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$$z = \frac{Cr^2}{\left(1 + \sqrt{1 - (k+1)C^2r^2}\right)} + \sum_{i=1}^{20} a_i |r^i|$$

z = sag
C = curvature at vertex
k = conic constant
r = radial coordinate

Asphere Metrology at Optimax

| Method | Cost of Test Setup ¹ | Leadtime ² | Time in Test ³ | Tightest Tolerance | Max Allowable Asphere Departure | Comments |
|--------------------------------------|---------------------------------|-----------------------|---------------------------|--------------------|---------------------------------|--|
| Physical Measurements | | | | | | |
| Brass Gauges | Low | Days | Seconds | > 25µm | mm → design limited | Only convex surfaces; used for condenser optics |
| CMM | Low | Minutes | ~10 min | ±5µm | mm → machine limited | No required symmetry; requires datum and fixturing |
| Profilometry | Low | Minutes | ~5 min | ±0.5µm | < 25mm | Most common method; only provides 2D data |
| Surface Testing in Reflection | | | | | | |
| Spherical Wavefronts | Low | Minutes | ~10 min | 0.1 fringes | < 10µm from sphere | Very little setup; Zernike subtraction |
| CGH | High | Months | ~20 min | 0.25 fringes | mm → optically limited | No required symmetry; part specific |
| Spherical Null Reflection | High | Weeks | ~10 min | 0.1 fringes | 100 µm | Part specific |
| Parabola/Ellipse | Average | ~2 hour | ~30 min | 0.1 fringes | ~mm from sphere | -1 ≤ k < 0 |
| SSI-A (QED) | Average | ~30 min | ~30 min | 0.1 fringes | < 80µm departure | Absolute test |
| VFA (Zygo) | Average | ~30 min | ~5 min | 0.1 fringes | < 800µm departure | No inflections |
| Lens Testing in Transmission | | | | | | |
| TWE | Average | ~1 hour | ~10 min | 0.1 fringes | < 50µm from sphere | Must be well-behaved aspheric lens |
| CGH | High | Months | ~20 min | 0.25 fringes | mm → optically limited | No required symmetry; part specific |
| Spherical Null TWE | High | Weeks | ~10 min | 0.1 fringes | ~100 µm | Part specific |

¹ Relative cost of tooling and labor for each test

² Includes time to obtain all needed components and alignment of test system

³ Includes time needed for alignment of unit under test, data collection, and data analysis