm. This gives the following fitting heights and lens depths:

	B.I.G.		Standard	
	Impression B.I.G. EXACT™/ B.I.G. NORM™ Sport	Impression B.I.G. EXACT™/ B.I.G. NORM™ Mono Sport	Progressiv Sport	Perfalit Sport
Design point far [mm]	0 to +4 mm	0 to +4 mm		
Near reference point [mm]	–18 mm		–18 mm	
Progression length [mm]	18 to 22 mm		18 mm	
Minimum fitting height [mm]	20 to 24 mm		20 mm	
Minimum lens depth [mm]	28 to 32 mm		28 mm	

Table 5-2: Fitting height and lens depth

5.5 CALCULATION OF FRAME DATA OF SPORT SPECTACLES

Information about determining the lens shape
In addition to the individual parameters, Rodenstock also requires the frame and centring data according to box dimensions for optimal correction.

Frame data:
- Lens shape
- Lens length, lens depth (according to box size)

Centring data (according to box size):
- Centring point distance
- Centring point height

Information about determining the lens shape during tracing:
Frames with face form angles (FFA) from roughly 10° can often not be scanned on both sides as the sensor pin slips from the groove in most tracers.
For one-sided tracing, these frames must be clamped diagonally in the tracer. However, with this inclined scanning, the distance between the lenses (Dbl) is not recorded. In order to prevent errors during the data transmission, we recommend checking the distance between the lenses, lens length and lens depth and adapt them if necessary.

The inclined tracing is more accurate for the subsequent processing as the grinding machine must grind the lens in the true size in the lens plane during the edge treatment. The scanned lens horizontal must correspond to the frame horizontal in order to avoid axis errors. Please ensure that you use the centring data z and y on the lens bag for centring the lenses (see Chapter 6).

Manual recording and transmission of lens shape
The frame is displayed on the order form so that the lens shape can be copied at a vertical projection on the lens plane. The frame must be aligned so that the geometric centre of the lens shape overlaps with the intersection point of the coordinate axis (see Figure 5-8).


Figure 5-8: Copying the lens shape of a sport frame

The lens can also be copied. The lens is displayed with the back surface on the order form and the shape of the frame is outlined with a pen. Also here, the frame must be aligned so that the geometric centre of the lens overlaps with the intersection point of the coordinate axis (see Figure 5-9). Before positioning the lens on the order form, the lens is usually marked with a horizontal auxiliary line when it is still in the frame. If you are using the focimeter for this, please ensure that the lens is held down by the lever so that it does not lead to a rotation of the lens horizontal. This also applies for the final check.


Figure 5-9: Copying the lens shape with help of the lens

As distortions may occur when plotting the lens shape, Rodenstock also requires the box dimensions for checking.

5.6 CENTRING CHECK

To check the correct centring during the handover of the spectacles to the customer the exact positioning of the centring point in front of the centre of the customer’s pupil is usually checked. For very curved sport spectacles, there is an offset of the centre of the pupil to the centring point as a result of the tilting of the lens, which in a first approximation behaves like the parallel shift of a plane-parallel plate. In addition, this effect is increased by the prismatic deflection of the inclined lens. This offset can be over 1.0 mm depending on the centre thickness, material of the lens and face form angle values. When checking the centring with the spectacles on, the centring point is not in the centre of the pupil as this is moved to the outside. You can check the centring point distance by remeasuring it after grinding in the frame plane across the distance of the two centring points of the stamp, e.g., with a PD measuring ruler.

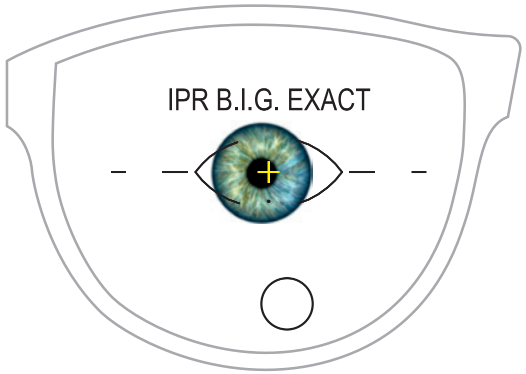


Figure 5-10: Diagram for checking the glazed lenses

5.7 BASE CURVE

In general, sport spectacles not only have a higher face form angle, but are also more curved in the lens plane. In order for a sport lens to be integrated in the sports frame, it should have a curvature of the anterior surface appropriate for the frame or a base curve.

With the Rodenstock sport lenses, it is mandatory to specify the base curve when ordering. The specification is used as a base curve preference for the further calculation at Rodenstock. The optical and technical feasibility is checked with this base curve preference in combination with other parameters such as the refraction data or the face form angle. For plus powers, high base curves are generally not problematic as the front surface must be more curved due to the required power. For minus powers the front surfaces are flatter. Here a high base curve of, e.g., 8 D cannot be guaranteed in every case. However, the most flexible base curve possible is always realised.

5.8 LENS GEOMETRY

With an increasing base curve, the overall height of the lens also increases. As a result, the lens appears subjectively thicker. Due to the high front surface curvature, there is a greater self-magnification of the lenses.

Table 5-3 shows the influence of the base curve on the overall height.
The basis of this calculation is a sports frame with a lens length of 58.0 mm, lens depth of 34.0 mm and a PD of 32.0 mm. The Impression B.I.G. NORM™ Mono Sport was calculated in the refractive index 1.6 and with a face form angle of 25°. The specified overall heights relate to the lens shape.

Power [D]	Base curve [D]	Overall height [mm]
–3.00	5	8.64
	7	10.97

Table 5-3: Influence of the base curve on the overall height

Curved sport frames often have a long lens length. In combination with a rather small customer PD, this results in a large order diameter and thus high edge and centre thicknesses for the lenses.
Attention should be paid to the following when selecting the sport spectacles, especially for individuals with higher ametropia:

- The lens length should be as small as possible.
- The centring point should be as close as possible to the centre of the lens.
- The base curve should be as flat as possible.

5.9 COMPATIBILITY

Rodenstock sport lenses are calculated specially for very curved frames, taking into account the individual customer data and offer the best optical imaging quality for all visual requirements in sport. Nevertheless, physical laws cannot be overridden with tilted lenses. With lateral eye movements, there are different angles between lens and viewing direction for R/L in contrast to non-tilted lenses.

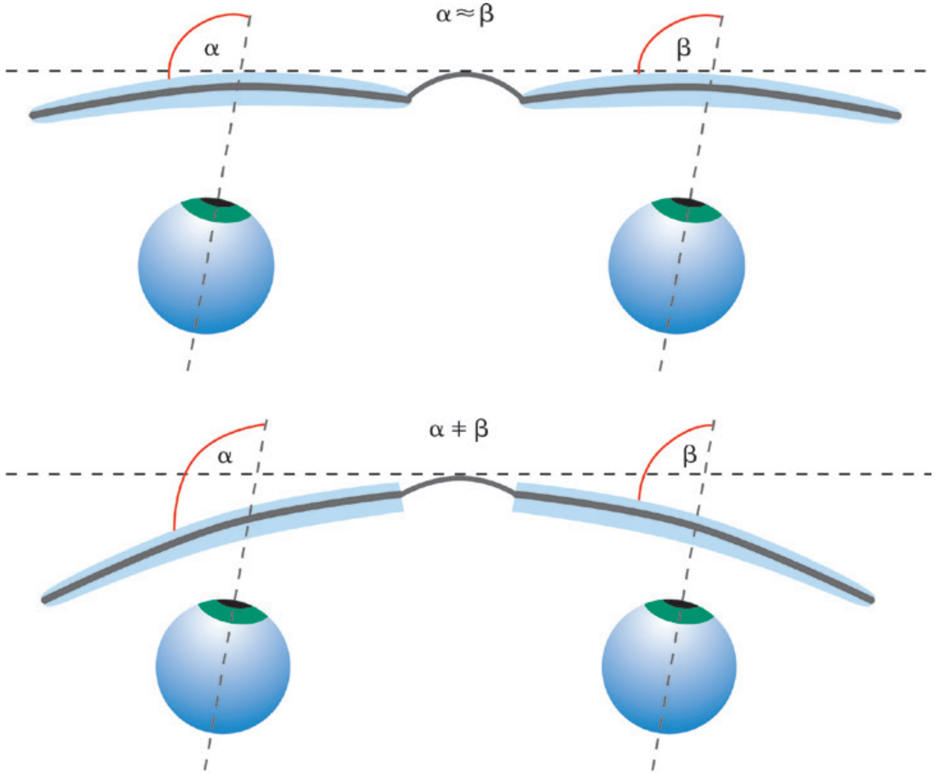


Figure 5-11: Different angle between lens and viewing direction for frames with high face form angle

Due to the different angles R/L, the nasal/temporal distribution of the aberrations is asymmetrical for tilted lenses. The asymmetry is greater the higher the tilt angle in front of the customer's eye is and the greater the ametropia is. As a result, there may be different visual impressions for the spectacles wearer for lateral eye movements. They are caused by the different extent of the aberrations, such as magnification and distortion. This applies to all frames for which the tilt angle deviates from the face form angle (see Figure 5-2).

Therefore, the spontaneous visual impression may differ from that of the spectacles worn previously. The system-related differences for binocular vision can lead to longer acclimatisation periods, especially for sensitive customers. Therefore, Rodenstock limited the power ranges of the sport spectacles compared to those of normal lenses. However, if there is incompatibility, you can make use of the Rodenstock compatibility guarantee.

CONTENT

6 ALL ABOUT LENSES

6.1 REFRACTION

Apart from the standard method of distance refraction, near refraction is becoming increasingly important within the optometric examination. The order of “Individual near refraction” gives you the option of including the near refraction data of your customer in the lens calculation.
The following procedure is just one way of determining the refraction data of your customer reliably and precisely. The procedure is based on the working guidelines applicable in Germany.

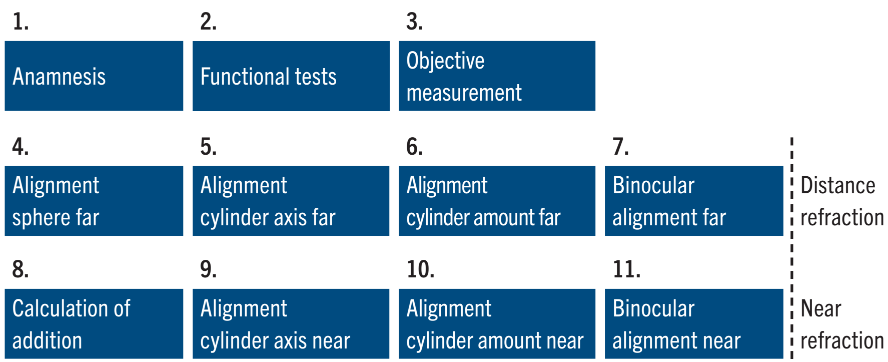


Figure 6-1: Possible procedure of refraction

6.1.1 Anamnesis

Before you start the subjective refraction, you should go through the customer’s anamnesis. Find out your customer’s requirements of their spectacles and whether there are problems with the previous spectacles.
If your customer has difficulties with viewing at near distances, this may be an early sign of a near astigmatism. Document all relevant information and test results.

6.1.2 Functional tests

If required, carry out tests to check important visual functions. This may include, e.g., tests for accommodation, stereo vision or colour perception. Select the function tests based on the anamnesis. You can use the Rodenstock EyeConsulting+ app for this.

6.1.3 Objective measurement

Before you start the distance refraction, it is recommended to first carry out an objective measurement with an aberrometer or auto-refractometer. The objective measurement values serve as a starting point for the subjective refraction. Compared to traditional aberrometers, the DNEye® scanner also has a near measurement. If the measured cylinder values and/or axis positions for distance and near are different, this may be an indicator that your customer has a near astigmatism. In this case, it is recommended to perform a subjective near refraction.

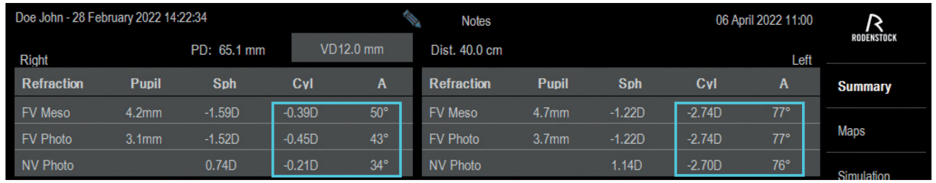


Figure 6-2: Extract from the results screen of the DNEye® Scanner 2 with different objective cylinder and axis values far and near

6.1.4 Subjective distance refraction

The first step for the subjective distance refraction is the comparison of the sphere on the basis of the objective measurement data or the previous refraction data. Then there are the comparisons of the cylinder axis position as well as the cylinder amount according to the cross-cylinder method.
At the end of the distance refraction, perform the binocular comparison for distance. This includes checking the refraction balance as well as the binocular fine alignment.
Refractions are determined at finite distances. A test room distance of 5 m causes an overcorrection of +0.20 D, at 6 m it is still +0.18 D. For an optimal result, you should perform a fine alignment with –0.12 D or –0.25 D trial lenses at the end of the distance refraction. Have your customer look out the window and ask them to fix their gaze on a certain object in the distance.
If required, it is recommended to perform a check of the binocular vision following the distance refraction.

6.1.5 Subjective near refraction

Near refraction is realised similar to distance refraction to some extent. All processes which are different are described in detail below.
Use the Rodenstock reading sample or the EyeConsulting+ app for determining the subjective near refraction. Both tools contain a ray figure for screening for near astigmatism and optotypes for the near refraction. EyeConsulting+ also offers further tests for even more comprehensive near refraction as well as a detailed video about the correct procedure. EyeConsulting+ is available in the app store.

Near pupil distance

Before you start the addition determination, the trial lenses should be adjusted to near pupil distance. You can easily determine the near pupil distance with EyeConsulting+. If you don't have the app at hand, you can calculate this using the following formula:

$$\text{optical centre near distance}_{R/L} = \frac{(\text{Refraction distance}_{Near} - \text{CVD}_{\text{Trial lenses}})}{(\text{Refraction distance}_{Near} + 13.5)} * \text{PD}_{R/L}$$

Ensure that your customer looks through the centre of the trial lenses during the near refraction and there is no gaze reduction.

Determination of addition

An estimation table is often used in practice for calculating the addition. However, when we take a look at Duane's curve, it is easy to recognise a considerable fluctuation of the accommodation success in the different age groups. According to Duane's curve, the maximum accommodation success of a 50-year-old is between approx. +1 and +3 D. Due to this fluctuation margin, it is recommended to perform an individual addition calculation in order to optimally correct your customer's ametropia.

