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Istituto Nazionale di Astrofisica
OSSERVATORIO ASTROFISICO DI ARCETRI
LARGO ENRICO FERMI, 5 – 50125 FIRENZE
Telefono: 055-27521 - Fax: 055-220039

ANNEX 1

Ref. Doc. ERIS.17-007.MI

Preliminary requirements specification for a set of optics (lenses+mirrors) in the framework of the ERIS project

v1.0, 19/Dec/2017

ERIS is a new instrument for the Very Large Telescope (VLT). It includes an Adaptive Optics (AO) Module requiring the following optical elements:

A. **1x WO NIX Mirror** – a 85mm diameter mirror working in a F/13.6 beam with 1000nm-5400nm wavelength range, AOI=45deg;
B. **1x WO LGS Folding Mirror** – a Zerodur mirror (diam 2") with coating for D2 Na laser beam (585nm-595nm), F/13.4, AOI=32deg;
C. **1x WO Telecentric Lens** – a 97mm diameter plano-convex lens working in a F/13.6 beam with 400nm-1000nm wavelength range;
D. **2x WFS Entrance Triplet** – two cemented triplets (diam 30mm), one with AR coating for wavelength range 400nm-1000nm, the other for 585nm-595nm range (D2 Na);
E. **2x WFS Collimator Doublet** – two cemented doublets (diam. 23mm), one with AR coating for 600nm-1000nm wavelength range, the other for 585nm-595nm range (D2 Na);
F. **4x NGS Relay Doublet** – four cemented doublets (diam. 16mm), AR coating for 600nm-1000nm wavelength range.

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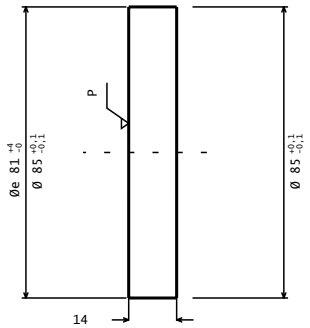
A 1x WO NIX Mirror

Coating: Protected Silver or Protected Gold
AOI: 45deg
F/number: 13.6
Wavelength range: 1000nm-5400nm



Dimensions in Millimeters

Left Surface

R PLANO
Øe 81 +4 -0
Ⓐ
3/ 0,25(0,125)
4/ -
5/ 1x0,25;L1x0,004
6/ -

Material: Zerodur

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
01/12/2017	0,7200:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS Warm Optics - OptA				
PART/DRAWING		REVISION		ERIS WO 2 aprMC_T0000 per ISO VIS-IR dicroico.ZMX
NIX selector mirror				Configuration 4 of 5

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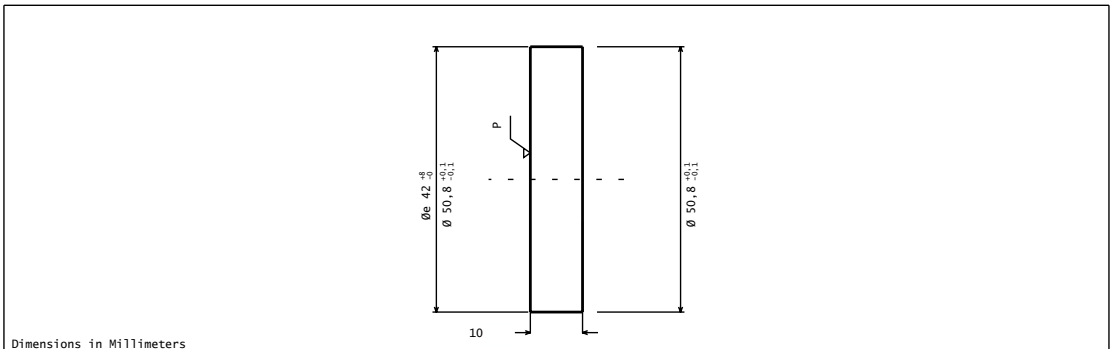
B 1x WO LGS Folding Mirror

Coating: Optimized for wavelength range
F/number: 13.4
Wavelength range: 585nm-595nm (D2 Na)
AOI: 32deg



