Burgess SWA and Meade QX Eyepieces

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Observers now have several choices of 1.25" and 2" eyepieces that promise superwide apparent fields of view at a cost scarcely greater than the price of a 1.25" Plössl just a few years ago. But just how well do they perform? In this report we will take a look at two such eyepiece lines, the Burgess SWA and Meade QX series. Also pictured is a 2" 32mm University Optics König II which will be included informally to provide a traditional point of reference.

Telescopes Used

The principal scope used for testing was my 10" f/5 Teleport, a superb Newtonian with excellent optics. Not everyone has an f/5 telescope, and while performance can be expected to improve at slower f-ratios, just how much improvement would remain a mystery if only one f-ratio were used. Consequently, in addition to f/5, observations were made at f/6 and f/10 by masking the Teleport's aperture. With a 5" aperture mask, the central obstruction is 36.7% of the diameter, much like a commercial SCT. Masked down to an aperture of 8.3", the Teleport becomes a 22% obstructed f/6 telescope.

My purpose in going with f/6, which seems fairly close to f/5, was to give some insight into how much slower a telescope will need to be in order to observe a significant improvement in performance. Furthermore, since I would not be using a coma corrector and since f/5 is often considered to be a borderline f-ratio for needing one, testing at f/6 would help allay the concern that coma would be responsible for any significant edge-offield performance problem. It turned out that there was not much difference to be seen in performance between f/6 and f/5, despite the reduction in coma.

There were additionally observing sessions with my 7" f/6.7 and 120mm f/8.3 Newtonians. The 7" does not have a large enough secondary to deliver much light to the edge of field in a long focal length 2" eyepiece, so this scope was useful mainly for evaluating the medium and shorter focal lengths. The 120mm f/8.5 scope has only a 1.25" focuser, but it should be useful for predicting performance in the common 114mm f/8 Newtonian. Unlike the 10" and 7" scopes, which have premium optics, the 120mm f/8.5 has an ordinary Meade surplus mirror (actually a 5" f/8 masked down slightly at the mirror cell to 120mm).

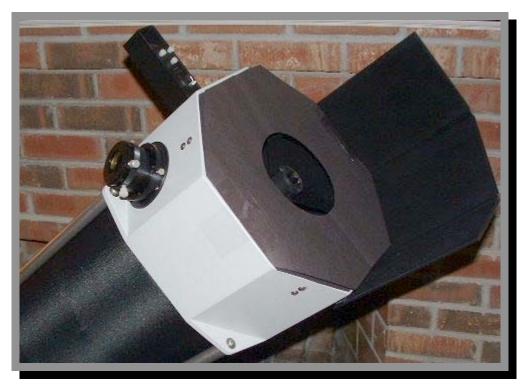


Figure 1. The 10" Teleport masked down for 5" f/10 Testing.

Coatings

The quality of eyepiece coatings is a very important factor in eyepiece performance. Overall transmission is only one thing that is affected. Poor coatings can cause extra reflections and scatter in the eyepiece and even introduce a noticeable color shift. Unfortunately, for coatings to perform as designed, their thickness must be precisely controlled, and so this is an area where inexpensive eyepieces can sometimes fail to measure up. Good broadband anti-reflection coatings tend to deliver colorful reflections of a bright light source depending on the angle that light makes when it reflects off the lens surfaces. Unfortunately, looking for pretty, colorful reflections is no way to evaluate the effectiveness of eyepiece coatings. In fact, because reflected light of any color is not being transmitted through the eyepiece, what we want to see are the dimmest possible reflections, at least when looking straight on, or nearly so.

The coatings look pretty good on all the Meade QX and Burgess SWA eyepieces, although just in handling them and comparing them to other eyepieces the green reflections seem a little too bright, not as bad as I have seen in the past, but not as good as they could be, either. The vertical photo (Figure 3) of the 2" eyepieces shows this rather clearly in comparison to the 32mm University Optics König II. All the eyepieces are seated on black lens caps. The 1.25" photo (Figure 4) does not make the case as strongly compared to the 12mm University Optics König at lower right, but zooming in on the picture, I think a difference can still be seen. The optics and barrel of a 2x Tele Vue Barlow are there as well.

