Zeiss **Abbe Eyepieces**

A-4, A-6, A-10, A-16, A-25, A-34

New Line of Eyepieces for
Astronomical Telescopes

Product Information

ZEISS

A new Generation of Eyepieces from Carl Zeiss Jena

Why new eyepieces?

Transmittance has been increased.

As part of the development program for a new line of telescopes, Carl Zeiss Jena created a novel oil gap-filling technology for the production of fully apochromatic refractor objectives using pure, grown fluorite. These telescope objectives, which have been given the name APQ, display a level of color purity and transmission which cannot be achieved with optical glass. They represent the absolute technological state of the art in optical production. For the amateur astronomist, the quality of the image he perceives in both visual observation and photography is of paramount importance. APQ refractors show just what they are capable of when critical demands are made on the quality of observation and when optimum viewing conditions are provided.

The enhanced brightness and sharp definition provided by Abbe eyepieces are underlined even further by a very favorable field of view.

The APQs demonstrate the absurdity of the standard rule of thumb used to obtain the useful magnification (i.e. that it is approximately equal to 1 to 1½ times the aperture in mm). Magnifications of up to 3 times the aperture are most certainly „useful" for viewing planets and binary stars!

We have now teamed the APQ objectives with the Abbe eyepieces. The intention is obvious: the eyepieces must do justice to the high transmission of the APQ objectives. Together, the APQ objective and Abbe eyepiece provide an extremely bright image. The role played by the eyepiece in the overall light loss is often underestimated. The new Abbe eyepieces, however, transmit 97% and more of the light. It therefore stands to reason that the transmittance is also several percent higher than that of comparable eyepieces. The increase in light will certainly not be lost on the experienced observer. He will immediately notice the true-to-nature colors: those annoying color fringes around Jupiter or Venus will be a thing of the past - even at high magnifications. And that is by no means all: the Abbe eyepieces provide not only an increase in brightness and razor-sharp definition, but also a very favorable field of view.

They increase the sheer enjoyment of viewing.

The new Abbe eyepieces from Carl Zeiss Jena put the finishing touches to the APQ line of telescopes. These state-of-the-art telescopes are not only your guarantee of better quality viewing; they will also increase the sheer enjoyment of astronomical observation. Experienced observers in particular are impressed by the superb images resulting from the combination of an „APQ" with Abbe eyepieces.

Are Abbe eyepieces only suitable for APQ refractors?

No. Needless to say, the new Abbe eyepieces are suitable for all telescopes. They reflect the current trend towards „faster" objectives in modern refractor design: strictly speaking, they are designed for fast lenses with the f-number 8. Comparison: classical eyepieces such as the excellently corrected orthoscopic eyepieces from Carl Zeiss Jena are designed for f /10. Since aberrations decrease with smaller f-numbers, it follows that Abbe eyepieces provide a level of image quality which will benefit any commercial telescope. There are practically no limits to the number of applications for which they can be used. However, the user must,of course, always remember that an eyepiece cannot improve the quality of an objective.

The new Abbe eyepieces are suitable for all telescopes.

Why „Abbe" eyepieces?

They feature an orthoscopic construction. The optical design dates back to one of the founding fathers of our company, the physicist Ernst Abbe. It is in his memory that we have given these new eyepieces the name „Abbe eyepieces". A single use of an „Abbe" will suffice to convince the practiced user of the many merits offered by this design compared with achromatic eyepieces.

The optical design dates back to Ernst Abbe.

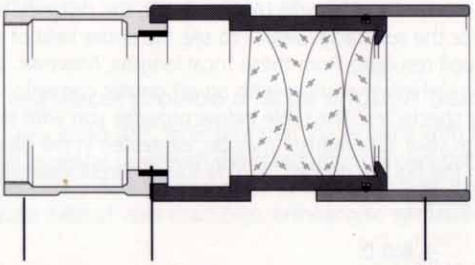

Fig 2 Cross section of the 25mm Abbe eyepiece

What is required for their connection?

The standard insert diameter of 1¼". The insert cylinder has a length of 25 mm. We have grooved its surface to lock it firmly in position - an effective means of ensuring that it cannot fall out accidentally. The insert sleeve features an internal screw thread to permit the attachment of commercial filters.

Insert diameter 1¼ ".