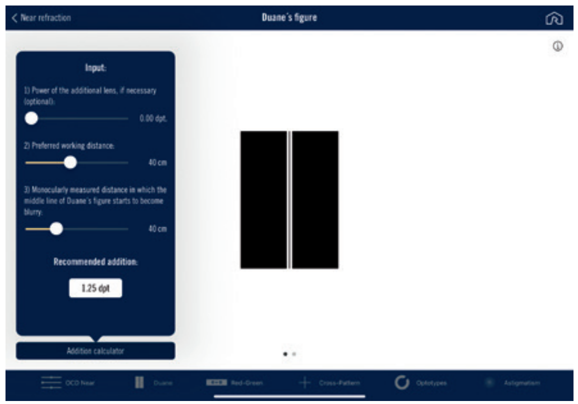


Figure 6-3: Test according to Duane from EyeConsulting+

Duane's test figure is suitable for the addition calculation (Figure 6-3). Here you calculate the maximum accommodation success of your customer. This test is performed in one eye. Therefore, cover one eye first. Have your customer hold the test figure at a distance of approx. 60 cm. Ask your customer to approach the reading sample until the middle line becomes blurred. Measure the distance from the figure to the eye. This equates to the so-called near point distance. Customers who are no longer able to detect the test figure at a distance of 60 cm should receive a corresponding additional power for this test.

You can then calculate the required addition using the following formulas:

$$\Delta A_{max} = -\frac{1}{a_p} - S'_z$$

$$N_z = A_E - \frac{1}{2} * \Delta A_{max}$$

ΔA_{max}	**Maximum accommodation success**
a_p	**Near point distance**
S'_z	**Power of additional lens**
N_z	**Addition**
A_E	**Reciprocal value of reading distance**

You can use the EyeConsulting+ app for the calculation. Enter the values in the app and the addition is automatically calculated.

Determining the cylinder amount and axis position
Insert the addition values in the trial lenses. Use round optotypes that are easily recognisable for the customer for determining the near astigmatism. The near refraction can be performed at the customer's preferred reading distance. The test figure should be held parallel to the trial lenses.
The rest of the process is carried out similar to the distance refraction. Also, here cross-cylinder method with the reverse consultation is offered for the fine adjustment of the axis and cylinder. Then a binocular adjustment should be carried out.

Binocular alignment, near
If different additions are determined for right and left, e.g., during the addition calculation according to Duane – e.g., in the case of anisometropia – it is recommended to check for accommodation balance. The red/green test is suitable here.

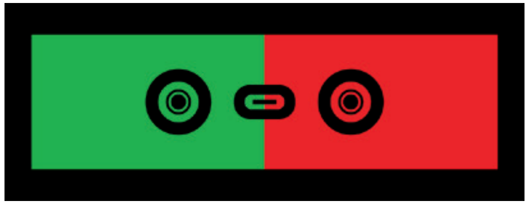


Figure 6-4: Binocular alignment near with the EyeConsulting+ app

The presentation of the test is carried out in a binocular process with separation using a Graefe prism or polarisation, depending on the test design. With the use of a Graefe prism, it is recommended to split this equally right and left with opposite base position up/down. The entire prism should be approx. 6 cm/m. Unlike for the distance refraction, the customer should concentrate on the red fields and check the rings at the top and bottom, which are seen double due to the prism, for the same contrast. If there are differences in the contrast, change the spherical value in one eye in small steps with plus or minus lenses until contrast equality has been achieved.

Then the binocular fine alignment is realised at near distance. A reversible viewer with +/–0.25 D is recommended here. Ask your customer to adopt their preferred reading distance and subjectively assess the quality of vision with and without the lenses held in front. A small change of the addition may be necessary. If required, other binocular tests may now follow.

In order to be able to clearly understand the exact process, an information film on near refraction with all content shown here is available in the EyeConsulting+ app.

6.1.6 Prismatic refraction

Prismatic refraction data can be determined using different methods. The results may also vary depending on the method used. Therefore, for an exact calculation of the lens, it is important to know how the values were determined.

<u>Pupil centre centration</u>

By default, Rodenstock assumes for all brand lenses (except Manufaktur) that the prismatic correction values ordered according to pupil centre centration (PCC case) were determined. This means that the trial lenses were not moved during the refraction. As a result, there may be a deviating actual prismatic power depending on the spherical-cylindrical and the prismatic power of the trial lenses as the eyes no longer see through the optical centre point of the spherical-cylindrical base lenses due to the prismatic trial lenses and thus prismatic additional components become effective. They may reduce or increase the power of the prismatic trial lenses depending on the power of the base lens and the base position of the prism.

In the Rodenstock ordering programme WinFit® Reference, the entire effective prism is calculated and displayed as a resulting prism. This is the corrective prism, which will also be effective in the lens. Based on this value, the centring correction is calculated for the lens.

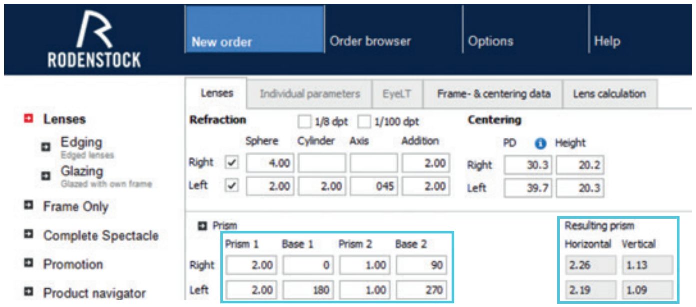


Figure 6-5: Ordered prism and resulting prism in WinFit® Reference

<u>Formula case</u>

If you performed the prism refraction according to the formula case and consequently moved the trial lenses against the base position of the correction prism using the rule of thumb 0.3 mm per 1.00 cm/m, then the spectacles wearer always looks through the optical centre of the trial lenses during the refraction. With this method, there is no additional resulting prismatic component. This means that the prismatic measurement values of the refraction correspond to the as-worn position values in the lens.

<u>Special case</u>

If the readjustment of the trial lenses was only possible to a certain extent because, e.g., the height of the trial lenses cannot be adjusted (monocular), then this can also be considered in the calculation.

For the refraction according to formula or special case, please specify this when ordering so that the calculation can respond accordingly.

Tips and information on subjective refraction

Please observe the following points for the refraction for an optimal measurement result:

- The pantoscopic tilt of the trial frame or the phoropter should be 0°. This is the basis for the calculation of the Rodenstock lenses. If the pantoscopic tilt of the trial frame has a value other than 0°, then, depending on the extent of the deviation as well as the refraction data, it may lead to a distorted result due to an astigmatism of oblique pencils.
- Sensitive customers already respond to 0.12 D blurring. Some trial frame boxes are not equipped with 0.12 D trial lenses as standard. In such cases, it is recommended to buy trial lenses with +0.12 D and –0.12 D. You can also order the distance value in 0.01 D steps for all lenses that are manufactured in freeform technology.
- If the CVD of the trial frame differs from the CVD of the prescription frame, then more or less refractive power differences occur for the spectacles wearer. You can specify the CVD of the trial frame for all Impression® lenses from Rodenstock. If the trial frame CVD is not known, then it is set to the same CVD of the prescription frame and there is no conversion of the order values.
- Irrespective of whether you perform a monocular or binocular refraction for near vision, you achieve an improvement for your customer in each case with the consideration of an existing near astigmatism. The main influencing factor for the near astigmatism is accommodation. This is recorded both for binocular and monocular near refraction. With the binocular measurement, the convergence and binocular processing of both visual impressions are also considered. Therefore, whenever possible, monocular measurement is preferred, but still with each eye individually tested under binocular conditions. Using a suitable polarising near vision testing device and polarising filters, both ray figure and optotypes can be presented separately.

6.1.7 Anisometropia

The vertical prismatic differences occurring in the case of anisometropia when looking at near distances may lead to fusion disturbances, especially when wearing progressive and near comfort lenses. You can easily check yourself whether these prism differences may lead to incompatibilities for your customer:
After the refraction, calculate the difference between the refractive powers R/L in the vertical main section and multiply this by the decentration distance d according to Prentice's Rule. For progressive lenses, this is 14.0 mm for progression zone length L starting from the prism reference point; for lenses with progression zone length S it is 10.0 mm. For all lenses with variable progression zone length, the decentration distance d is calculated as follows: d = |DN| –4 mm.
In the example shown, the DN is –18.0 mm. Therefore, the decentration distance d = 14.0 mm.

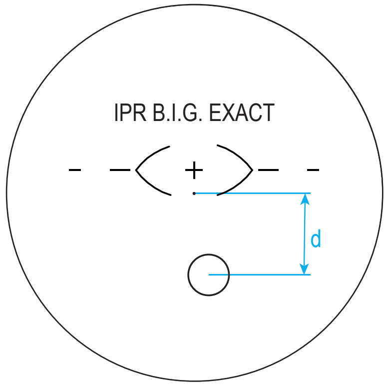
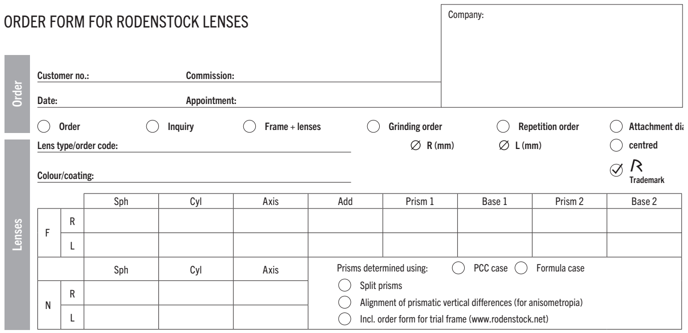


Figure 6-6: Decentration distance d using the example of Impression B.I.G. NORM™

Example for progression length 18 mm:
R sph –2.0 cyl –2.0 A 90°
L sph –5.0 cyl –0.5 A 0°
Δ S´ in 90° = 3.50 D
P [cm/m] = Δ S´ [1/m] * d [cm]
P = 3.5 1/m * 1.4 cm = **4.90 cm/m**

The resulting prismatic value is approximately the value that your customer must compensate when looking at near distances.

Place the calculated prism in addition to the data determined in the refraction in the trial frame and have your customer look at near distance and read a text, for example. It is irrelevant in front of which eye the prism is placed. It is important that the base position has a vertical direction. If no double images or unusual visual impressions occur, then the prismatic vertical difference can be compensated by the customer. If viewing is unpleasant or double images occur, then the prism reference point in which the vertical prismatic power is always the same for right and left should be moved to the middle of the progression zone. The vertical prism difference is reduced in the near reference point by this method. Please note this on the order form under "Alignment of prismatic vertical differences".


ORDER FORM FOR RODENSTOCK LENSES

Company:

Order

Customer no.: Commission:

Date: Appointment:

○ Order ○ Inquiry ○ Frame + lenses ○ Grinding order ○ Repetition order ○ Attachment di

Lenses

Lens type/order code: ∅ R (mm) ∅ L (mm) ○ centred

Colour/coating: ✓ R Trademark

		Sph	Cyl	Axis	Add	Prism 1	Base 1	Prism 2	Base 2
F	R								
	L								
		Sph	Cyl	Axis					
N	R								
	L								

Prisms determined using: ○ PCC case ○ Formula case

○ Split prisms

○ Alignment of prismatic vertical differences (for anisometropia)

○ Incl. order form for trial frame (www.rodenstock.net)

Figure 6-7: Alignment of vertical prismatic differences on the order form

Choice of progression length for anisometropia:
With anisometropia, it is recommended to choose a short to medium progression zone length. The longer the progression zone is, the higher the vertical prism differences right/left.

Base curve alignment for anisometropia:
Since the curvatures of the front surfaces of the lenses can differ significantly in anisometropia, the base curves R/L are automatically aligned in the calculation. As a result, the more curved lens is calculated and made somewhat flatter and the flatter lens is calculated and made more curved.

Anisometropia and aniseikonia:
In some cases, size or shape differences occur between the visual impression of the right and left eye (aniseikonia) in connection with anisometropia, which result in double images or fusion disturbances. In order to determine this with the refraction, you can use iseikonic trial lenses. The calculated value can be incorporated in the calculation of the lens in order to guarantee the same retinal image sizes. For ordering, it is sufficient to indicate the intrinsic magnification of the iseikonic lens, with which the visual impressions R/L were the same. In addition, an aesthetic alignment of the lenses can be realised by adapting the base curve and/or increasing the centre thickness of the thinner lens.

6.2 FITTING RECOMMENDATIONS

The exact fitting of the frame and a precise centring of the lenses play a decisive role in the compatibility and wearing comfort of a pair of spectacles. You should always determine the centring data as well as the individual parameters with a well-fitted frame. The measurement can be carried out with ImpressionIST® or manually. For the manual measurement, ensure that your eye is at the same level as the customer's eye in order to avoid parallax errors. For the measurement with ImpressionIST® your customer should adopt their natural head and body posture. For this your customer could first walk through your shop and then position themselves in front of the ImpressionIST®.

Single vision lenses, distance
All B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses are fitted for zero gaze direction and natural head and body posture. The natural head and body posture corresponds to the individual posture when looking into the distance. Tall people, for example, often tilt their head more than smaller people. Figure 6-8 should illustrate the head posture in this position.

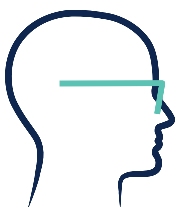


Figure 6-8: Head position in usual head and body posture

All standard single vision lenses are fitted for zero gaze direction and vertical frame plane (centre of rotation requirement). Figure 6-9 shows the fitting according to the centre of rotation requirement.

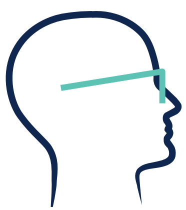


Figure 6-9: Head position with fitting according to the centre of rotation requirement

If you determine the centring data with the ImpressionIST®, the image is always taken with zero gaze direction and in normal head and body posture. Then you can choose whether the centring data should be displayed according to the centre of rotation requirement or reference point. The device automatically converts the centring point height.

Single vision lenses, near
To maintain the familiar convergence behaviour from the distance spectacles, it is also recommended to centre according to far PD for single vision lenses. For the centring according to far PD, the lenses are also 4-5 mm smaller in the diameter, i.e., thinner and lighter.

Progressive lenses and near comfort lenses
All Rodenstock progressive and near comfort lenses are fitted with zero gaze direction and in normal head and body posture. The centring cross is at the centre of the pupil.

6.3 ORDERING

For ordering, use WinFit® Reference or the Rodenstock order form. In the product catalogue there is information about which parameters are required for ordering. Furthermore you also find information about the optional order parameters.

6.3.1 Diameter

The optimal diameter is automatically calculated for you as soon as you submit the frame and centring data to Rodenstock.

For higher plus powers, the centre thickness can be reduced considerably with a smaller diameter alone. For this reason, the smallest possible frame with centring as central as possible should be selected.