Dimensions in Millimeters

Left Surface

R PLANO
Øe 42 +8 -0
Ⓐ > 99% 585-595 nm
3/ 0,25(0,125)
4/ -
5/ 1x0,25;L1x0,004
6/ -

AOI = 32 deg

Material: Zerodur

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
01/12/2017	1,2000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS Warm Optics - OptA				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_LGS_v13 LGS WFS - FM.zmx
LGS WFS-FM				Configuration 1 of 1

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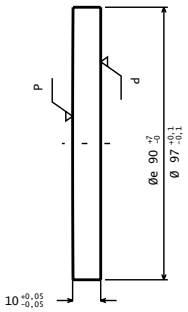
C 1x WO Telecentric Lens

Left and Right surfaces: AR coating
Input F/number: 13.6
Wavelength range: 400nm-1000nm

Adaptation of the prescription to glass melt data is allowed.
The thickness in the ISO table refers to the central thickness.



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 7666 +15 -15 CX Øe 90 +7 -0 ⍉ <1% 400-1000 nm 3/ -(0,125) 4/ 1,14(0,005) 5/ 1x0,25;L1x0,004 6/ -	GLASS: N-BK7 Nd = 1,516800 +1e-05 -1e-05 Vd = 64,17 +0,13 -0,13 0/ 5 1/ 2x0,05 2/ 4;5	R PLANO Øe 90 +7 -0 ⍉ <1% 400-1000 nm 3/ 0,25(0,125) 4/ 1,14(0,005) 5/ 1x0,25;L1x0,004 6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	0,6300:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE: ERIS Warm Optics - OptA				
PART/DRAWING: Telecentric lens		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX Configuration 1 of 4

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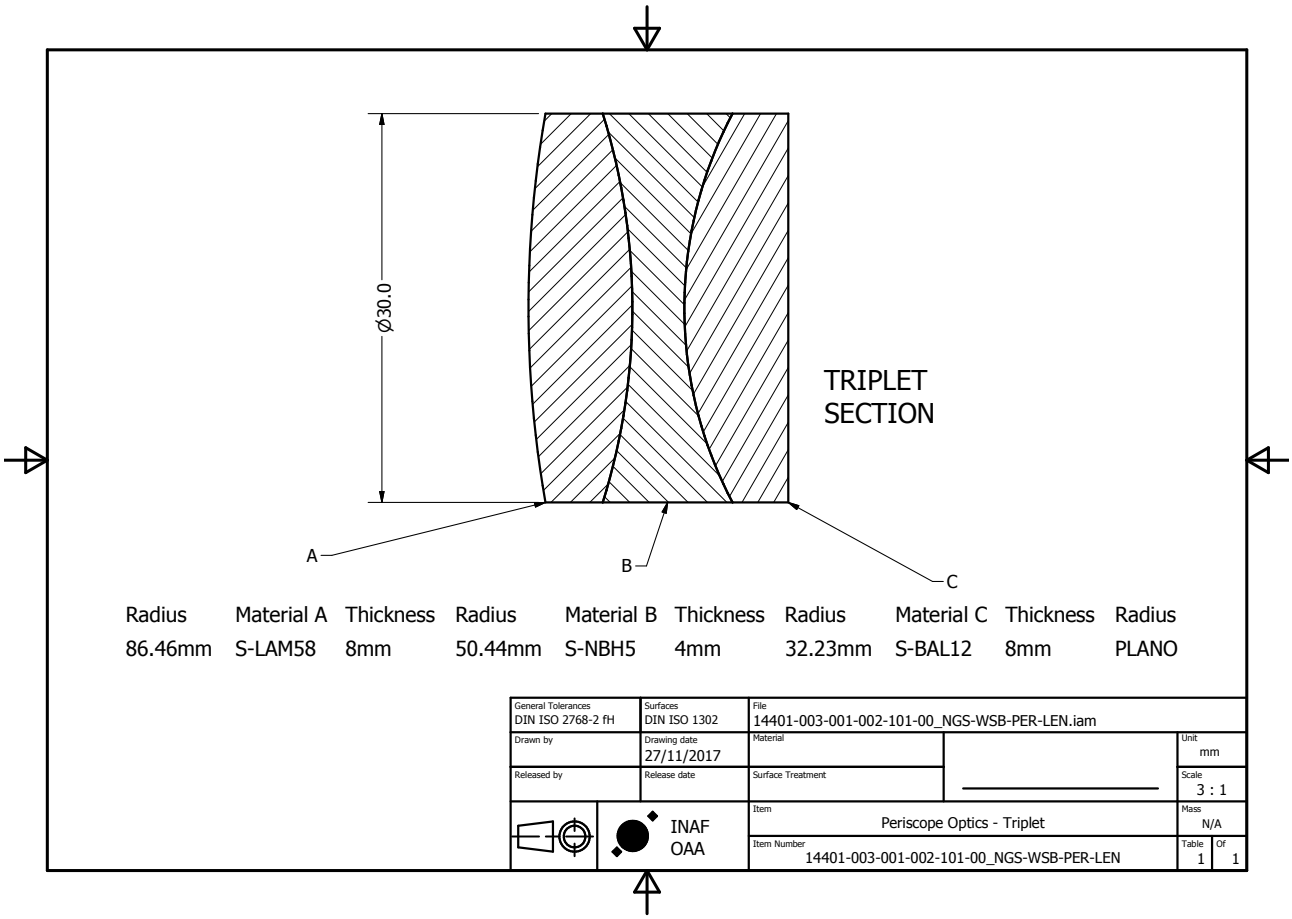
D 2x WFS Entrance Triplet