In the photos one can see a bright ring in the Meade QX eyepieces. This is an unblackened section at the end of the barrel for filters and should not, in my opinion, be considered a defect. It is not uncommon among premium eyepieces, and it does not seem to be a problem in practice here. One could easily blacken the barrel ends with paint or flocking paper if desired. I would not bother with it, as it is unlikely that contrastreducing reflections off this surface will make it into the exit pupil given the decent coatings and excellent blackening of these eyepieces.

In handling the eyepieces and comparing them, I developed the impression that the Meade coatings were slightly better. For example, reflections of a bright light source are multi-colored in the 20mm Meade QX and more uniformly green in the 20mm Burgess SWA, as if a green filter had been applied. This was easy to compare because the reflections are identical in their arrangement, which of course, is evidence of similar (if not identical) optical designs.

A couple of the eyepieces arrived with some coating blemishes. The 38mm Burgess SWA eye lens coatings had a slightly splotchy appearance here and there under just the right lighting conditions. This might clean up or it might not, but it was very subtle, difficult to detect, and in any case I could see no effect whatsoever on performance. The 20mm Meade QX came with a nice c-shaped sleek near the center of the eye lens. There may also be a scratch on the inside of the eye lens, judging from what I was able to see with a very small exit pupil when using the eyepiece with a 3x Barlow. If this had been a planetary eyepiece review I would have asked for a replacement, but it posed no visible artifacts with the 2mm and larger exit pupils it was serving up in most of the testing. As the photo indicates, the scratches were invisible when viewing straight on. Anyway, it is always a good idea to do a careful coating inspection before using a new eyepiece. All the others seemed to be in perfect shape, so I suppose these were just random cases.



Figure 2. Vertical view of 2" eyepieces. The Burgess SWA eyepieces are on top with the Meade QX eyepieces sandwiching a 32mm UO König II.



Figure 3. Vertical view of the 1.25" eyepieces. Burgess SWA eyepieces at top, Meade QX eyepieces at lower left. Also included are a 12mm UO König II and a Tele Vue Barlow.

Measurements

I measured several parameters of the eyepieces. All length measurements are quoted in millimeters and were obtained with the aid of digital calipers.

	Manufacturer Focal Length	1. Measured Focal Length	2. Field Stop Diameter	3. Focus Location	4. Edge Defocus
Burgess SWA	38	38.0	45.8	-4.1	2.4
Meade QX	36	36.0	44.8	2.4	1.4
Burgess SWA	32	32.0	40.0	3.0	1.8
UO 32mm König	32	32.0	34.0	0.7	1.2
Burgess SWA	26	26.0	32.3	3.2	1.5
Meade QX	26	26.0	32.3	6.5	1.9
Burgess SWA	20	19.5	25.1	2.8	1.6
Meade QX	20	19.3	25.0	3.1	1.9
Burgess SWA	16	15.0	18.8	3.8	1.2
Meade QX	15	15.0	18.6	3.8	1.1
Burgess SWA	9	9.5	12.9	3.4	1.0

Some explanations and comments are in order.

- 1. Measured Focal Length. This was estimated by measuring the exit pupil diameter in a 10" f/5 Teleport and multiplying by 5. As a rule the results confirmed the manufacturers' focal lengths. It did seem that the 16mm Burgess SWA might be closer to 15mm in focal length. Also, both 20mm eyepieces may have a slightly shorter focal length, and the 9mm Burgess SWA may have a slightly longer focal length.
- 2. Field Stop Diameter. These were measured directly.
- 3. Focus Location. The focus location indicates where the eyepiece focal plane is relative to the barrel flange (also known as the eyepiece "shoulder"). A positive value indicates that the focal plane of the eyepiece is somewhere in the barrel below the flange, whereas a negative value indicates that the focal plane is in the upper casing. In other words, the greater the positive value, the more focuser outtravel will be required to focus. Conversely, the larger the size of the negative value, the more focuser in-travel will be required. This corresponds to the "F" measurement in Tele Vue's eyepiece specifications. I calibrated with a 24mm Panoptic (assigning it a value of +6.35 mm since Tele Vue quotes as having a field stop 0.25 inches below the barrel flange) and measured the actual (paraxial) focus position of each eyepiece. For the most part, the Burgess SWA and Meade QX eyepieces are close to parfocal, the main exception being the 38mm Burgess SWA, which requires several millimeters of in-focus as compared to the others. The 26mm Meade QX was a curiosity in that it required more out-travel than the other Meade QX eyepieces and the Burgess SWAs.
- 4. Edge Defocus. I included this measurement because both lines suffer from field curvature, and I wanted a measure of the problem. The tabulated numbers are the measured travel of the focuser drawtube from the position with the center of the view focused at infinity to the position with the edge of the view optimally