Sample calculation for Impression B.I.G. EXACT™ Mono in Perfalit 1.60 with the following refraction data:

sph +3.00 D cyl +2.00 D A 0°

	Diameter 70	Diameter 65	Saving	
Centre thickness	5.1 mm	4.5 mm	0.6 mm	12 %
Weight	15.93 g	12.22 g	3.7 g	23 %

Table 6-1: Centre thickness and weight comparison for diameter of 70 mm and 65 mm

For high minus powers, it is also recommended to select the smallest possible frame. A central centering would reduce the edge thickness and weight of the lenses.

Sample calculation for Impression B.I.G. EXACT™ Mono in Perfalit 1.60 with the following refraction data:

sph -4.00 D cyl 0.75 D A 16°

	Lens length: 54 mm Dbl: 19 mm	Lens length: 45 mm Dbl: 22 mm	Saving	
Min. edge thickness	3.1 mm	2.8 mm	0.3 mm	10 %
Max. edge thickness	5.8 mm	3.8 mm	2.2 mm	35 %
Weight	7.08 g	3.95 g	5.5 g	44 %

Table 6-2: Edge thickness and weight comparison with different size frames

For very high minus powers, there may be restrictions in the optically usable diameter, which are smaller than the geometric diameter. For example, there are restrictions in the Index 1.67 in the geometric diameter 60 mm from a power of approx. –13.50 D. The optically usable diameter is approx. 58 mm with this power. For higher powers, the optically usable diameter is even smaller.

For –14.00 D: Approx. 57 mm
For –16.00 D: Approx. 50 mm
For –17.00 D: Approx. 47 mm

The optically usable diameter may vary depending on the product and power.
The product catalogue contains further information on this topic.

For an exact calculation of the diameter for prismatic lenses, the centring data z and y must maintain the product-dependent centring correction. More information can be found in Chapter 6.7 “Centring of lenses”.

6.3.2 Predecentration

In general, you have different ways to order the diameter:

- Centric
- Pre-decentered by 2.5 mm
- With variable predecentration or
- With individual predecentration

The following overview shows the different options:

	Progressive	Near comfort	Sport	Single vision	
	B.I.G. EXACT™ and B.I.G. NORM™			B.I.G. EXACT™ and B.I.G. NORM™	Standard
Centric	Possible on request		–	Possible on request	Standard case
Pre-decentered by 2.5 mm	Standard case		–	Standard case	–
Variable Pre-decentred	Calculated by Rodenstock as soon as frame and centring data available				–
Individual Pre-decentred	Possible on request		–	Possible on request	–

Table 6-3: The different predecentrations

Predecentered by 2.5 mm

As shown in Table 6-3, all B.I.G. EXACT™ and B.I.G. NORM™ progressive, near comfort and single vision lenses (except Sport) are by default pre-decentred by 2.5 mm. This predecentration is based on the experience that the customer PD is smaller than the geometric centre distance of the frame in most cases. A nasal predecentration has the advantage that a smaller diameter and thus a thinner lens can be made.

Variable predecentration

With the variable predecentration, the usable diameter is increased. It is available up to 10 mm depending on the product and power. This has a favourable effect on the lens geometry, especially for sports lenses. The variable predecentration is calculated by Rodenstock based on the frame and centring data.

Individual predecentration

The individual predecentration can be determined by you depending on the product. Proceed as follows:

1. Take the centric centring card for your product in your hand. Determine the minimum diameter for the selected frame. This corresponds to the smallest circumscribing diameter circle of the centring card irrespective of the lateral centring. This value reveals the first value of your diameter order, e.g. **50**/60.
2. Now position the vision point determined in the fitting on the centring card so that it is congruent with the centring cross of the centring card.
3. Then read off the largest diameter required. As in most cases of nasal decentration (PD smaller than the centre distance of the frame), this is the diameter circle that circumscribes the frame temporally. This value corresponds to the second value of the diameter order, e.g. 50/**60**.
4. If the diameters are nasal and temporally equal, it is recommended to order in centric version.

The following overview shows the power-dependent options for the predecentration:

	Power range [D]	Maximum predecentration without frame and centring data [mm]	Maximum predecentration with frame and centring data [mm]
B.I.G. EXACT™ and B.I.G. NORM™	–18.00 to –12.25	Centric	Centric
	–12.00 to –10.25	2.5	2.5
	–10.00 to –4.25	5	5
	–4.00 to +4.00	5	10
	+4.25 to +10.00	5	5
	+10.25 to +13.00	2.5	2.5

Table 6-4: Power-dependent predecentration

6.3.3 Centre thickness optimisation

The aesthetics as well as the weight of the spectacles have a major influence on whether the customer feels comfortable with their new spectacles or not. In order to make a lens as thin and light as possible, Rodenstock offers the option of centre thickness minimisation (CTO). This is an optimisation of the lens diameter. For this, it is necessary to specify the frame as well as the centring data when ordering the lenses.

At least one of the following conditions must be fulfilled so that the centre thickness optimisation is also beneficial for your customer:

- At least one main meridian with positive power or
- Prismatic refraction data in plus or low minus range

The thickness and weight saving is greatest for:

- Plus cylinder axes around 0° or 180°
- Prism base out

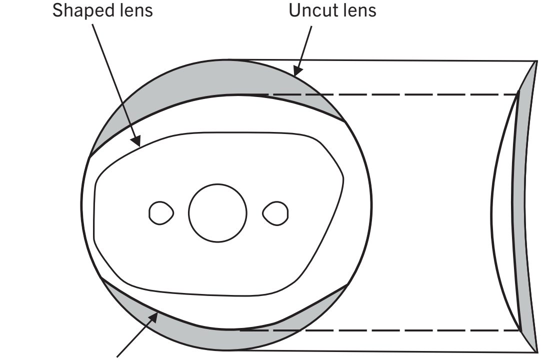


Figure 6-10: Diagram of centre thickness optimisation

Sample calculation for Impression B.I.G. NORM™ Allround 1.60 with the following refraction data:

sph +3.00 D cyl +2.00 D A 0° Add 2.00 D
PD 66.0 mm, height 25.0 mm

A required uncut lens diameter of 74 mm is the result for the given frame and centring data.

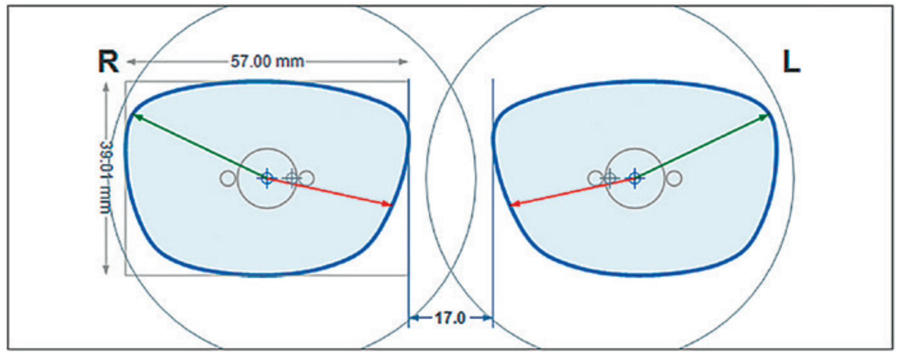


Figure 6-11: Figure for above example

	without CTO	with CTO	Saving	
Centre thickness	6.9 mm	4.8 mm	2.1 mm	31 %
Min. edge thickness	3.3 mm	1.1 mm	2.2 mm	66 %
Max. edge thickness	5.7 mm	3.5 mm	2.2 mm	39 %
Weight	14.56 g	9.11 g	5.5 g	37 %

Table 6-5: Thickness and weight comparison with CTO

When ordering the lenses with CTO, there are considerable savings in the centre and edge thicknesses as well as the weight compared to an uncut lens.

6.3.4 Base curve

The base curve is described as the nominal surface refractive power of the front surface of a lens.

For all B.I.G. EXACT™ and B.I.G. NORM™ lenses you have the option of adding a base curve request to the order. Rodenstock selects the base curve that is technically feasible and comes as close as possible to your request. This is dependent on the refraction data and the ordered diameter, among other things. Therefore, deviations to the specified base curve request are possible. At Rodenstock, the specification of the base curve always refers to the tool index 1.525.

Which base curve is the most appropriate for the glazing of the selected prescription frame can be easily determined by using a spherometer. Measure the curvature of the support lenses or the existing lenses or observe the recommendations of the frame manufacturer for the base curve.

Calculation of the base curve in WinFit® Reference

You have the option of calculating a base curve using WinFit® Reference (see Figure 6-12). The standard base curve and other properties of the selected lens are determined by pressing the "Calculator" button (1). After the calculation you have the option to make the suggested base curve of the lens flatter or more curved. For this, use the input field "Base curve" (2). WinFit® Reference calculates a comparable lens based on the modified base curve (3). The best possible base curve is displayed in the comparison (4). Please note that any base curve cannot be manufactured for all refraction data. WinFit® Reference accesses the manufacturing server directly with its calculation and checks the technical feasibility immediately.

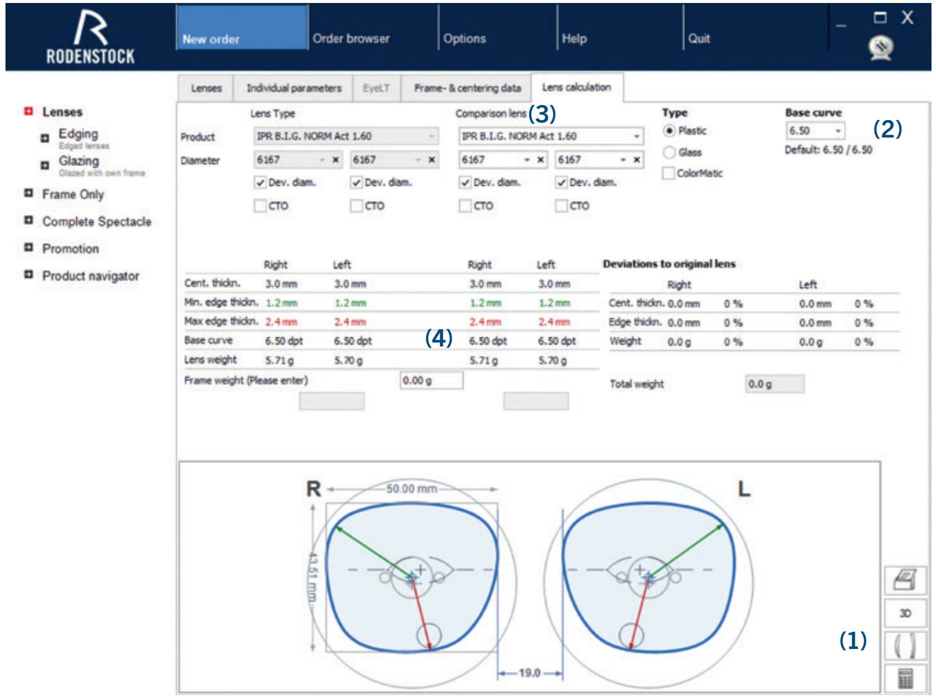


Figure 6-12: Calculation of the base curve in WinFit® Reference

6.3.5 Individual near distance

For all B.I.G. EXACT™ and B.I.G. NORM™ progressive and near comfort lenses (except Sport), you have the option to take into account the individual near distance of your customer in the lens calculation. If this deviates from the refraction distance near, please specify the two distances with the order. Rodenstock takes this information into consideration when calculating the near addition and the inset.

The following example should show the impact of a consideration of the individual near distance on the power in the lens (individual addition):

Example for calculation of the addition for the main viewing distance:

$$Add_{MVDN}\,[D] = Add_{RDN}\,[D] - \left(\frac{1}{RDN\,[m]}\right) + \left(\frac{1}{MVDN\,[m]}\right)$$

Add_{MVDN}	Addition for main viewing distance
Add_{RDN}	Addition during refraction
RDN	Refraction distance near
MVDN	Main viewing distance near

Addition during refraction (Add_{RDN}): +2.00 D
Near main viewing distance: 30 cm
Main viewing distance near: 40 cm
Addition for main viewing distance: Add_{MVDN} = +2.00 D – 2.50 D + 3.33 D
Add_{MVDN} = +**2.83 D**

Based on this, Rodenstock calculates the addition for the main viewing distance of the lens.

The customer also benefits from an optimisation of the inset and a reduction of the astigmatism of oblique pencils for near distance of 30 cm.

Please note that the addition for the main viewing distance must be in the addition delivery range between +0.75 D and +3.50 D.
If there is no information on the near distance or refraction distance, a standard reading distance of 40 cm is presumed for both distances (applies up to addition +2.50 D, for higher additions 1/addition applies).
If only one distance (main viewing distance or refraction distance) is specified, Rodenstock assumes that the ordered addition relates to the main viewing distance and the refraction distance. There is no adjustment of the near power.

6.3.6 Thinning prism

Thinning prisms can provide a reduction of the edge and centre thicknesses. Particularly with progressive and near comfort lenses, there are different edge thicknesses at the top and bottom due to the power change in the lens. In order to avoid this and to reduce the weight and centre thickness of the lenses, the lenses receive a thinning prism, generally with base at the bottom. For a pair of lenses, the thinning prism always has the same value for right and left and is therefore not noticeable for the spectacles wearer.

Figure 6-13: Left: Lens without thinning reduction prism. Right: Lens with thinning prism

6.3.7 Reordering lenses

As for Rodenstock products the thinning prism is calculated on the basis of the individual order data, please specify the order or delivery note number when reordering, e.g., in the case of a broken lens, or share all known data from the original order with us:

- Refraction data R/L
- Size of the thinning prism
- Diameter and
- Other information such as different base curves ordered, etc.

Your product advisor will be happy to inform you about the compatibility of products.

6.4 STAMP

All progressive and near comfort lenses from Rodenstock have the following stamp markings:

Centring point

In all lenses, the centring point is in the middle of the cross 4 mm above the prism reference point. It serves the correct positioning of the lenses for glazing as well as the checking of the centring data when dispensing the spectacles.

Prism reference point

The prism reference point is stamped as a dot and is 4 mm below the centring point.

Near reference point

The near reference point overlaps with the centring point of the stamped near measuring circle. The position of the near measuring circle is dependent on the progression length and the inset and is therefore variable.