Input F/number: 13.4

Triplet#1: Left surface: AR 400nm-1000nm; **Right plano surface:** no coating
Triplet#2: Left and right surfaces: AR 585nm-595nm

Adaptation of the prescription to glass melt data is allowed.



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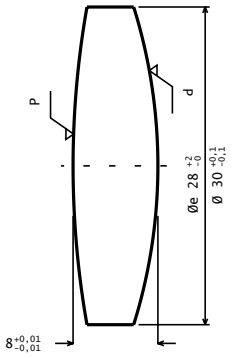
D.1 L1



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 86,5 +0,2 -0,2 CX	GLASS: S-LAM58	R 50,4 +0,1 -0,1 CX
Øe 28 +2 -0	Nd = 1,720000 +1e-05 -1e-05	Øe 28 +2 -0
<1% 400-1000nm	Vd = 41,98 +0,08 -0,08	
3/ -(0,125)	0/ 5	3/ -(0,125)
4/ 1,14(0,005)	1/ 2x0,05	4/ 1,14(0,005)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	2,1000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS WFS NGS				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX
L1 triplet				Configuration 1 of 4

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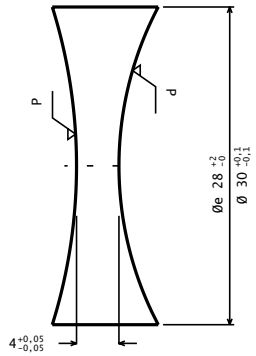
D.2 L2



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 50,4 +0,1 -0,1 CC	GLASS: S-NBH5	R 32,23 +0,06 -0,06 CC
Øe 28 +2 -0	Nd = 1,654115 +1e-05 -1e-05	Øe 28 +2 -0
A	Vd = 39,68 +0,08 -0,08	A
3/ -(0,125)	0/ 5	3/ -(0,125)
4/ 1,14(0,005)	1/ 2x0,05	4/ 1,14(0,005)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	2,1000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS WFS NGS				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX Configuration 1 of 4
L2 triplet				

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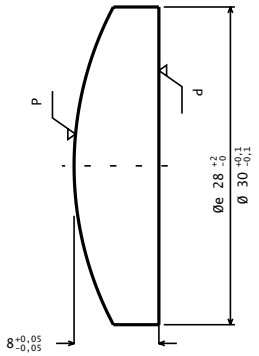
D.3 L3



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 32,23 +0.06 -0.06 CX	GLASS: S-BAL12	R PLANO
Øe 28 +2 -0	Nd = 1,539956 +1e-05 -1e-05	Øe 28 +2 -0
A	Vd = 59,46 +0.12 -0.12	A
3/ -(0,125)	0/ 5	3/ 0,25(0,125)
4/ 1,14(0,005)	1/ 2x0,05	4/ 1,14(0,005)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	2,1000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS WFS NGS				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX Configuration 1 of 4
L3 triplet				

