Transmission Spheres
Specifications

A complete offering of high quality transmission spheres (TS) designed to provide optimum interferometer performance. ZYGO's optics are specified and fully qualified to ensure accurate metrology for applications ranging from testing conventionally polished ultra smooth surfaces, to providing critical metrology feedback for small tool polishing processes. Each TS comes in a protective storage case with quality certification.

OVERVIEW

Measurement Capability	Used in conjunction with a laser Fizeau interferometer for the measurement of the surface form or transmitted wavefront of spherical optics and assemblies. Can also be utilized in the measurement of conic and aspheric shapes[1].
Diameters	4 inch, 6 inch
Wavelength	633 nm
Specifications	Apply to advertised TS f/#
Design	Low expansion reference element.
	Field coverage and residual axial ghosts are suitable for use with ZYGO Ring-of-Fire illumination.
	Controlled mid-spatial frequency content (PSD). Suitable for use in closed-loop feedback processes in work cells utilizing small pad polishing technologies.

STANDARD PERFORMANCE (λ/10) TS [8]

Best for metrology of test optics with ≤ 40% reflectivity.

Entrance Beam Dia.	4 inch (101.6 mm) 6 inch (152.4 mm)
f/# (4 inch)	f/0.65, f/0.75, f/1.5, f/3.3, f/7.1, f/10.7
f/# (6 inch)	f/0.8, f/1.1, f/2.2, f/3.5, f/5.4, f/7.2
Reference Surface	4% reflectivity λ/10 PV (λ = 633 nm)

STANDARD PERFORMANCE DYNAFLECT™ (λ/20) TS [8]

Best for metrology of test optics with > 40% reflectivity.

Entrance Beam Dia.	4 inch (101.6 mm)
f/# (4 inch)	f/0.75, f/1.5, f/3.3, f/7.1, f/10.7
Reference Surface	Dynaflect coating λ/20 PV (λ = 633 nm)

HIGH PERFORMANCE (λ/20) TS [8]

Best for metrology of test optics with ≤ 40% reflectivity.

Entrance Beam Dia.	4 inch (101.6 mm)
f/# (4 inch)	f/0.65, f/0.75, f/1.5, f/3.3, f/7.1, f/10.7
f/# (6 inch)	f/0.8, f/1.1, f/2.2, f/3.5, f/5.4, f/7.2
Reference Surface	4% reflectivity λ/20 PV (λ = 633 nm)

OPERATIONAL ENVIRONMENT [7]

Temperature	15 to 30°C (59 to 86°F)
Rate of Temp. Change	<1.0°C per 15 min.
Humidity	5 to 95% relative, non-condensing

ULTRASPHERE (λ/40) TS [8]

The UltraSphere is designed to enable surface form metrology with an uncertainty in the RMS[2] of ≤ 3.2 nm (λ/200 at 633 nm) when used with a ZYGO interferometer.
Best for metrology of test optics with ≤ 40% reflectivity.

Entrance Beam Dia.	4 inch (101.6 mm)
f/# (4 inch)	f/0.75, f/1.5, f/3.3
Reference Surface	4% reflectivity λ/40 PVr[3] (λ = 633 nm) < 2.5 nm RMSi[4]
Reference Surface Power Spectral Density (PSD)[5]	Mean Radial Profiles: $< 5 \times 10^4 \cdot freq^{-1.55}$ A^{2}μm Azimuthal Profiles: $< 1 \times 10^5 \cdot freq^{-1.55}$ A^{2}μm
Transmitted Wavefront Slope	Supports < 2 nm RMS cavity induced error[6]

The UltraSphere TS products include absolute calibration of the reference surface and are shipped with the resulting data file and 37 term Zernike fit on a USB memory stick.

ADDITIONAL INFORMATION

To dynamically determine the recommened TS for an application, use the *Transmission Sphere Selection Tool, OMP-0495* or the *Verifire Asphere Calculator Tool, OMP-0525*.

Reference Drawings *6024-0034-02* and *6024-0048-02* provide mechanical dimensions of 4 inch and 6 inch TS's, respectively.

Notes

1. Direct measurement of an asphere with a spherical reference wavefront will introduce retrace errors. A ZYGO Verifire Asphere interferometer minimizes retrace by measuring null zones of the asphere that match the f/# of the transmission sphere.
2. Assumes form metrology of smooth spherical surfaces, a well-nulled cavity, data averaging to minimize systematic noise, a suitably stable environment, and uncertainty estimation following ISO's "Guide to the Expression of Uncertainty in Measurement" (1995) with k=1.
3. PVr is defined as the 36 term Zernike fit plus 3 times the rms residual of the Zernike fit ($PVr = PV_{36\ Zernike} + 3 \times \sigma_{36\ Zernike\ Residual}$) .
4. RMSi is the irregularity after removing the best fit spherical surface per ISO 10110 part 5 (1996)/ISO 14999 Part 4 (2007) standards.
5. Spatial frequency band: 3/Clear Aperture to 0.2/Lateral Scale. PSD limits defined by the power law model of ISO 10110-8.
6. As-built TS wavefront slope is controlled to insure that the peak cavity induced retrace errors will contribute less than the specified RMS value up to reference-to-part radius ratios of 5:1. As an example, a 5:1 ratio for an f/0.75 TS corresponds to a reference surface of radius 48.2 mm and a test sphere of radius 9.64 mm. Cavities that yield ratios of > 5:1 may induce error that exceed the specified RMS.
7. These parameters outline the conditions under which the system can operate; they do not represent the environmental stability required to meet specified performance.
8. Performance qualified with stable temperature set point between 20-23°C.

Part Number	Aperture	f/#	R_1 (mm)	D_0 (mm)	R_2 (mm)	D_1 (mm)	D_2 (mm)
6024-0454-XX	4 inch	0.65	38.7	62.0	36	60	56
6024-0444-XX	4 inch	0.75	48.2	65.5	45	64	60
6024-0430-XX	4 inch	1.5	121.2	93.7	115	81	76
6024-0399-XX	4 inch	3.3	298.0	89.2	282	90	85
6024-0404-XX	4 inch	7.1	681.7	98.1	674	96	95
6024-0410-XX	4 inch	10.7	1039.2	100.4	1030	97	96
6024-0458-XX	6 inch	0.8	80.0	104.9	77	100	97
6024-0455-XX	6 inch	1.1	123.3	128.4	118	112	107
6024-0414-XX	6 inch	2.2	290.0	164.1	274	132	125
6024-0413-XX	6 inch	3.5	475.8	164.1	458	149	130
6024-0417-XX	6 inch	5.4	776.4	164.1	761	147	141
6024-0405-XX	6 inch	7.2	1045.0	164.1	1022	145	142

4 inch TS Coverage for Convex Radii

6 inch TS Coverage for Convex Radii