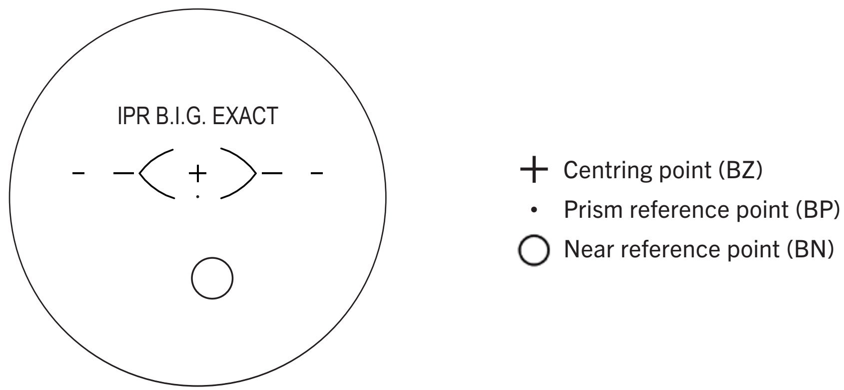
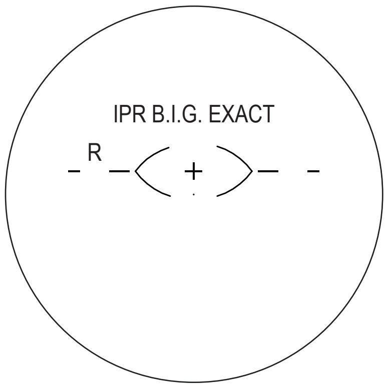


Figure 6-14: The stamp of Impression B.I.G. EXACT™

All B.I.G. EXACT™ and B.I.G. NORM™ single vision lenses from Rodenstock have the following stamp markings:

Centring point
In all lenses, the centring point is 4 mm above the prism reference point. It serves the correct positioning of the lenses for glazing as well as the checking of the centring data when dispensing the spectacles.



+ Centring cross
• Prism reference point (BP)

Figure 6-15: The stamp of Impression B.I.G. EXACT™ Mono

Apart from the centring point and the prism reference point, the stamp of the Mono and Mono/Mono+ lenses shows a marking for the respective lens (R = right lens, L = left lens).

The standard single vision lenses are normally not stamped. Exceptions include, e.g., orders with visible Rodenstock trademark and prismatic refractions. In this case, the lenses also receive functional engravings.

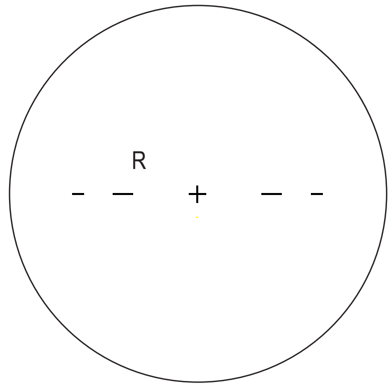
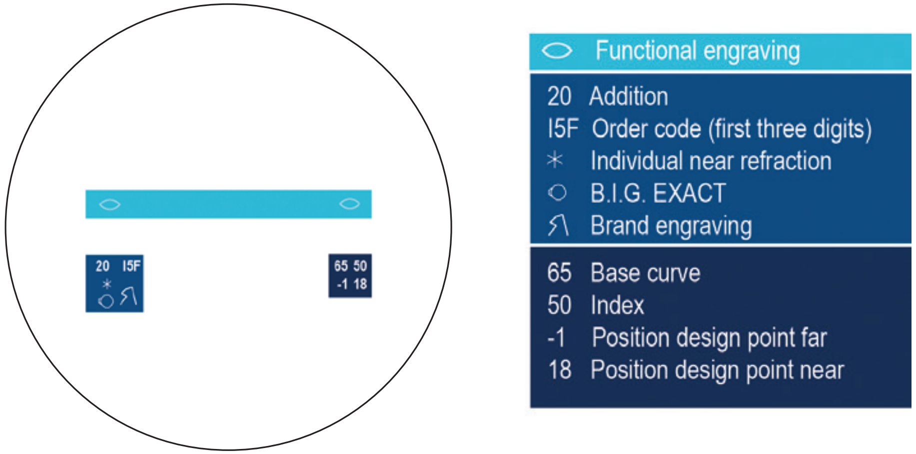


Figure 6-16: The stamp of standard single vision lenses

6.5 ENGRAVING

All B.I.G. EXACT™ and B.I.G. NORM™ lenses from Rodenstock have functional engravings and additional engravings depending on the product.

Engravings using the example of a progressive lens



6-17: The engravings using the example of Impression B.I.G. EXACT™, view of back surface of lens

The functional engravings for B.I.G. EXACT™ and B.I.G. NORM™ lenses are located at the level of the centring point, for the standard progressive and near comfort lenses, they are at the level of the prism reference point.

Engravings using the example of a single vision lens

All B.I.G. EXACT™ and B.I.G. NORM™ and Perfalit Sport single vision lenses from Rodenstock also have functional engravings and additional engravings depending on the product.

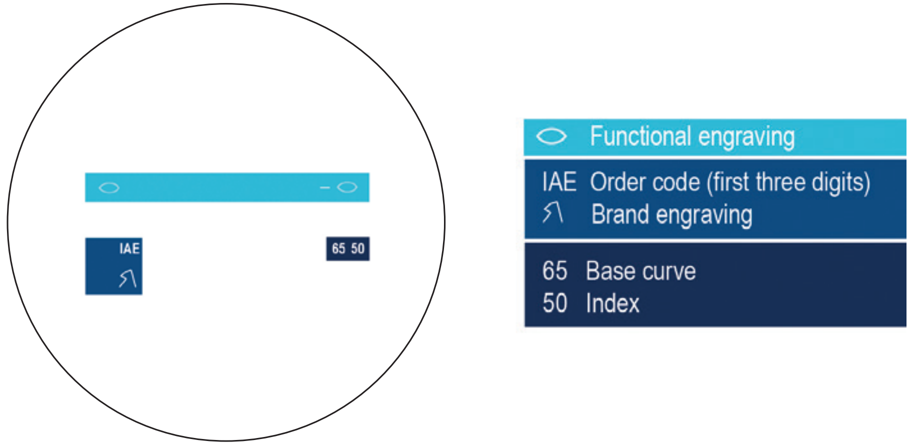


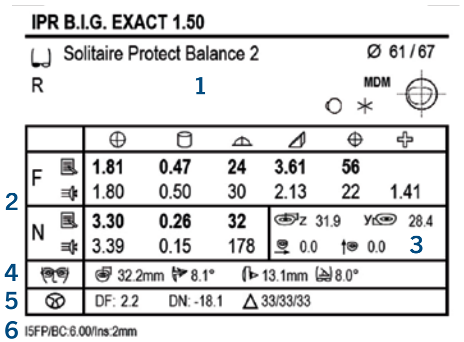
Figure 6-18: The engravings using the example of Impression B.I.G. NORM™, view of back surface of lens

The functional engravings are located at the level of the centring point in all single vision lenses.

6.6 LENS ENVELOPE

All order data belonging to the order can be found on the lens envelope. There may be differences depending on the ordered product and the selected order options.

For B.I.G. EXACT™ orders, the combined order values of subjective and objective refraction for distance and near are printed on the lens envelope in place of the purely subjective refraction data.



1 Lens type, R/L marking, colour, coating, diameter, CTO, B.I.G. EXACT™, individual near refraction
2 Order values far, reference values far and addition, order values near with individual near refraction or B.I.G. EXACT™, reference values near
3 Centring data z and y, centring correction horizontal/vertical for prismatic prescriptions
4 Pupil distance, pantoscopic tilt, corneal vertex distance, face form angle
5 Design point far, design point near, design characteristic
6 Additional order parameters such as order code, base curve, inset, predecentration, CVD refraction spectacles

Figure 6-19: Lens envelope using the example of Impression B.I.G. EXACT™

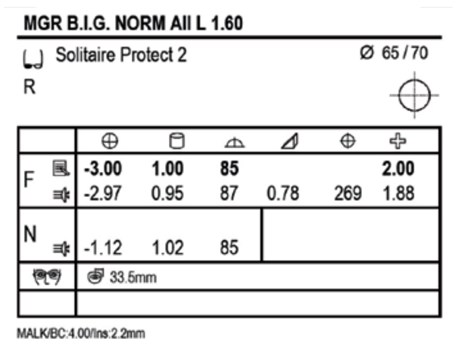


Figure 6-20: Lens envelope for Multigressiv B.I.G. NORM™

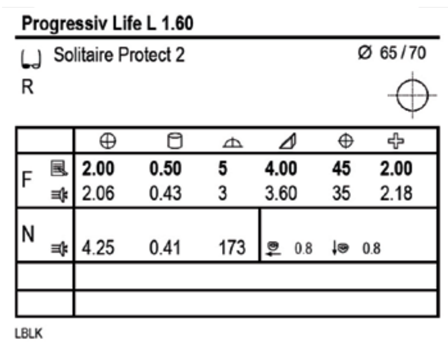


Figure 6-21: Lens envelope for Progressiv Life

The following overview describes the pictograms on the lens envelope.

Order and reference values			
	Order value		Reference value
	Right		Left
	Sphere		Addition
	Cylinder		Axis
	Prism		Base
Ø	Diameter	CTO	Centre thickness optimisation (CTO)
	Individual parameters		**Further details**
	Pupil distance R	**BC**	Base curve
	Pupil distance L	**INS**	Inset
	Corneal vertex distance	**CVD refraction**	CVD of trial frame
	Face form angle	**HDEC**	Horizontal predecentration
	Pantoscopic tilt	**Prism adaptation**	Prism alignment
Design parameters			
△	Design characteristic	**MVDR**	Main viewing distance Room
DF	Design point far	**MVDM**	Main viewing distance Middle
DM	Design point middle	**MVDN**	Main viewing distance near
DN	Design point near	**RDN**	Refraction distance near
	B.I.G. EXACT™		Individual near refraction
Centring data in lens plane			
z	Centring point distance R	z	Centring point distance L
y	Centring point height R	y	Centring point height left
	Centring correction R inwards		Centring correction L, inwards
	Centring correction R outwards		Centring correction L, outwards
	Centring correction down		Centring correction up

Table 6-22: Overview of pictograms on lens envelope

6.7 CENTRING OF LENSES

For an exact centring of the lenses when glazing, it is not only necessary to observe the PD and fitting height in frame plane which are calculated manually or by the ImpressionIST®. The following parameters may also be considered, e.g., for calculating the exact centring data for the lens plane: refraction data, frame data (lens length, lens depth, Dbl), individual parameters (pantoscopic tilt, face form angle, CVD), base curve, and refractive index.

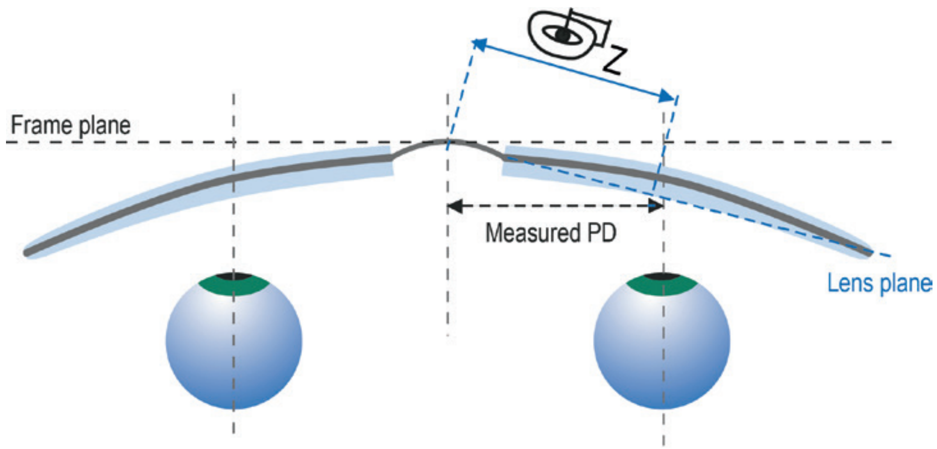


Figure 6-23: Difference between centring point distance z in lens plane and customer PD in frame plane

Primarily through the consideration of the horizontal (face form angle) and vertical tilting (pantoscopic tilt) of the lens in front of the eye can centring data for the lens plane which deviate from the values calculated for PD and height at the video centring device in frame plane arise during the optimisation. Rodenstock calculates the exact centring point distance z and the exact centring point height y for the centring in lens plane by considering the above parameters. The centring data z and y are printed on the lens envelope for all B.I.G. EXACT™ and B.I.G. NORM™ lenses if there are frame and centring data (see Figure 6-24). For the standard sport spectacles the centring point distance z is printed on the envelope. The Rodenstock lenses should be glazed according to these centring data.

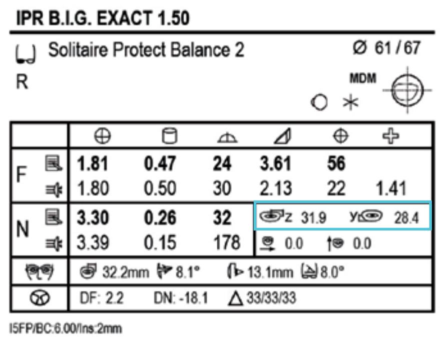


Figure 6-24: Centring data z and y for lens plane

The more individual data available to Rodenstock for the calculation of the order, the more accurately the centring data are calculated.

Centring of prismatic lenses

Prismatic lenses are correctly centred to the eyes when the spectacles wearer looks through the reference point of the lens in their optometric rest position. Typically, a centring correction must be calculated using the general rule of thumb 0.30 mm per 1 cm/m against the base position of the correction prism and added to or subtracted from the measured values for PD and height.

Please observe the product-dependent differences for the centring of prismatic lenses.

B.I.G. EXACT and B.I.G. NORM lenses
For all B.I.G. EXACT™ and B.I.G. NORM™ lenses Rodenstock already shifts the back surface during the optimisation so that a decentration of the lens is no longer required when grinding in horizontal and vertical direction. Therefore, the necessary centring correction for these lenses is always noted with 0 on the lens bag.

For grinding prismatic B.I.G. EXACT™ and B.I.G. NORM™ lenses, use the centring data z and y on the lens envelope.

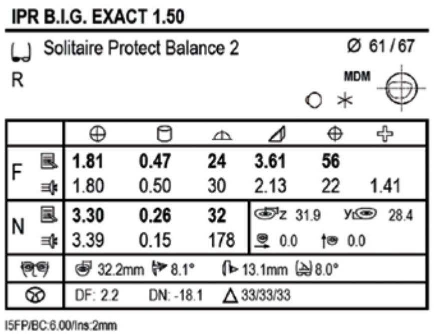


Figure 6-25: Impression B.I.G. EXACT™ with final centring data and centring correction 0 mm horizontal/ 0 mm vertical

Standard and multifocal lenses
For standard lenses and multifocal lenses, you must take into account the centring correction on the lens bag when calculating the centring data. The arrow direction of the icons on the lens envelope shows whether the centring correction must be added to or subtracted from the measurement data for PD and fitting height. It is dependent on the base position of the prism.