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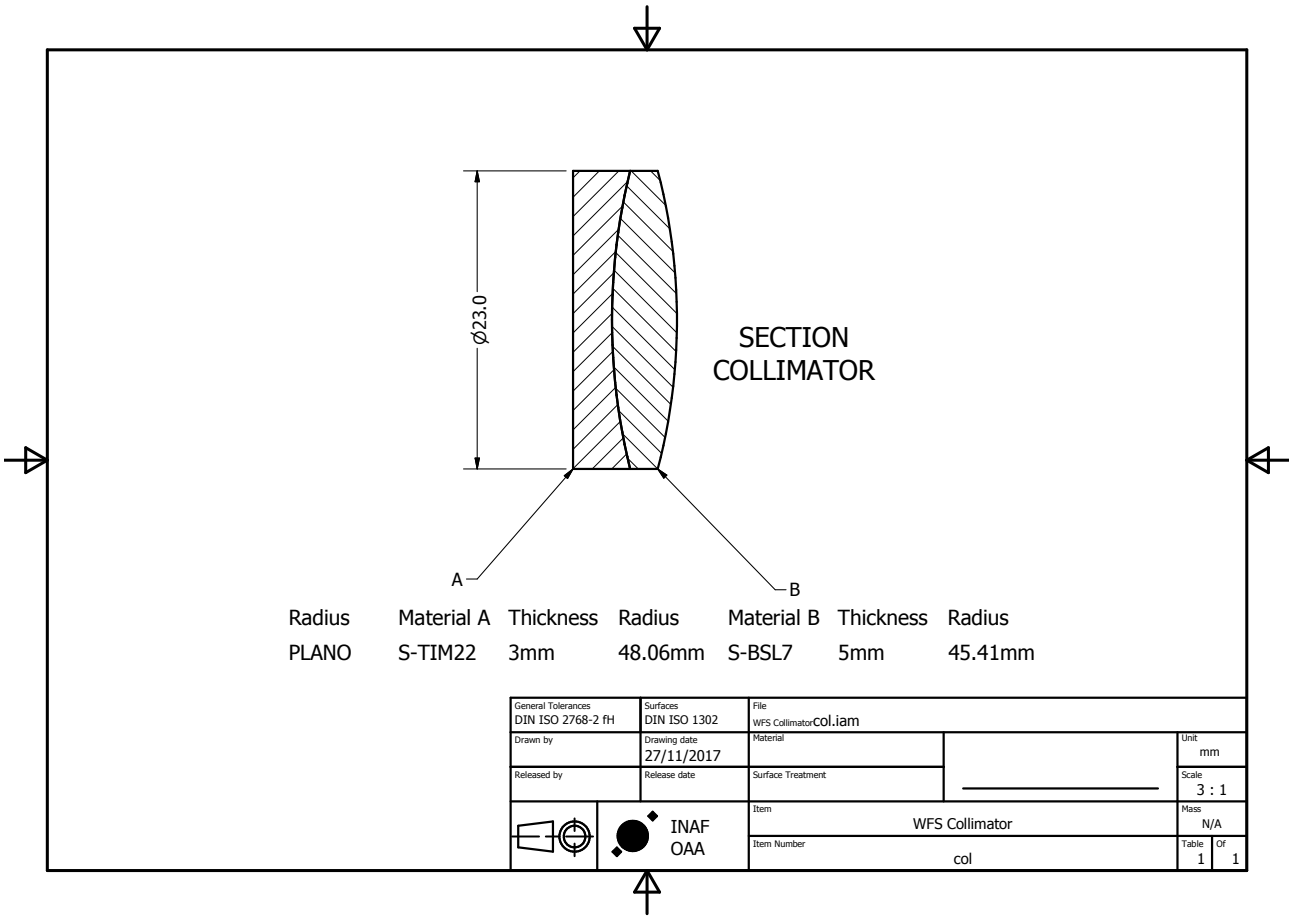
E 2x WFS Collimator Doublet

Input F/number: 20

Triplet#1: Left and right surfaces: AR 600nm-1000nm
Triplet#2: Left and right surfaces: AR 585nm-595nm

Adaptation of the prescription to glass melt data is allowed.