focused. Unfortunately, when there is a significant amount of astigmatism there is no single, good focus position at the edge of field, so there is no unique defocus amount to be measured. The measurements were taken at f/6, and unfortunately there was astigmatism seen, and so there was considerable subjectivity involved. The important point in any case is that the edge is not sharp if this number is not zero. Note that the raw data were adjusted to remove the slight curvature inherent in the Newtonian telescope design. One might want to divide these numbers by the focal lengths of the respective eyepieces and consider them each as a percentage of eyepiece focal length. For comparison, note that a 24mm Panoptic shows no edge defocus in my scopes.

Although it is not tabulated, I also attempted to measure the apparent field of view of each eyepiece directly. The method I used is not very precise, and fortunately, in every case the apparent field of view seemed at least as large as the manufacturer quotes. Also, holding a Burgess SWA up to one eye and a Meade QX up to the other, there seemed little or no difference in the apparent fields.

Test Results

Findings in Common

My initial outing with the eyepieces was just a quick look in the 7" f/6.7 Newtonian. The moon provided a convenient target for assessing field sharpness. All of the eyepieces showed dust on their field lenses with disturbing clarity, both with my glasses on and especially when I removed my glasses and used the focuser to compensate for my nearsightedness. After this observing session I blew out the dust with clean air from plastic, oil-less syringe pump. This needed repeating occasionally between observing sessions, especially when one of the eyepieces was used with a Barlow to observe the moon. Other than with lunar and planetary viewing, I had little further problem with dust.

Another common issue was that all the eyepieces showed noticeable field curvature—the edge sharpness improved substantially with refocusing. This was not merely an edge-of-field issue at faster focal ratios. The farther off-axis an object was, the more it seemed to invite a focus adjustment. On the positive side, baffling and blackening seemed to be effective. Panning Saturn into and out of the view revealed no problems with glare. There were some reflections, but most of these (except in the 9mm Burgess SWA) proved to be of external rather than internal origin. In other words, I saw reflections at times, but usually they were eliminated by putting a shroud over my head to screen out ambient light.

One problem that has sometimes been observed in inexpensive superwide eyepieces is spherical aberration of the exit pupil, also known as kidney beaning. In all of these eyepieces the exit pupil seemed to be formed well enough, and I had no difficulty maintaining the views without blackouts. Lateral color was present at the field extremities, but the amount was not a differentiating factor. If anything the amount of lateral color seen in these eyepieces was significantly less than usual for fields 70 or more degrees wide.

The field stop and focal length data indicate a normal amount of angular magnification distortion for eyepieces with super-wide apparent fields. One nice feature is that rectilinear distortion is fairly well-controlled. The upshot is that, although there is some geometric distortion, stars track across the view in nearly straight lines while panning.

38mm Burgess SWA

I was at first surprised by the large size of the box for this eyepiece. The eyepiece itself is the largest and heaviest of the bunch, probably about 22 ounces, give or take an ounce. The eye lens is recessed by about 15mm. Recessing the eye lens is a technique employed by eyepiece designers to avoid the need for a tall rubber eye guard and to assist with eye positioning. It reduces usable eye relief, but I still had plenty for use with my eyeglasses on.

The lens spacers are well blackened, and the space between the field lens and field stop is grooved as well. I first turned this eyepiece to the M81/M82 field. At f/10 faint stars were nearly sharp to the edge. Turning to M3 revealed nothing new. Performance was comfortable and the view was pleasing. At f/5 the Trapezium in M42 resolved over about 80-85% of the view and easily resolved at the edge with refocusing. Without refocusing, however, even faint stars appeared as line segments (seagulls) at the edge. The view of the Pleiades was nice, but again, the edge of field problems were apparent in the outer 15-20%. At f/6 the view was only slightly better than at f/5, but overall I would have been pleased with this eyepiece at the price.