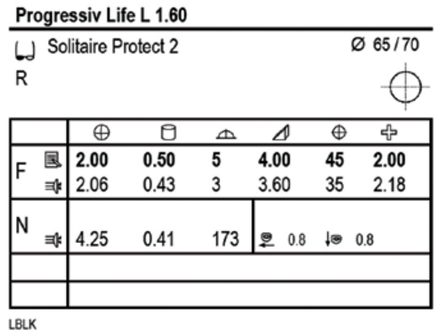
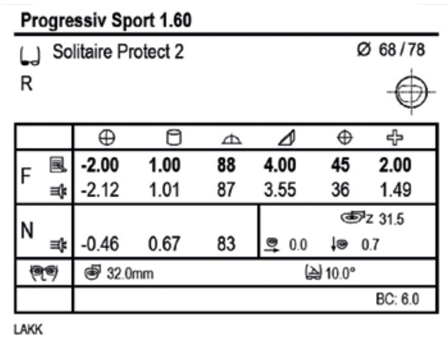


Figure 6-26: Progressiv Life® with centring correction 0.8 mm horizontal/0.8 mm vertical

In the example in Figure 6-26, there is a prism of 4 cm/m in 45° for the right eye. The lens must therefore be decentred outwards and down. For the grinding data, the result is z = 32.8 mm (for PD of 32 mm) and y = 23.2 mm (for height of 24 mm).

Standard Sport
For the standard sports lenses, a decentration of the lens is not required when grinding in horizontal direction. Therefore, the horizontal centring correction on the lens envelope = 0 and is for information only. Please use the centring point distance Z for grinding.

The centring correction must be observed in vertical direction. The vertical centring correction printed on the lens bag must be added to or subtracted from the measured fitting height.


Progressiv Sport 1.60
Solitaire Protect 2 Ø 68 / 78
R

F		**-2.00**	**1.00**	**88**	**4.00**	**45**	**2.00**
		-2.12	1.01	87	3.55	36	1.49
N		-0.46	0.67	83	Z 31.5	0.0	0.7
		32.0mm			10.0°		
							BC: 6.0

LAKK

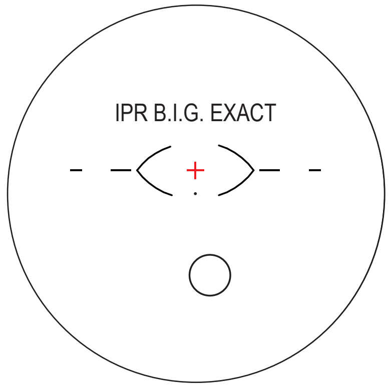
Figure 6-27: Progressiv Sport with centring point distance Z, centring correction 0 mm horizontal, and 0.7 mm vertical

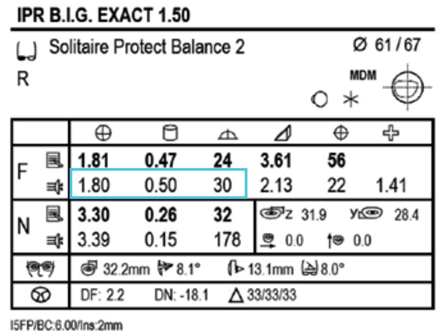
6.8 MEASUREMENT OF LENSES

With Rodenstock lenses, the as-worn position is taken into account depending on the product. Therefore, differences arise between the order values and the reference values for the measurement in the lensmeter. The reference values can be found on the lens bag below the order values. Unless otherwise specified, they refer to the concave vertex measuring position.

6.8.1 Progressive and single vision lenses

Far
The reference values far (sphere, cylinder, and axis) are checked for progressive and single vision lenses in the centring point. The centre of the stamped centring cross corresponds to the centring point.




IPR B.I.G. EXACT 1.50
Solitaire Protect Balance 2 Ø 61 / 67
R MDM

F		**1.81**	**0.47**	**24**	**3.61**	**56**	
		1.80	0.50	30	2.13	22	1.41
N		**3.30**	**0.26**	**32**	Z 31.9	28.4	
		3.39	0.15	178	0.0	0.0	
		32.2mm	8.1°	13.1mm	8.0°		
		DF: 2.2	DN: -18.1	△ 33/33/33			

I5FP/BC:6.00/Ins:2mm

Figure 6-28: Reference values far in centring point using the example of Impression B.I.G. EXACT™

Prism

In the prism reference point, you measure a combined power of thickness reduction prism, and correction prism, as well as any compensation prism for high face form angles.

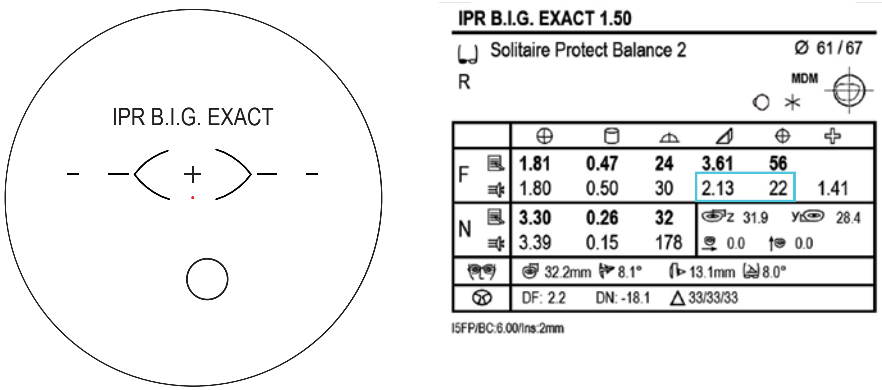


Figure 6-29: Reference values for prism using the example of Impression B.I.G. EXACT™

Addition

In order to check the reference value for the addition, you can determine the measurement values in the centring point and near reference point. From this, determine the spherical equivalent. The difference between these two values corresponds to the reference value addition.

Near

For all B.I.G. EXACT™ and B.I.G. NORM™ progressive and near comfort lenses, the spherical-cylindrical reference value for near in addition to the reference value for addition is also printed on the lens bag. This value can be measured again in the near reference point, i.e., in the centre of the stamped near measuring circle. For B.I.G. EXACT™ or if an individual near refraction was ordered, you can find the ordered near refraction data above the reference value near.

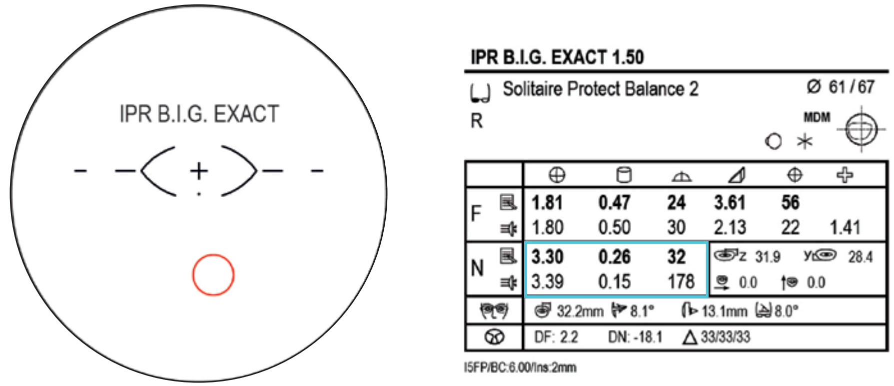


Figure 6-30: Lens bag for B.I.G. EXACT™ with near order values for the individual near refraction and reference values near

6.8.2 Near comfort lenses

For the Rodenstock near comfort lenses, the reference values for sphere, cylinder, and axis refer to near vision. They are checked in the near reference point (see Figure 6-31).

The reference value for the degression corresponds to the difference between the spherical equivalent of the reference value near and the measurement value 8 mm above the centring point.

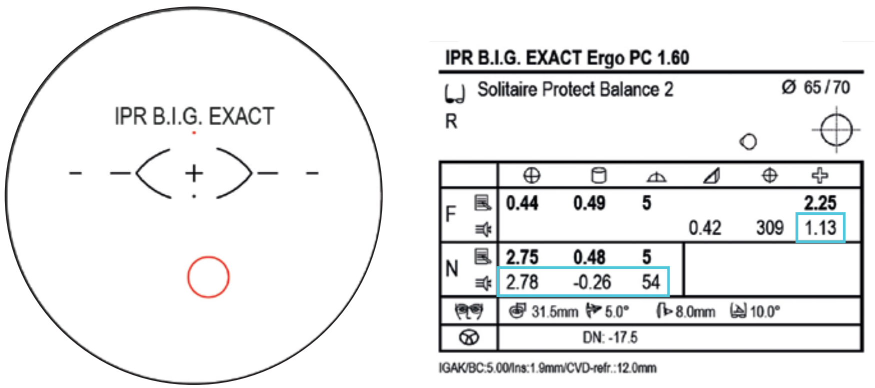


Figure 6-31: Reference values for near and degression using the example of Impression B.I.G. EXACT™ Ergo

CONTENT

7 TOOLS AND CONSULTING

7.1 DNEYE® SCANNER & DNEYE® SCANNER 2/2+

In contrast to standard aberrometers, the DNEye® Scanner not only measures the eyes when looking into the distance, but also in the near distance. In doing so, the low and high order aberrations of the eye as well as the individual pupil sizes are determined.[1,2] In fact, the high order aberrations (HOA) cannot be corrected with a lens; however, by adapting the spherical-cylindrical correction, their influence on vision can be minimised. For this reason, with the DNEye® technology (see Chapter 1 Technologies), Rodenstock optimises the spherical-cylindrical power at every point of the lens based on the aberrometric measurement data of the eye.

Figure 7-1: DNEye® Scanner (left) and DNEye® Scanner 2/2+ (right)

In addition to the functions of the first generation, the DNEye® Scanner 2/2+ offers the following functions:

Opacity
The opacity of the refractive media is shown using retro illumination.

Pachymetry
The integrated Scheimpflug camera measures the corneal thickness and provides a detailed analysis of the anterior eye chamber.

Tonometry
The intraocular pressure can be measured using contactless air blast applanation tonometry. In combination with the corneal thickness determined in the pachymetry, this also gives a more precise and meaningful result for the intraocular pressure.

Remote display
You can have the measurement results displayed on external devices, e.g., tablets. While you discuss the measurement results with one customer, a new customer can already be measured.

Comparison of measurement results
Compare different measurements of a customer directly at a glance.

Import interface
The DNEye® Scanner 2/2+ can import customer data from suitable external customer management systems with a corresponding interface.

Compile reports
Reports can be generated directly from the DNEye® Scanner 2/2+, exported, sent by e-mail and printed. You define the desired content for your documentation.

Faster backup
Data backup can be effected in stages, i.e., only the last changes and updates are transferred to the backup. The backup process is thus considerably faster.

Online update
Updates can be downloaded directly online. This way, you can easily update your software as needed.

Sources:
1 K. Nicke et al., “Brillengläser der Zukunft – Schritt 3 – Der DNEye® Scanner”, Der Augenoptiker 12/2012
2 D. Evdokimova et. al., “Neues multifunktionales Messgerät”, Der Augenoptiker 01/2017

Important information about the screening
The DNEye® Scanner 2/2+ provides useful parameters and information for the screening. However, measurements with the DNEye® Scanner 2/2+ do not replace a complete screening process, but can only show individual components of a screening. In general, all necessary steps must be carried out for all screening measures. The applicable working guidelines for opticians and optometrists must be observed. Screenings may only be performed by qualified staff.

In the development of both devices, special attention was paid to making the measurement as comfortable, fast and simple as possible both for the customer and the optician. Focusing and centring in real time are possible with the fully automatic alignment. With a simple touch on the touchscreen, both eyes can be measured within seconds with maximum measurement reliability, substantial time saving and added comfort for the customer. The objectively determined measurement values are perfect as a base for a faster and uncomplicated procedure for the subjective refraction as well as for screening for a near astigmatism.

For ordering B.I.G. EXACT™ lenses (see Chapter 1 Technologies) you can simply import the aberrometric, biometric and pupillometry measurement results from your DNEye® scanner to our order software WinFit® Reference. More information can be found in the manual with your DNEye® Scanner.

An automatic data exchange takes place with CNXT® select. The refraction data are transferred directly to CNXT® select.
This data exchange is optional. In order to conduct the consultation optimally and use all acquired data in real time, the connection to CNXT® is the recommended procedure.

Overview of DNEye® Scanner and DNEye® Scanner 2/2+

<table>
<tr><th></th><th>DNEye® Scanner</th><th>DNEye® Scanner 2/2+</th></tr>
<tr><td rowspan="14">Properties</td><td colspan="2">High-resolution wavefront analyses with brightness-dependent pupillometry for the measurement of low and high order aberrations of the eye</td></tr>
<tr><td colspan="2">Topography/Topometry</td></tr>
<tr><td colspan="2">Fully automatic, operator-independent measurement in real time using eye tracking</td></tr>
<tr><td colspan="2">Visualisation of the wavefronts and simulation of ametropia</td></tr>
<tr><td colspan="2">Accurate ordering to 1/100 D thanks to WinFit® Reference connection</td></tr>
<tr><td></td><td>Pachymetry function for measuring the corneal thickness and analysis of the anterior eye chamber</td></tr>
<tr><td></td><td>Contactless air blast tonometry function for measuring the intraocular pressure</td></tr>
<tr><td></td><td>Remote access to the display of the results on external devices, e.g., tablets</td></tr>
<tr><td></td><td>Direct comparison of results from different measurements</td></tr>
<tr><td></td><td>Create, print and send reports</td></tr>
<tr><td></td><td>Incremental back-up function for fast and convenient data back-up</td></tr>
<tr><td></td><td>Simple update of software via online updates</td></tr>
<tr><td></td><td>Import interface for transferring data from suitable, external customer management systems</td></tr>
<tr><td colspan="2" style="display:none"></td></tr>
<tr><td rowspan="5">Measuring units</td><td colspan="2">High-resolution Shack-Hartmann technology with wavefront precision analysis</td></tr>
<tr><td colspan="2">Placido disc-based cornea topography/topometry with central and peripheral keratometry</td></tr>
<tr><td></td><td>Retro illumination</td></tr>
<tr><td></td><td>Scheimpflug pachymeter</td></tr>
<tr><td></td><td>Non-contact tonometer (DNEye® Scanner 2+ only)</td></tr>
</table>

Table 7-1: Comparison of DNEye® Scanner and DNEye® Scanner 2/2+

7.2. RODENSTOCK FUNDUS SCANNER

The perfect vision and health of your customers is your top priority. Rodenstock completes a holistic approach for screening abnormalities in the eye with the Rodenstock Fundus Scanner. Use the results in the lens consultation and be the contact partner for perfect and healthy vision. In combination with the Rodenstock DNEye® Scanner 2+ and its measuring functions, you now have the opportunity to analyse both the anterior and posterior segments of the eye. Supplemented by a detailed anamnesis, you offer your customers comprehensive care with important information on eye health in addition to competent advice.

Figure 7-2: Rodenstock Fundus Scanner

The eye as a window into the body
The ocular fundus is the only place in the human body where a direct view of the vessels and nerves is possible. Therefore, the analysis of the fundus image provides insights not only about eye health, but also about other health-relevant parameters (e.g., cardio-vascular system and metabolism).
Your customers will perceive you as a specialist for good vision and eye health.