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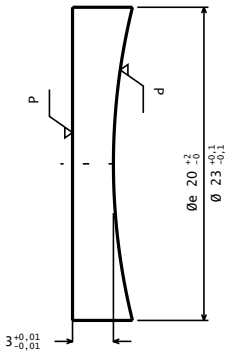
E.1 L1



Dimensions in Millimeters

Left Surface	Material	Right Surface
R PLANO	GLASS: S-TIM22	R 48,06 +0,11 -0,11 CC
Øe 20 +2 -0	Nd = 1,647689 +1e-05 -1e-05	Øe 20 +2 -0
<1% 600-1000 nm	Vd = 33,79 +0,07 -0,07	
3/ 0,25(0,125)	0/ 5	3/ -(0,125)
4/ 1,5(0,01)	1/ 2x0,05	4/ 1,5(0,01)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	2,7000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS WFS NGS				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX
L1 collimatore				Configuration 1 of 4

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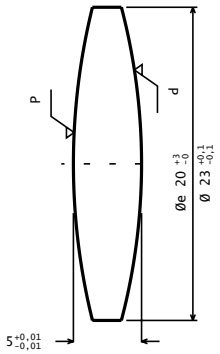
E.2 L2



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 48,06 +0.11 -0.11 CX	GLASS: S-BSL7	R 45,41 +0.09 -0.09 CX
Øe 20 +3 -0	Nd = 1,516330 +1e-05 -1e-05	Øe 20 +3 -0
⍀	Vd = 64,14 +0.13 -0.13	⍀ <1% 600-1000 nm
3/ -(0,125)	0/ 5	3/ -(0,125)
4/ 1,5(0,01)	1/ 2x0,05	4/ 1,5(0,01)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	
24/11/2017	2,7000:1			Zemax Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS WFS NGS				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX Configuration 1 of 4
L2 collimatore				

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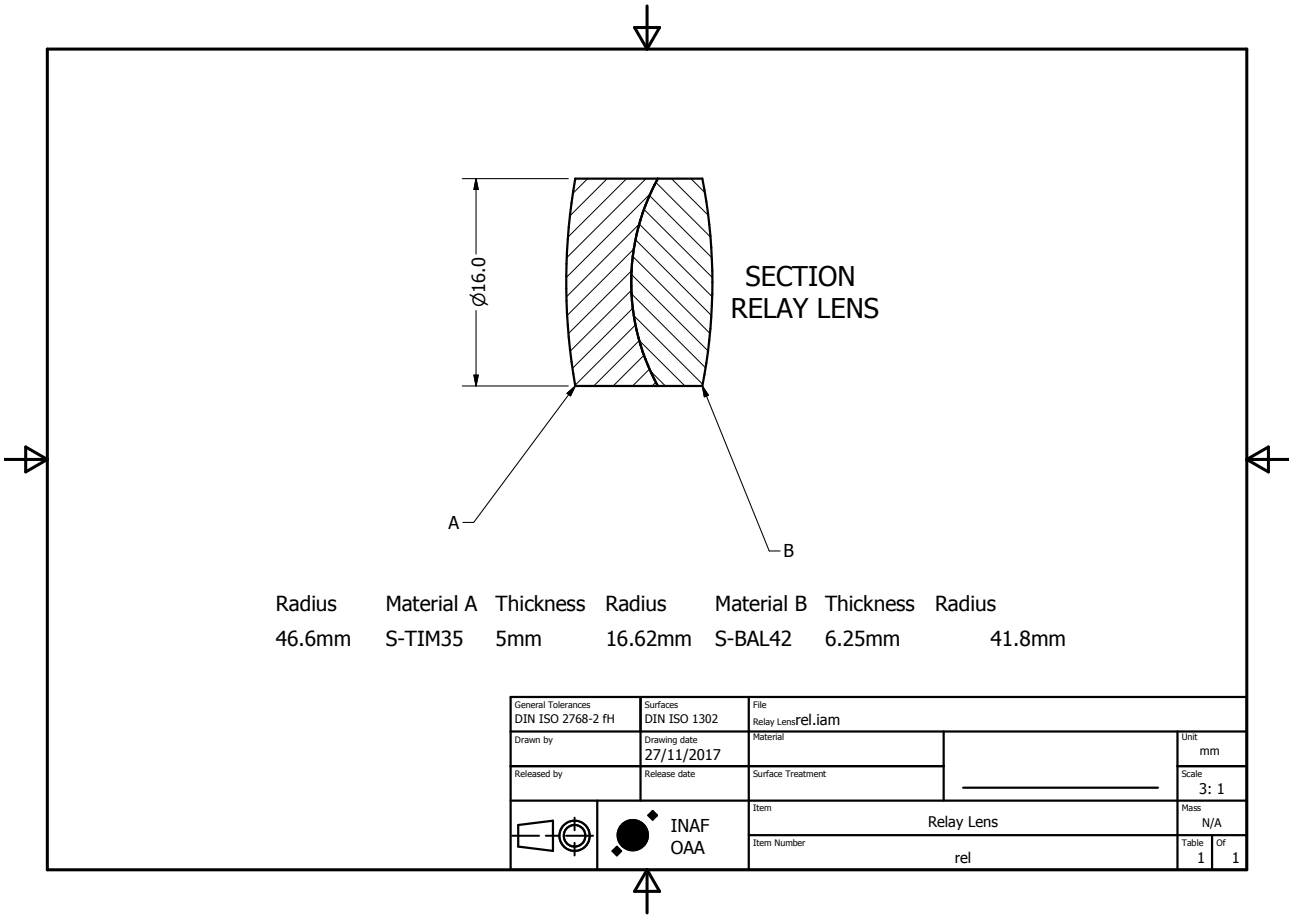
F 4x NGS Relay Doublet