36mm Meade QX

The 36mm Meade QX is slightly less massive, about as wide as the 38mm Burgess SWA, but more squat owing to the size of the barrel portion of the eyepiece. Compared to the GSO SuperViews, which I tried within the last year, the lenses appear quite large, larger than the diameter of the barrel, although the eye lens has a more restricted clear aperture than the 38mm Burgess. As with the 38mm Burgess, the eye lens is recessed by about 15mm. I still had enough eye relief for viewing with glasses on, just barely, but I could have wished for slightly smaller recess so that I wouldn't have to make sure my glasses were parallel to the eye lens.

Blackening is superbly done. Again, there is grooving between the field lens all the way to the bottom of the eyepiece. As previously noted, the end of the barrel is left unblackened for use with filters.

At f/10 the eyepiece performed very well, similar to the 38mm Burgess, which is to say, nearly sharp to the edge. A choice between the two would be difficult at this f-ratio. Contrast seemed slightly better in the Meade, but correction seemed ever so slightly better in the Burgess. I felt there was slightly more astigmatism in the Meade, as star

images did not seem quite as sharp about 70% off-axis, although at f/10 all star images were relatively compact. Generally I felt a very slight preference for the 38mm Burgess optically, but I did appreciate that the Meade focused in a more standard location compared to the other eyepieces being tested and compared to the eyepieces in my current collection.

At f/5 the Trapezium in M42 was "resolved" (not sharp, but recognizable) nearly to the edge of field, but it was a mess at the edge. Refocusing cleaned it up for the most part. Again, at f/6 the view was only slightly improved over f/5.

It may seem that I am not that enthusiastic about the 36mm Meade QX at faster f-ratios, but that actually is not the case. I merely want to be clear about its imperfections. While I liked the 38mm Burgess slightly better in some cases, the build quality, blackening, coatings, focus position, size, and weight favor the Meade. In fact, I plan to keep the Meade as my new "finder" eyepiece.

32mm Burgess SWA

The eye lens in the 32mm Burgess SWA is recessed about 11mm. Eye relief was okay for me with glasses on. Blackening is good, similar to the 38mm Burgess, but a well-blackened but smooth spacer ring appears more prominent and could possibly present a bit more low angle scatter. Performance was similar to the 36mm Meade QX, although the Burgess failed to make good on its focal length advantage by providing a noticeable improvement in contrast. Compared directly to the 32mm University Optics König II, the König seemed to have slightly better contrast. At faster f-ratios the optical correction as observed on all targets was very similar to that of the 38mm Burgess.

In terms of optical correction, there was not much separation between the 32mm and 38mm Burgess SWA and 36mm Meade QX eyepieces, considering field curvature, astigmatism, and lateral color. Although the University Optics König II did seem to have slightly better contrast, its field of view was noticeably narrower, and additionally, between the two, I would have to give a slight edge to the 32mm Burgess SWA in optical correction.

26mm Burgess SWA and 26mm Meade QX

Both 26mm eyepieces have an eye lens recess of 5mm or so. Eye relief is just passable for use with eyeglasses. I was able to see the whole field with my relatively thin glasses, but there was not much clearance.

Blackening of the 26mm Burgess SWA is similar to the 32mm Burgess SWA except with a slightly shinier (albeit still black) spacer visible inside. The barrel also has slightly less paint coverage towards the bottom, but it is adequately done. The 26mm Meade QX has blackening is similar to the 36mm Meade QX, which is to say excellent.