The Rodenstock Fundus Scanner – a Scanning Laser Ophthalmoscope (SLO)
The Rodenstock Fundus Scanner functions according to the principle of a scanning laser ophthalmoscope: The fundus is "scanned" with the confocal light and the reflected light is detected. The image is not generated like a photo, but calculated. Benefits: Detailed images can also be taken for media opacity, such as cataract.
In contrast to a classic white light fundus camera, with the Rodenstock Fundus Scanner an image can also be taken with small pupil diameters (>1.5 mm). It is therefore possible to take an image of the fundus without darkening the room and without the need to administer drugs for pupil dilation – and even in different deep layers as the fundus is scanned in two different wavelengths.

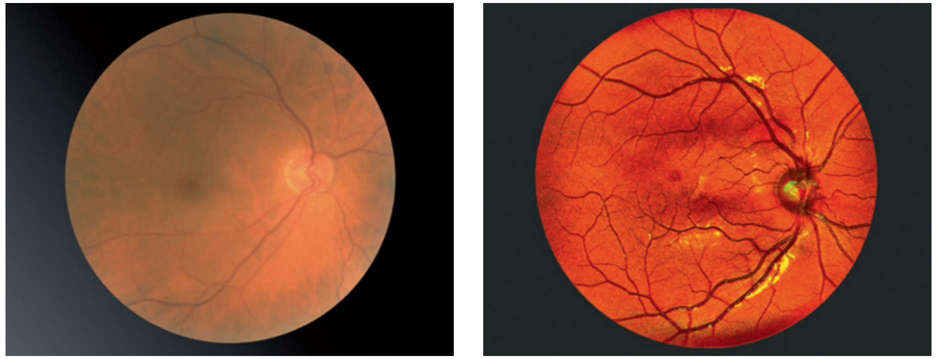


Figure 7-3: Comparison: Image with classic white light fundus camera (left) vs. image with the Rodenstock Fundus Scanner (right)

The continuous real-time video mode in the near infrared range (NIR) is used in order to support focusing and alignment. After the alignment, images are taken with infrared light as well as with green light. Different layers of the retina can be scanned with the various lasers. As a result, a very precise analysis is possible.

The green laser with a wavelength of 532 nm allows you to look at the pigment epithelium. With these images abnormalities on the retina can be optimally examined.
The red laser has a wavelength of 785 nm and extends as far as the choroidal tissue. Veins and vessels can be optimally assessed with these images.

You can also use the images of the ocular fundus to explain a customer's vision system to them in an impressive and clear manner.

With the simultaneous production of two images, there is the option to perform progress monitoring as well as a direct right-left comparison.
An appropriate and thus the best possible optical correction for your customer is possible.

Holistic analysis concept
With the Rodenstock Fundus Scanner and the DNEye® Scanner 2+, as well as a detailed anamnesis, it is possible to offer your customers a comprehensive risk analysis as well as important additional information on eye health and general health condition.

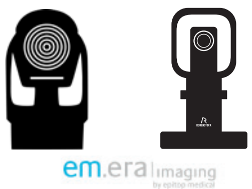


Figure 7-4: DNEye® Scanner 2+ and Fundus Scanner

DNEye® Scanner 2+, Rodenstock Fundus Scanner and telemedicine service
- Data from: anamnesis, tonometry, pachymetry, opacity, as well as retinal scan
- Includes a comprehensive risk analysis on eye health incl. recommended action

DNEye® Scanner 2+ and telemedicine service
- Data from: anamnesis, tonometry, pachymetry and opacity
- Enables a risk analysis for the anterior eye segment incl. recommended action

Rodenstock Fundus Scanner and telemedicine service
- Data from: anamnesis and retinal scan
- Offers a risk analysis for abnormalities at the posterior eye segment incl. recommended action

Telemedicine service em.era | imaging by epitop medical
After you have taken the images and completed the medical history, there is the option to transfer the data to the telemedicine service em.era of the company Epitop Medical. The specially trained ophthalmologists analyse the images/parameters and compile a risk analysis. This gives you professional and legal certainty within the framework of a screening offer. Specific recommendations for action are given if further clarifications are required.
Both the data of the DNEye® Scanner 2+ and the Rodenstock Fundus Scanner are evaluated exclusively by the telemedicine service for Rodenstock customers. Rodenstock offers you one of the most comprehensive risk analyses when it comes to eye health. The competence of the optician as a vision expert is strengthened by the extension of optometric examinations. You can also offer your customers an optimal overall solution for the lens and health consultation from a single source.

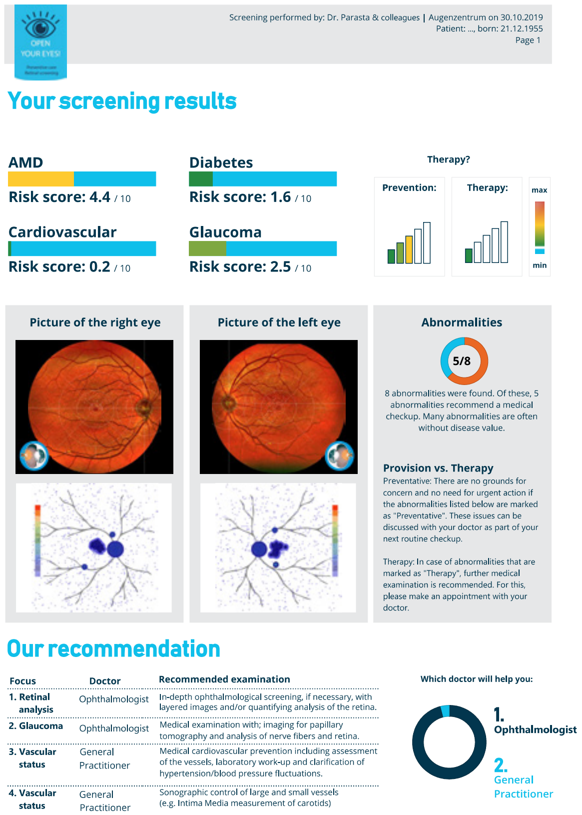


Figure 7-5: Extract of the risk analysis from em.era ("Your screening results")

Important information about the screening

The Rodenstock Fundus Scanner provides useful parameters and information for the screening. However, measurements with the Rodenstock Fundus Scanner do not replace a complete screening process, but can only show individual components of a screening. In general, all necessary steps must be carried out for all screening measures. The applicable statutory requirements and the working guidelines for opticians and optometrists must be observed. Screenings may only be performed by qualified opticians. The optician or optometrist must hold a corresponding university degree or have an appropriate additional qualification.

7.3. IMPRESSIONIST® 4

The ImpressionIST® is the world's first video centring system, which makes it possible to measure all individual parameters in natural head and body positions without an additional clip.
Using the patented stereo camera system, all parameters can be determined in two images captured simultaneously with the activation of only one shooting. Thanks to the 3D measuring technology, it provides precise measurement results within no time.

The ImpressionIST® 4 is the latest video centring device in the ImpressionIST® product line. Thanks to its formidable design, it is also a winner of the Red Dot Design Award and the iF Design Award 2017.
Rodenstock focussed on the original design of the predecessor model during development and optimised it. Highlights include the innovative light concept and the coloured LED ON/OFF button.
The ImpressionIST® 4 is available in two different versions (free-standing version and wall-mounted version). There is also enough space for the device in shops with limited space. The control unit (PC) is mounted at the rear of the device and is invisible. The ImpressionIST® is controlled by the Rodenstock CNXT® software and all measurement data are also available there. The data collected can be called up by different consultation areas (multi-user capability), so that several customers can be served at the same time. In addition to the PC, the ImpressionIST® 4 can also be controlled with the iPad. The results are available on all connected end devices with the automatic synchronisation in CNXT® smart.

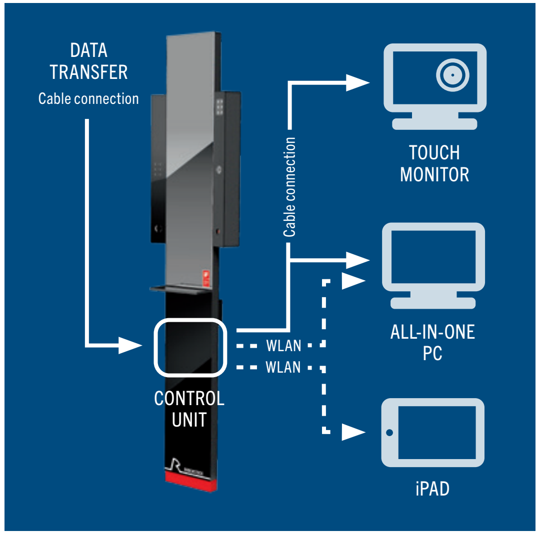


Figure 7-6: Data transfer with ImpressionIST® 4

The 3D measurement module is fully integrated in CNXT® smart. It is no longer necessary to export or import data as there is access to a central database. CNXT® smart guarantees complete data integration and data security, but also offers the direct connection to the industry software.

To sum up, the ImpressionIST® 4 offers the following benefits:

- Individual centring data in normal head and body posture without any annoying trial frame
- Control via the iPad or other end devices
- Completely new software including new, intuitive design
- Database in the control unit (PC) of ImpressionIST®
- Optional, direct synchronisation with CNXT® smart
- Data storage at every programme step
- Award-winning device design
- Available in two different sizes for space-saving use in the shop

The connection to CNXT® smart is the recommended procedure. If you do not have or want a CNXT® licence, then as an alternative you can use the ImpressionIST® 4 basic software to control the devices and evaluate the data. The scope of services of CNXT® is different here.

Figure 7-7: ImpressionIST® 4 as free-standing and wall-mounted version

7.4 MEASUREMENT TOOLS

To determine the individual parameters, you can also use the measurement tools developed by Rodenstock for this purpose. With the measurement tools integrated in the measurement toolbox, the individual parameters such as face form angle, corneal vertex distance and pantoscopic tilt can be measured. The affordable measurement toolbox can be ordered using the order number WG 404241.
A detailed description of the individual measurement tools can be found in the instruction manual enclosed with the box.

Figure 7-8: Measurement toolbox

7.5 CNXT®

CNXT® is a software platform that assists you in many everyday ophthalmic situations. The modular structure gives you complete flexibility for the individual customer consultation.

CNXT® smart
CNXT® smart offers automatic networking of the Rodenstock measurement devices with your PCs, tablets and other programmes such as WinFit® Reference and your industry software. The ImpressionIST® can be controlled directly from any end device. Data on the DNEye® Scanner are available at every workstation after the measurement. All measurement data are synchronised within the network in real time and can be used for the consultation and ordering.

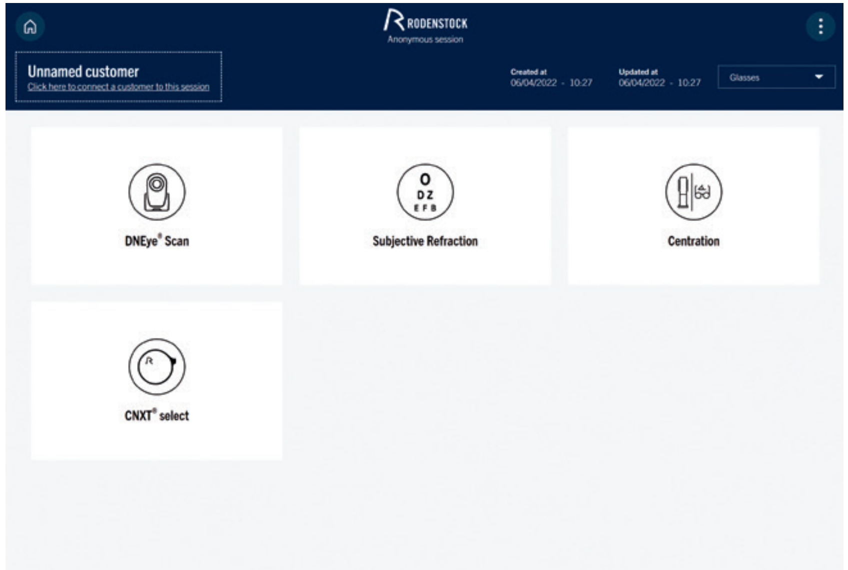


Figure 7-9: CNXT® platform

CNXT® select

CNXT® select is a flexible, intelligent and visually appealing software for your individual customer consultation. The intuitive software provides contemporary support for all relevant decisions of the spectacles wearer, which can be selected in the course of the consultation, such as lens design, lens materials, tintings and coatings.
The consultation is based on previously measured parameters such as refraction and centring data. In addition to many setting and adjustment options, CNXT® select also enables an individual product design and pricing. Once the consultation is completed, the data can be used directly for ordering the lenses through the Rodenstock order software WinFit® Reference or industry software.
CNXT® select is an online-based software solution that can be activated and used directly after purchase. Local installation of the software is not required. CNXT® runs on Windows computers and iPads.

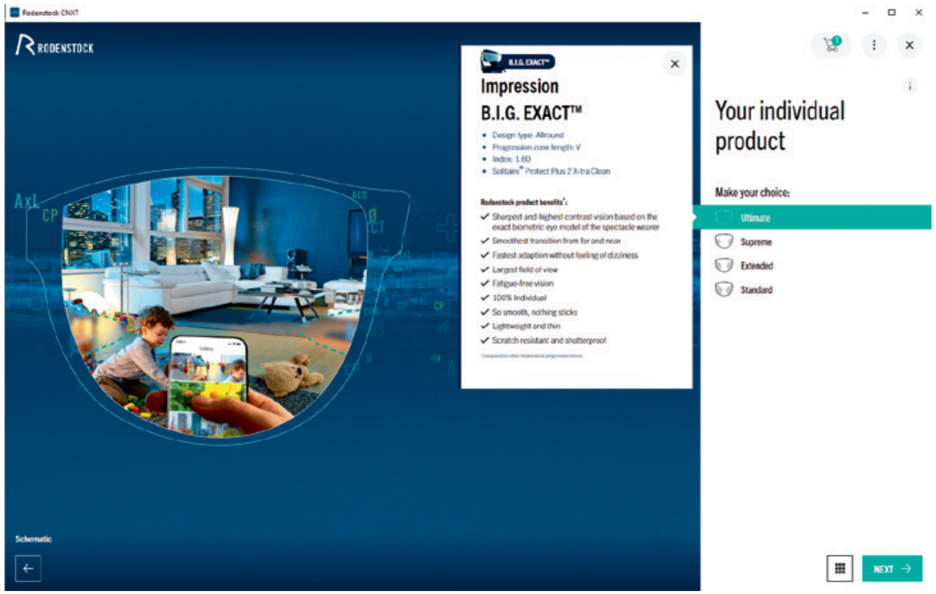


Figure 7-10: Lens consulting in CNXT® select

CNXT® Professional

CNXT® Professional is the combination of CNXT® smart and CNXT® select.
The CNXT® platform and corresponding modules can be purchased in Rodenstock Net. There you also find further information as well as an overview of frequently asked questions. Rodenstock offers easy-to-understand tutorials in video format for the introduction of CNXT®. A practical step-by-step training facilitates startup in order to get to know all functions.