Can Abbe eyepieces be used in combination with Zeiss telescopes featuring 24.5 mm barrel-type eyepieces?

Zeiss M44 eyepiece clamp - 1¹/₄".

Yes. Just use our eyepiece clamp with an M44 connecting thread and a 1¹/₄" insert diameter.

Has Zeiss thought up something special for spectacle-wearers?

The Abbe eyepieces with longer focal lengths (from A-16 upwards) feature a sliding sleeve.

That goes without saying. To improve viewing for spectacle-wearers, Abbe eyepieces with longer focal lengths (from A-16 upwards) feature a sliding sleeve. The spectacle-wearer pushes this in with the aid of a grip to obtain the optimum eye relief. The result: relaxed viewing is also guaranteed for users wearing glasses. This configuration is particularly beneficial for short periods of observation without any need for spectacle-wearers to take off their glasses and, of course, for ametropic viewers with a pronounced astigmatism. Generally speaking, however,viewing with spectacles is not recommended. Glasses make alignment of the eye with the exit pupil more difficult. Another drawback is that lateral light can reach the eye unhindered. Spectacles should only be used for longer periods of observation if the wearer has a prescription with a very high astigmatic correction. This is where the sliding sleeves really come into their own.

In eyepieces with shorter focal lengths (A-4 to A-10), the distance to the exit pupil is too small for the spectacle-wearer to see the entire field of view. Due to the small exit pupil resulting from these focal lengths, however, the permissible astigmatism is so high that users with an astigmatic correction seldom need to wear their spectacles. The table below provides you with some guidelines as to how high your astigmatism may be, expressed in the dioptre power of your glasses. (In the figures quoted, a 20% loss in Strehl intensity is assumed to be admissible.)

A-4	± 6.0 D
A-6	± 2.7 D
A-10	± 1.0 D

If your astigmatic prescription clearly exceeds the powers given in the table, we highly recommend the use of our Barlow lens.

Are the Abbe eyepieces also coated?

Of course. The multilayer coating (multi-coating) makes a major contribution to the high transmittance and color purity of the eyepieces. The multi-coating is resistant and protects the lens surfaces against everyday wear and tear. The anti-reflection coating features precisely the abrasion resistance needed to protect it during cleaning.
Incidentally, it is important to note that, unlike the objective, eyepieces should be frequently cleaned.The smaller the exit pupil of the telescope, the more the quality of the image observed will be impaired by dust particles. The best things to use for this purpose are a squeeze-type air bulb or a totally grease-free, dust-free brush. Only if either of these tools fails to remove stubborn dirt should a piece of cotton wool soaked in pure alcohol (at least 96%) be used, but without the application of pressure.

All Abbe eyepieces feature a multi-coating.

How does Zeiss achieve such a high transmittance?

That is no secret. We use special types of glass with a very high transmittance, which we then increase even further by the application of the multi-coating. Finally, with precisely the right dimensions and exactly the right position, the baffle (a device used to exclude stray light) also plays a major role in increasing image contrast.

We use special types of glass.

Do Abbe eyepieces provide a large enough field of view?

The field of view totals 45°. To ensure that the eypiece with the long focal length (A-34) could be used with the standardized insert diameter of 1¼", it was designed with a field of view of 40°. Abbe eyepieces therefore provide a markedly wider field of view than Zeiss orthoscopic eyepieces.

The field of view measures 45°.

What about the optical correction of the Abbe eyepieces?

It is very good. The improvement in the state of correction compared with orthoscopic eyepieces has been achieved by the use of new types of high-index lanthanum glass. For observation, it is very important to have a good balance between astigmatism and field curvature. This is something to which we have attached great importance: an optimum balance has been achieved in the Abbe eyepieces.

The state of correction is very good.

What do the colored rings stand for?

Colored rings identify the focal lengths.

Colored rings identify the focal lengths. They are very useful, for instance, for task-specific configuration of the eyepiece turret.

Are there enough focal lengths available to provide finely-stepped magnifications?

Our Barlow lens doubles the range of eyepieces available.