There are enough superficial similarities between these two eyepieces that it may be worthwhile to detail some of the more obvious differences. The eye lens of the Meade has a slightly wider clear aperture, and the optics of the Meade seem to occupy a longer space in the casing. Whether its elements are mainly thicker or mainly more widely spaced, I do not know. There is a substantially wider separation between the field stop and the field lens in the Burgess, but the measurements above seem to indicate that the field stop of the Meade may be somewhat closer to the field lens than it should be. The field stops themselves, by the way, are quite different in appearance,

My initial testing at f/10 favored the Meade. It seemed to have better contrast than the Burgess, and it was almost sharp to the edge. The Burgess, on the other hand, seemed less well corrected with slight bloating and fanning of star images at the edge. Background sky glow also seemed a little brighter in the Burgess. Faster f-ratios were met with much the same results as the longer focal lengths, except that I was less satisfied with the correction of both eyepieces overall than I had been with their big brothers. Furthermore, there seemed less to distinguish the two 26mm eyepieces at faster f-ratios. As before, refocusing the edge helped, but the improvement was less complete. It could be that the difference in performance as compared to the longer focal lengths has something to do with partial illumination at the edge of field in my Newtonians giving an advantage to the longer focal lengths, but whatever the cause, the 26mm eyepieces just did not seem to perform quite as well. Field curvature was a bit more obvious and bothersome, and as a result I felt more invited to refocus when looking here and there throughout the views.

20mm Burgess SWA and 20mm Meade QX

The blackening on the 20mm Burgess is reminiscent of the 32mm Burgess, smooth internal spacer ring and all, but again the blackening is quite good. The Meade is virtually identical to the Burgess in blackening, except that the internal spacer appears to be slightly less reflective. These eyepieces are quite similar but different in minor ways. For example, although both 20mm eyepieces use a tapered, grooved retaining ring for a field stop, the parts are different—the Meade has finer grooves. The rubber eye guards are similarly different in minor ways. On the other hand, the pattern of reflections of a bright light seems to be identical, so I take it that the optical designs are very similar, and in fact, no significant differences in optical correction were seen.

At f/10 these eyepieces perform well over the central 80% of the view, with decent performance out to about 90%. Eye relief was just adequate for use with my thin glasses. Field curvature was a bother, but generally the performance was good. At f/5, field curvature became obtrusive, and astigmatism created seagulls at the edge of field, worse than that seen in the longer focal lengths. The field was reasonably sharp only over 70% of the view at most.

When I tried these eyepieces in my little f/8.5 Newtonian, however, I was a bit more pleased. Observers with f/8 and slower scopes taking their first steps into the world of superwide eyepieces will find either of these 20mm eyepieces exciting. It is not that the

optical correction was improved over that at f/10, but the performance seen at f/10 held up, and they have such large eye lenses compared to their casing diameter that they seem to almost disappear when in use, like the 28mm RKE and 25mm University Optics Abbe orthoscopic. They Barlowed well, with minimal vignetting and minimal problems with internal reflections. The 20mm with a 2x Barlow made a nice 10mm combination.

However, the improvement in correction when a Barlow was used was not all that I had hoped for. Jupiter, for example, remained about the right size and shape, but most detail just disappeared from the surface as it was panned a half to _ of the way towards the edge. Although these eyepieces sport very wide apparent fields with the capability of forming relatively tight star images at slower f-ratios, they seem to lack the correction required for planetary resolution over much of the apparent field, especially at faster f-ratios. Consequently, for the purpose of letting a planet drift longer on an undriven scope, they are not good substitutes for highly corrected ultrawides. However, I do think they would be useful for casual planetary observation with a Barlow. The extra field is immersive and helpful in some ways; it is just that a planet still needs to be kept in the central part of the view for good resolution.

16mm Burgess SWA and 15mm Meade QX

The 15mm Meade QX and 16mm Burgess are also quite similar. The tradition of good blackening continues in both, albeit with the corresponding, smooth black spacer ring. The Meade's spacer seems just slightly blacker. On the other hand, the Burgess still has grooving between the field lens and the field stop at this focal length, whereas the Meade just has a smooth, blackened surface.

The Meade has a slightly larger clear aperture of the eye lens, but the optical designs appear quite similar. The Burgess is labeled 16mm focal length and the Meade QX 15mm, but my (rough) measurements indicated that they were both about 15mm in focal length. Furthermore, as in the previous comparison of the 20mm eyepieces, there were not any differences in optical correction to note.