7.6 WINFIT® REFERENCE

With WinFit® Reference, you can include orders of lenses, remote edging and remote glazing, complete spectacles and frames easily and simply and send them to Rodenstock with a mouse click.

WinFit® Reference also offers other practical functions:

- Online calculation of selected lenses in comparison, CTO, edge thickness and drill hole calculation
- Display of edge thickness profile on average
- Impressive 3D simulation for the visualisation of the lens thickness
- Base curve calculation and check for technical feasibility
- Frame database incl. Rodenstock frames and licence brands
- Shape data management with standard shape data and saved shapes
- Loading of Tracer/Tableau data
- Integrated order tracking for status request about which production step your order is at (order management)
- Data transfer from ImpressionIST® or CNXT®
- Data transfer from the DNEye® Scanner/DNEye® Scanner 2/2+ for ordering B.I.G. EXACT™ lenses
- Under “Frame + lenses” you find the latest Rodenstock campaigns

7.7 EYECONSULTING+

The EyeConsulting+ app is aimed at opticians, optometrists and ophthalmologists who work with professional refraction. Particular attention is paid here to the lens calculation for near vision. In the app you find a selection of different tests, near reading samples, as well as other useful content to support you with refraction. There is also the option to perform distance refraction. Refractions can be easily carried out at home visits or events.

Overview of content:

- Film on near refraction
- Calculation of optical centre distance at near (OCD)
- Test for determining addition (Duane) incl. addition calculator
- Tests for fine adjustment for near vision (cross-pattern test and red-green test)
- Optotypes and ray figure for individual near refraction or visual acuity
- Near reading samples
- Optotypes and ray figure for performing distance refraction and cylinder calculation
- Tests for fine adjustment for distance (cross-pattern test and red-green test)

The app is programmed as an iOS app for Apple end devices.

Figure 7-12: Content of EyeConsulting+

In order to guarantee even simpler processing for distance refraction, you can use a second iOS device as a remote control. The remote operating software can be downloaded for free in the App Store and is available for iPad, iPhone and iPod. The respective devices are paired and connected after a successful search via WLAN or Bluetooth.

CONTENT

8 COLORMATIC® 3

THE INTELLIGENT SELF-TINTING LENSES

Self-tinting lenses have the spectacular property of changing their light absorption evenly and reversibly depending on the sunlight intensity. Starting from a highly transparent basic state, the operating principle of these lenses is to darken when exposed to the sun and brighten up again with decreasing sunlight, i.e., return to the basic state.

The first generation of phototropic plastic lenses[1] from Rodenstock was introduced on the market in 1986. Compared to today's standard, however, these lenses, just like the competitor products at the time, have very unsatisfactory properties with regard to achievable absorption and colour, as well as lifetime. Since then the photochromic dyes responsible for the colour absorption and the plastic material surrounding them have been continuously improved through complex development. (ColorMatic® 3 owes its excellent phototropic properties not least to the customised plastic; also Chapter 8.2)

8.1 COLORMATIC® 3: THE TECHNOLOGY

ColorMatic® 3 is now the eighth phototropic plastic lens generation from Rodenstock. The portfolio of newly developed, broadly absorbing photochromic dyes used in the successful predecessor ColorMatic IQ® 2 has been expanded and supplemented for the new generation. The brightening speed, absorption on hot days, as well as the colour stability, have once again been significantly improved. Rodenstock ColorMatic® 3 brand lenses in all indices use these high-performance dyes – a product range with uniform colour aesthetics and performance.

Figure 8-1 describes the main operating principle of current photochromic dyes: The photochromic dye molecules are in their basic state A in their colourless form (not excited). If sunlight hits a molecule, the UV light of the sun (long-wave UV-A) causes a reversible bond break at a specific, predetermined breaking point. The molecule opens up and takes on its coloured (excited) form B – the lens darkens (phototropic reaction).

Source:
1 I. H. Zinner, Phototrope Brillengläser – Der Wandel von Mineral zu Kunststoff, FOCUS 06/2016

The type of reverse action to the colourless basic state A of the dyes is decisive for understanding the operating principle of phototropic plastic lenses: The closing of the dye molecule reversing the previously dissolved chemical bond happens by the thermal movement of the molecule. The lens brightens up again itself. The speed of this brightening is dependent on the ambient temperature. The warmer it is, the faster the brightening. The darkness of the lens is therefore the result of the balance of the repeatedly coloured form B simulated by UV light and the colourless basic form A reversed by thermal reaction. The higher the amount of coloured form B, the higher the observable absorption of the lens. In practice this means that a phototropic lens achieves slightly lower light absorption on a hot summer's day than for example on a cooler day with strong sunlight as the amount of coloured form B decreases with rising temperature due to the faster reverse reaction (brightening).

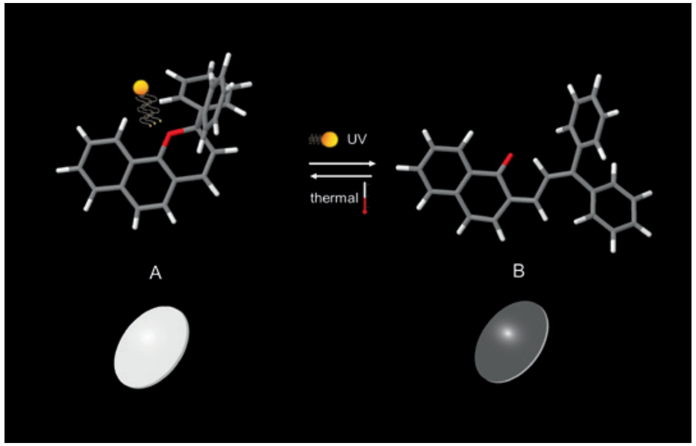


Figure 8-1: Main operating principle of photochromic dyes

At a constant temperature, a phototropic lens becomes darker the higher the light intensity is. In partial shade, phototropic lenses, therefore, have lower light absorption than when in bright sunlight. Rodenstock ColorMatic® products also darken with lower light intensity. Phototropic lenses behave differently to classic, static coloured sunglasses. ColorMatic® 3 lenses are designed as everyday spectacles in their unexcited state due to their high transparency. They replace colourless lenses and have the advantage of flexible absorption increase if the spectacles wearer goes outdoors. Good glare protection is always guaranteed even on warmer days when the light absorption of very dark sunglasses is not achieved.

The physiologically damaging UV light is trapped in the plastic lens by ColorMatic® dyes. UV-400 protection is guaranteed in all lighting conditions (Table 8-1).

	Refractive index ne	Abbe number µe	Density g/cm³	UV protection mm	Protection up to centre thickness mm
ColorMatic® 3 1.67	1.668	31.4	1.37	400	≥ 1.50
ColorMatic® 3 1.60	1.597	40.5	1.3	400	≥ 1.50
ColorMatic® 3 1.54	1.539	42.8	1.2	400	≥ 1.80

Table 8-1: Product information for ColorMatic® 3

ColorMatic® 3 lenses are available as single vision, multifocal and progressive lenses. The colours Smoky Grey and Chestnut Brown are available in the indices 1.54, 1.60 and 1.67 and blends in with the Rodenstock colour portfolio; the new colours Pilot Green and Steel Blue are available in Index 1.60 (Figure 8-2).

ColorMatic® 3

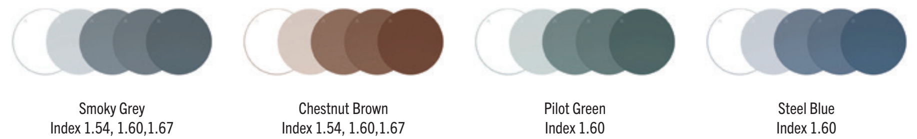


Figure 8-2 ColorMatic® 3 portfolio

8.2 COLORMATIC® 3 1.54 – HIGH PERFORMANCE IN LOW INDEX

Up to now, the photochromic performance of the high-index products 1.60/1.67 was considerably better than that of the Rodenstock 1.54 lenses. This gap is impressively closed with the new ColorMatic® 3 1.54.

In the colours Smoky Grey and Chestnut Brown (ColorMatic® 3 1.60/1.67), your customer receives lenses whose excellent eye clarity and darkening are well above the already good level of the predecessor CM IQ® 2 1.54. Apart from the quick reaction kinetics (Figure 8-3), the noticeably better absorption is impressive in weakened stimulation light and at high temperatures.

The technical explanation is not compatible with the basic explanations in chapter 8.1. In contrast to IQ® 2 1.54, the ColorMatic® 3 1.54 technology is based on the complete separation of the phototrophy function from the optical and mechanical properties. It is possible to adapt the plastic material that surrounds the dyes (the polymer matrix) with higher degrees of freedom to our requirements of kinetics and absorption. The dyes show their full potential here – the balance of A colourless and B darkened is shifted more to the side of molecule B (Figure 8-1). We are already familiar with this concept from ColorMatic® X-tra Fast 1.54.

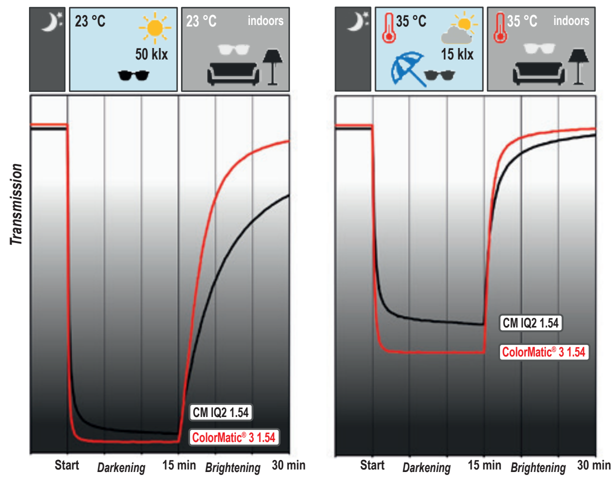


Figure 8.3: ColorMatic® 3 1.54 vs. IQ® 2 1.54. Apart from the standard parameters (23° C and 50 klx = 50.000 Lux), demanding real-life measurement conditions (35° C and 15 klx with weakened stimulation) are created in order to identify the advantages of ColorMatic® 3.

8.3 COLORMATIC® 3 SUN: THE INTELLIGENT SUNGLASSES WITH CONTRAST ENHANCER

ColorMatic® 3 Sun are intelligent phototropic sunglasses with a basic tint of 40% to 55% absorption and maximum tinting of 90% absorption. The self-tinting sunglasses ColorMatic® 3 Sun is available in four colours: the three trendy colours Smoky Grey, Chestnut Brown and Fashion Green, as well as the contrast-enhancing colour Contrast Orange. The trendy colours are ideal for everyday situations. Contrast Orange offers optimal vision during sports and in outdoor activities.

ColorMatic® 3 Sun | **Solitaire® Mirrors**

Smoky Grey Index 1.60 | Chestnut Brown Index 1.60 | Fashion Green Index 1.60 | Contrast Orange Index 1.60 | Sky Blue 2 Silver Moon Red Sun 2

Figure 8-4: Portfolio of ColorMatic® 3 Sun

CONTENT

9 REMOTE EDGING AND GLAZING

9.1 REMOTE EDGING

You have the option to have remote edging carried out on your lenses by Rodenstock. In addition to the usual lens order data, please also send us the tracer data of the frame, the distance between lenses (Dbl), as well as your customer's centring data by remote data transfer (e.g., via WinFit® Reference). We also need additional information such as material of the frame and bevel type in order to carry out precise remote edging on your lenses. The lenses are machined at Rodenstock using industrial, high-precision grinding and milling machines. Before the lenses are sent, they are checked in terms of quality and centring precision.

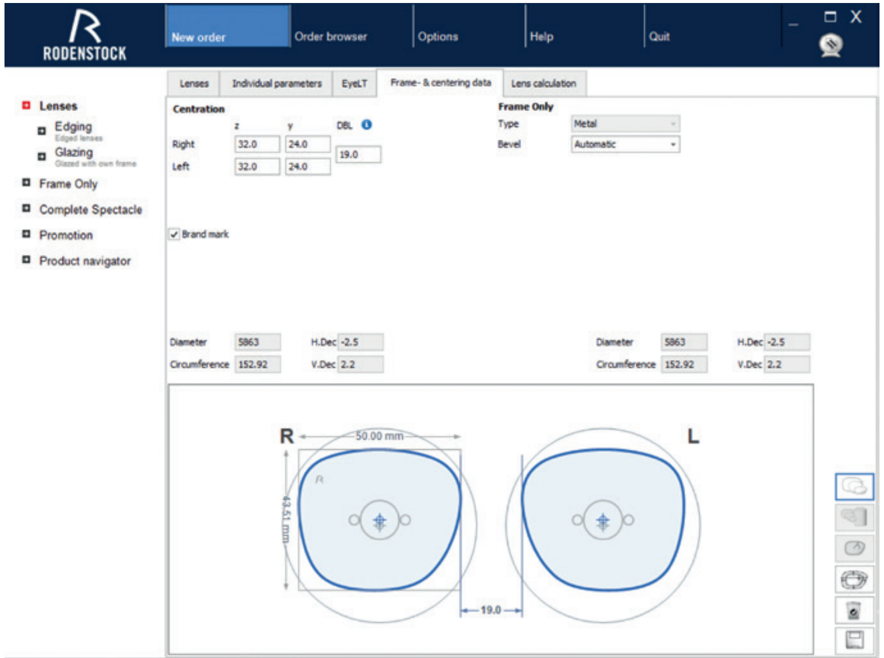


Figure 9-1: Frame and centring data in WinFit® Reference

Remote edging offers the following order options:

- Pointed bevel: automatic or controlled by your specifications in WinFit® Reference
- Flat bevel: grooved with and without polishing; variable groove width and depth
- Flat bevel: with and without polishing
- Drill holes, country-dependent

The following order options cannot be represented via remote edging:

- Partial milled recesses
- Lenticular glazing
- Special bevels (T bevel, inclined bevel, etc.)
- Non-equidistant/inverse radii (see Figure 9-2)

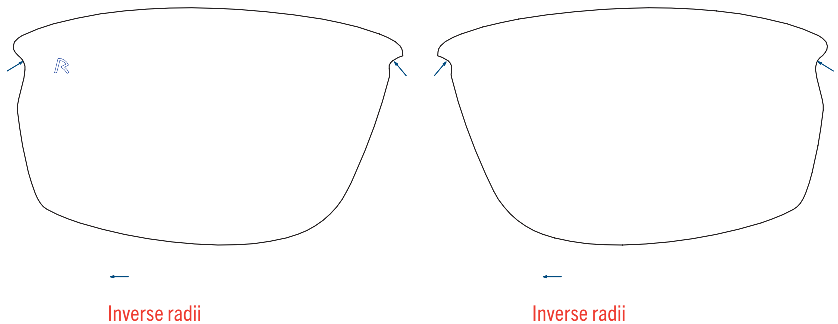


Figure 9-2: Example of inverse radii

Delivery range for remote edging:

- Sph +8.00 D/–8.00 D and cyl ±4.00 D (strongest main meridian)
- Prismatic power: maximum 4.00 cm/m
- Minimum lens depth: for flat bevel 20.0 mm and pointed bevel 21.0 mm
- Base curve is dependent on the ordered power and lens index and is between +0.00 D and +7.50 D; higher base curves can be processed after consultation.
- Remote edging is not offered for sports lenses and Manufaktur lenses

Customer-specific size database
You can create your own size database for remote edging orders in consultation with Rodenstock. This contains your individual measurements or dimensions (e.g., plastic frame always 0.1 mm larger, etc.). These data are determined by trial orders which you send us.