Yes and no. The eyepieces themselves provide a wide variety of finely-stepped magnifications. For viewers who are interested in even finer increments, we can now provide the new Barlow lens (2X). It halves the eyepiece focal length. This therefore provides an additional series (2, 3, 5, 8, 12.5 and 17 mm) in addition to the existing sequence 4, 6, 10, 16, 25 and 34 mm. The result: your range of eyepieces is doubled.
For the emmetropic eye, the focus remains unchanged after the insertion of the Barlow lens: the optical system is homofocal.
The Barlow lens also comes in handy for photography using eyepiece projection. It doubles the f-number of the light-gathering optics, resulting in an image which is practically aberration-free right to the edge of the field of view.

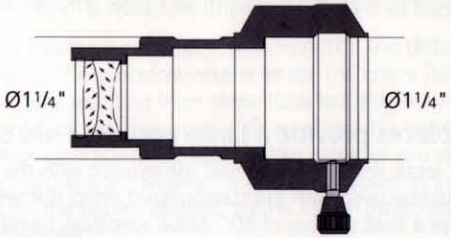

Fig 3 Cross section of the Barlow lens (2x)

Interested in the technical data?

No problem. The first overview lists the technical parameters.
Fig. 4 plots the transmission curve of an Abbe eyepiece compared with an Zeiss orthoscopic eyepiece. Table 1 shows the optical data for viewing, and Table 2 provides the distance from the exit pupil to the end of the eyepiece for observation with and without spectacles.

Technical parameters

Insert diameter	1,25 ins (31,8 mm)
Length of insert cylinder	25 mm
Diameter, ocular side	34 mm
Focal lengths	4, 6, 10, 16, 25, 34 mm
Relative aperture (state of correction)	1:8
No. of lens elements	4
Cemented components / elements	1/3
Anti-reflection coating	multi-coating
Transmission	≥ 97 %
Field of view	45° (A-34: 40°)
Adaptation for spectacle-wearers	A-16, A-25, A-34
Filter thread	M28,5x0,6 (objective side)
Locking groove on insert cylinder	yes
Color coding	yes

Transmission

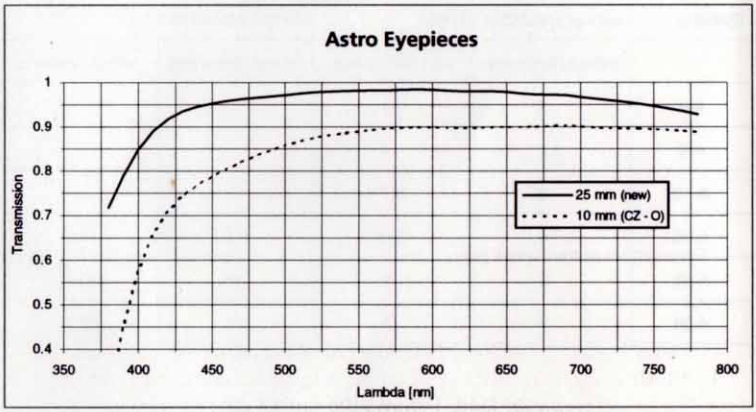

Fig 4 Transmission curve of an Abbe eyepiece compared with an Zeiss orthoscopic eyepiece

Optical data

Table 1
Optical data for viewing

Eyepiece	Diameter of field stops D in mm	Visible field of view W in ∞	Diameter of field of view with 1000 mm objective focal length H*	Colored ring
A-4	3.3	45	11'20"	light blue
A-6	5	45	17'10"	turquoise
A-10	8.3	45	28'30"	ocher
A-16	13.2	45	45'20"	medium yellow
A-25	20.7	45	1∞10'	orange
A-34	24.3	40	1∞25'	red

* For other objective focal lengths, H changes in the corresponding focal distance ratio.

Exit pupil

Table 2
Distance from exit pupil to end of eyepiece

Eyepiece	without spectacles (in mm)		with spectacles (in mm)	
	without Barlow lens	with Barlow lens	without Barlow lens	with Barlow lens
A-4	2	2.1	-	-
A-6	3.7	4	-	-
A-10	5	5.7	-	-
A-16	4	5.8	9.8	11.6
A-25	5	5	16	20.4
A-34	5	5	21	28.7

Note:
Initially, the eyepieces A-4 to A-25 will be available; the A-34 and the Barlow lens will probably be available in the secound quarter of 1995.

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Astronomische Geräte
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Edition: July 1994
Publ.-No.:
56-15/**274**/1/94
File: abbeo2_e.pm5