At f/10 there seemed more image degradation at the edge of field than in the longer focal lengths. Eye relief was not really adequate for use even with my thin glasses, although I could see the entire field by pressing flat against the folded-down rubber eye guard. For deep sky observation the view was sharp over about 75-80%. Planetary detail seemed to give way much closer in, so much so that it would be hard for me to recommend these eyepieces even for casual planetary use in an undriven scope, at least without a Barlow. On the plus side, internal reflections were faint and not obtrusive.

At f/5 the view was sharp only over about 50% of the view, and slowing to f/6 did not result in much improvement. Field curvature was a significant bother. The eyepieces Barlowed fairly well, albeit in lunar observation showing clearly whatever new dust had accumulated since the last time it had been blown out.

9mm Burgess SWA

The 9mm Burgess seems to be a scaled down version of the16mm in every respect, although there is not enough room for a rubber grip ring.

Correction was similar to the 16mm at all f-ratios. At f/10 about 70% of the view was useful. As expected, eye relief was tighter, and it was not possible to see the entire view with glasses. Unfortunately reflections and scatter were noticeably worse than in any of the other eyepieces, and this time the problem was internal. Because of the reflections, I would not recommend this eyepiece for planetary use. In fact, for a slightly longer focal length, I would suggest instead the 20mm Burgess with a good 2x Barlow for any purpose. I also compared the 9mm to the 16mm Burgess in a 2x Barlow. Although the usable field was increased to about 80%, I actually preferred the 9mm a little bit when observing DSOs, though this might have been due to the difference in magnification.

Summary

In a nutshell, I found the 32mm and 38mm Burgess SWA and 36mm Meade QX eyepieces to be good performers at all f-ratios considering their price. The correction is on a par with or slightly better than commonly available classical designs such as the 32mm UO König II and at the same time providing a very wide field. They do suffer from field curvature, which is a minor nuisance at faster focal ratios, but they work well for sweeping and starhopping because of their wide fields and low rectilinear distortion.

The general pattern was *decreasingly* good performance as the focal length decreased. The 26mm eyepieces were good at f/10, but they showed more degradation from astigmatism and field curvature at faster focal ratios than the longer focal lengths. The 20mm eyepieces showed some particular charm, especially in the small 120mm f/8 Newtonian. Those using stock 25mm Plössls with 4.5" f/8 and similar scopes will find these an enjoyable upgrade, as they deliver a true field just shy of what a 32mm Plössl would provide at a higher magnification and with a more immersive view. Unfortunately, their performance was less satisfactory at faster f-ratios. The 16mm Burgess SWA and 15mm Meade QX had tighter eye relief and were only sharp over 75-80% of the view even at f/10.

Although the build quality of all of these eyepieces was good, and optically there is not much to separate them, the Meades look and feel more refined. They cost a little bit more, and it shows, at least in ways other than optical correction. I think the quality of the coatings favors the Meades, and, although I am not fond of safety undercuts in eyepiece barrels, the Meades have them and sturdier barrels as well. Finally, you get the plastic bolt cases, which seem more sturdy than standard aftermarket bolt cases.

Finally, the 9mm Burgess SWA was merely passable at f/10, but because of the tighter eye relief, astigmatism, field curvature, and the internal reflections, I enjoyed it least of all the eyepieces.

A frequently asked question is how less expensive eyepieces like these compare to premium fare, and in this case one might wonder how the nearby Burgess SWA and Meade QX compare to, say, Panoptics. I just had the 24mm Panoptic with which to compare to the 26mm Burgess SWA and 26mm Meade QX eyepieces, and at f/5 there was little subtlety in it. The Panoptic showed a flat focal plane and stars were reasonably sharp to the edge. In these ways the Panoptic was far superior. However, the Panoptic did show more lateral color, and it did show pincushion distortion when panning, i.e., when you pan with the Panoptic, stars move in arcs at the edge of field when they should be moving in straight lines. So nothing is perfect, but if pinpoint stars to the edge of field are required at moderate to fast f-ratios, it is very difficult to find suitable alternatives to today's expensive, state-of-the-art superwides and ultrawides. On the other hand, if some field curvature and astigmatism can be tolerated, the Burgess SWA and Meade QX may be good, inexpensive alternatives, especially in telescopes with moderate and slower f-ratios.

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