9.2 GLAZING

A glazing order differs from a remote edging order to the extent that you receive a fully glazed pair of spectacles from us. If it is not a complete (frame and lenses) order, please send the frame to Rodenstock. Bevel type and position are optimally adapted to the frame. After edging, the lenses are fitted by our specialists. Complex glazing orders are processed in a specially equipped lab, the Manufaktur. The spectacles are checked in the final inspection and sent to you.

You have the following options when placing a glazing order:

Ordering with tracer:
- First trace the frame and order the lenses by dial-up. In order to achieve a perfect fit of the lenses, internal scanning on both sides is required. A perfect fit is not guaranteed with external scanning of the shaped lens on one side. The respective frame should be sent to your local Rodenstock glazing laboratory. The advantage of this order process is a shorter processing and delivery time as the lenses are included directly in the production processes.

Ordering without tracer:
- Send the frame with the associated, completed form to our glazing lab; the job and the tracing are carried out there. This procedure may lead to time delays as the production process of the lenses can only be started when frame and order data are submitted.
- The lenses are ordered via dial-up. The frame is submitted at a later date. The shape data of the frame are taken from the Rodenstock shape database in advance, e.g., for determining the required lens diameter. In order to guarantee an optimal fit, the frame is scanned in front of the edges of the lenses in the lab.
- As a frame and lens manufacturer, Rodenstock offers special spectacles packages. You can order the lenses and the frame together in one order.

You can use glazing with the following options or frames:
- All technically feasible bevel types
- Individual shape and size changes
- Non-equidistant or inverse radii (specially for sport spectacles) after consultation
- In-Shield-RX glazing
- Drilled and nylor spectacles
- Sports spectacles

The following order options cannot be represented via glazing:
- Incompatible lens curvature and frame curve
- Rx frames that cannot be glazed

Delivery range for glazing orders:
- Sph ±8.00 D, cyl ±4.00 D, and beyond if technically feasible (Manufaktur)
- Prismatic power up to 4.00 cm/m, and beyond if technically feasible
- Minimum lens size: for flat bevel 20.0 mm and pointed bevel 21.0 mm
- Base curve: All available base curves can be processed

Manufaktur and special orders
Rodenstock processes all special orders or orders with particularly high powers as Manufaktur orders. If such a order is received, we will always contact you before proceeding. Examples of such glazing are high prisms, lenticular glazing, diving goggles or also other high powers. For such orders, communication between lab, customer service and you is particularly important.

Figure 9-3: Lenticular glazing

Shape database
There is a shape database in WinFit® Reference which you can access when ordering lenses. Here you find all Rodenstock frames including the Rodenstock license brands. The precision of the shape data depends on the reproducibility of the frames. For this reason, the shape database is not suitable for remote edging orders. However, you can use the shape data for remote edging and glazing orders for calculating the lens diameter. For glazing orders, the data are then replaced in the lab by the individual frame data.

9.3 TIPS ON REMOTE EDGING AND GLAZING

- When placing glazing and remote edging orders, you have the option to use WinFit® Reference or the Rodenstock order form.
- Checking for feasibility: For orders where power, prism, base curve or edge thickness are outside the delivery range, the order is either declined or executed even though there is a risk. If an order is outside the edging delivery range, you have the option of having the frame glazed by us.
- Bear in mind the specification of the bevel type when ordering.
- The following minimum lens center thicknesses (CT) must be observed depending on the type of frame:
  - Nylor spectacles (nylor thread CT 0.6 mm): Minimum edge thickness 1.8 mm
  - Metal nylor (material thickness 1.0 mm): Minimum edge thickness 2.2 mm
  - Drilled spectacles (thickness at drilled hole): 2.2 mm
- Please send the frame in a suitable case (incl. fitting material if necessary) promptly.
- If using tracers, please note the individual specifications of the manufacturer.
- Irrespective of which tracer you use for the shape determination, please calibrate the device daily so that the size reproducibility can be ensured.

CONTENT

10 CARE INSTRUCTIONS

Generally all spectacles with premium coatings from Rodenstock are finished in such a way that they can be cleaned with a standard microfibre cloth. Dry cleaning should be avoided where possible because dust particles which are on the lens are rubbed into the lens, causing scratches.
Instead, the lenses should be rinsed under warm running water using a pH-neutral cleaning agent, diluted detergent that has no greasing properties or a solvent-free care product for spectacles. For drying, we recommend using a clean, fine-fibre microfibre or cotton cloth.

X-tra Clean: So smooth, nothing sticks.
With X-tra Clean, the front and back surfaces of the lens have a premium coating. This extremely smooth surface means that dirt hardly sticks. And if it gets dirty, the dirt can be easily removed.

Further information

- Spectacles should not be cleaned with abrasive household cleaning products, liquids containing solvents (acetone, etc.), acids or lyes.
- Spectacles should never be put down with the lenses facing the front. A firm spectacle case is most suitable for storing spectacles.
- Lenses which have a temporary “anti-fogging” property on the surface must be cleaned carefully depending on the manufacturing method and, if necessary, treated with a special cloth or spray.
- Spectacles should be protected against unusually high temperatures, such as those that may occur in a sauna or in a car parked in the sun.

CONTENT

11 MEDICAL PRODUCT: SPECTACLES

11.1 INSTRUCTIONS FOR USE AND LABELLING

Lenses and spectacles are Class 1 medical products. For their distribution and sale you are obligated as a “practitioner” to inform the spectacle wearer about the correct use and restrictions of use ideally in writing, within your individual and personal consultation. The instructions for use for Rodenstock lenses can be found online at https://www.rodenstock.de/de/de/instructions-for-use.html or simply scan the QR code on the back of the Rodenstock lens bag.

The Ordinance on Medical Devices (Regulation (EU) 2017/745 of the European Parliament and European Council dated 5 April 2017 on medical products, …), also called Medical Device Regulation or MDR for short, regulates the free movement of medical products in Europe. The MDR ensures that only tested products which meet EU requirements are allowed. It describes the conditions for the manufacturers of lenses and frames. Lenses and frames from Rodenstock meet all MDR requirements. This guarantees the CE mark. For functional reasons, it is not printed on the lens, but is easily visible on its packaging.

Figure 11-1: The CE mark stands for “Communauté Européenne” and means “European Community”.

Figure 11-2: Rodenstock lens envelope

11.2 CUSTOM PRODUCTS AND SPECIAL DESIGNS

Custom products can be described, e.g., as all products of Manufaktur or products with lens geometry specifications outside the approved geometry range. The products must be classified as custom products pursuant to EU Regulation 2017/745 (MDR) due to their nature as an individual fabrication as they are not manufactured in the sense of series production. Custom products are made according to the specifications of the regulation by the optician/ophthalmologist and according to the state of the art. Where possible, these products satisfy the fundamental safety requirements i.a.w. Annex I MDR as well as the applicable standard EN ISO 14889 (Ophthalmic optics – Spectacle lenses – Fundamental requirements for uncut finished lenses). Deviations and if necessary even restrictions of the permitted use are identified by Rodenstock together with required manufacturer documentation (cf. Annex XIII MDR). As a result, arising risks must be weighed against the benefits for the spectacles wearer by the issuer of the regulation (optician/ophthalmologist) and documented in the customer file.

Figure 11-3: Custom product by Rodenstock Manufaktur

For all custom versions at the customer's request, which are not included in the specified Rodenstock range, such as inset reduction, base curve request, adaptations to thickness reduction prisms or prisms, etc., and which may alter the performance of the lenses, it is not guaranteed that they are suitable for driving vehicles or have the minimum strength according to EN ISO 14889.
This also includes the combination of different lens types in a pair of spectacles. The user/optician is responsible for using these parameters and conducting a risk-benefit analysis individually adapted to the customer. The intended use and the possible degrees of freedom of the products can be found in Tips & Technology, the Rodenstock instructions for use for the respective products, as well as the Rodenstock product catalogue.

11.3 EXTERNAL PROCESSING OF LENSES

Every subsequent processing of the delivered lenses such as tinting, mirror coating or anti-reflection coating, which is outside the typical edging treatment, is at the customer's own risk and extinguishes all liability on the part of Rodenstock.

11.4 ROADWORTHINESS AND SUITABILITY FOR DRIVING AT NIGHT

In the main visual zone of the lens, the distance must be corrected so that the spectacles can be used in traffic. As near comfort lenses correct intermediate to near distances in the main visual zone, they are not roadworthy.
In addition, tinting may restrict the roadworthiness or suitability for driving at night. These specifications can be found in Rodenstock's instructions for use for the respective product as well as the Rodenstock product catalogue.

11.5 IMPORTANT INFORMATION ABOUT RODENSTOCK SUNGLASSES

Rodenstock lenses are primarily intended for the manufacture of prescription spectacles and meet the requirements of the Medical Products Regulation 2017/745/EEC and the standard EN ISO 14889, which also includes tinted prescription lenses.
If two flat lenses are used for the manufacture of sunglasses, then the requirements of EU Regulation 2016/425 about personal protective equipment and the standard EN ISO 12312-1 must be observed. When grinding plano lenses for sunglasses, the standard EN ISO 12312-1, Section 11 “Requirements of the protective function” must be observed.

Spectacles from Rodenstock meet the respective requirements. Information for consumers, such as the filter category and if necessary phototropic or polarising properties of the lenses, can be found on the Rodenstock instructions for use or in the product catalogue. A description of the filter categories, their values for light transmission and their recommended use can be found in Table 11-1.

The following restrictions of use must be observed:
- Sunglasses are not suitable for looking directly at the sun and for protection against artificial light sources, e.g., in the solarium.
- Sunglasses are not suitable as eye protection against mechanical hazards and impacts.
- Lenses in filter categories 1 - 3, as well as self-tinting lenses with transmission values less than 75%, are not suitable for driving at dusk and at night.
- Lenses in filter category 4 are not roadworthy.
- Further restrictions regarding roadworthiness and suitability for night driving can be found in the Rodenstock instructions for use and the Rodenstock product catalogue.

11.6 ADDITIONAL INFORMATION FOR SELF-TINTING PRESCRIPTION SUNGLASSES

The light transmission values of self-tinting sunglasses are dependent on the ambient temperature, UV radiation and other factors.
ColorMatic® 3 and ColorMatic® IQ 2 spectacles correspond to filter categories 0 – 3 in normal conditions depending on the level of darkening, while ColorMatic® 3 Sun and ColorMatic® IQ 2 Sun sunglasses correspond to filter categories 1 to 3 in normal conditions.

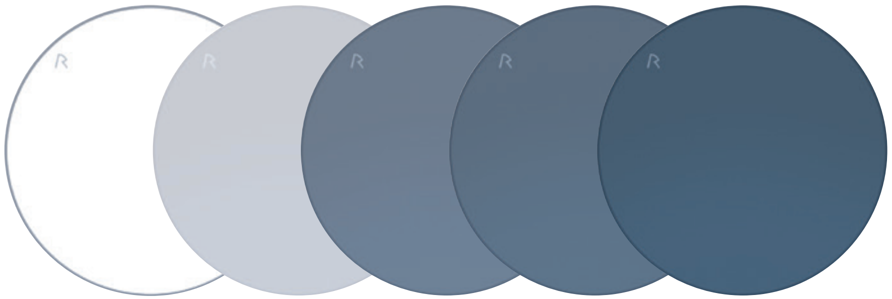


Figure 11-4: ColorMatic® 3 lens in Steel Blue; darkening states

Our self-tinting sunglasses are tested in the lab under normal conditions. In everyday ambient conditions (above 10°C in normal sunlight), they are suitable for road traffic. At low temperatures and in very strong sunlight, there may be reduced values for the light transmission according to filter category 4.

At high temperatures or with reduced sunlight there may be higher values for the light transmission.

ColorMatic®

- ColorMatic® 3 and ColorMatic® IQ 2 plastic lenses are suitable for night driving i.a.w. EN ISO 14889 and 8980-3:2013 or 12312-1:2013.
- ColorMatic® 3 Sun and ColorMatic® IQ 2 Sun spectacles are not suitable for night driving due to their precolouring.
- Real values of the respective ColorMatic® lens determined indoors (brightened) or at 20° C in the midday sun dimmed.
- The lab values are measured in accordance with EN ISO 8980-3:2013 or 12311:2013.
- In contrast to ColorMatic® plastic lenses, ColorMatic® mineral lenses are not suitable for night driving without restrictions i.a.w. EN ISO 14889 and 8980-3:2013 or 12312-1:2013. This is due to the typical, material-related slower brightening of mineral lenses compared to modern plastic lenses.
  The following restrictions apply: Phototropic mineral lenses without anti-reflection coating are not suitable for night driving from a centre thickness of approx. 4 mm (ColorMatic® 1.60 grey: approx. 6 mm). ColorMatic® mineral lenses with anti-reflection coating are no longer suitable for driving from a centre thickness of approx. 6 mm (ColorMatic® 1.60 grey: approx. 7 mm). The lenses are classified in category 0 or 1 depending on the centre thickness.

Further information on restrictions of use can be found in the current Rodenstock product catalogue as well as the Rodenstock instructions for use.

11.7 TRANSMISSION CLASSES

Filter category Light transmission	Description	Use
0 81–100 %	Slightly tinted sunglasses	Very restricted absorption of sunlight
1 44–80 %		Restricted protection against sunlight
2 19–43 %	Sunglasses for general use	Good protection against sunlight
3 9–18 %		High protection against sunlight
4 3–8 %	Very dark sunglasses for special use, very high absorption of sunlight	Very high protection against extreme sunlight, which occurs, e.g., at the sea, in snow fields, in high mountain ranges or in deserts. Not roadworthy

Table 11-1: Transmission classes - Lenses

The consumer must be informed in writing about the respective classification of his spectacles, as well as any resulting restrictions of use.

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