Triplet#1: Left and right surfaces: AR 600nm-1000nm

Adaptation of the prescription to glass melt data is allowed.



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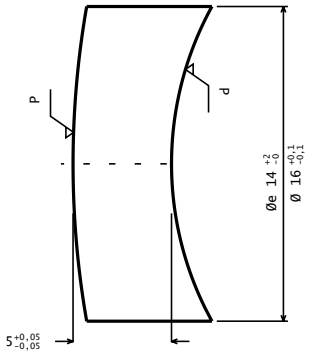
F.1 L1



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 46,6 +0,3 -0,3 CX	GLASS: S-TIM35	R 16,62 +0,08 -0,08 CC
Øe 14 +2 -0	Nd = 1,698947 +1e-05 -1e-05	Øe 14 +2 -0
<1% 600-1000nm	Vd = 30,13 +0,06 -0,06	
3/ -(0,125)	0/ 5	3/ -(0,125)
4/ 1,5(0,01)	1/ 2x0,05	4/ 1,5(0,01)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	3,9000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS Warm Optics - OptA				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX Configuration 1 of 4
Relay L1				

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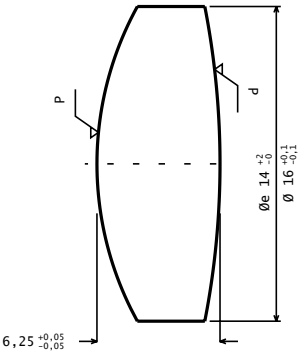
F.2 L2



Dimensions in Millimeters

Left Surface	Material	Right Surface
R 16,62 +0,08 -0,08 CX	GLASS: S-BAL42	R 41,8 +0,2 -0,2 CX
Øe 14 +2 -0	Nd = 1,583126 +1e-05 -1e-05	Øe 14 +2 -0
ℚ	Vd = 59,37 -0,12 -0,12	ℚ <1% 600-1000 nm
3/ -(0,125)	0/ 5	3/ -(0,125)
4/ 1,5(0,01)	1/ 2x0,05	4/ 1,5(0,01)
5/ 1x0,25;L1x0,004	2/ 4;5	5/ 1x0,25;L1x0,004
6/ -		6/ -

ISO Element Drawing Indications According to ISO 10110

DATE	SCALE	DRAWN	APPRV	Zemax
24/11/2017	3,9000:1			Zemax OpticStudio 16.5 SP3
PROJECT/TITLE				
ERIS Warm Optics - OptA				
PART/DRAWING		REVISION		ERIS_BFL500_WFS_NGS_v27.ZMX
Relay L2				Configuration 1 of 4

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G Environmental

REQ#	Item	Specification
ENV01	Air Temperature	All requirements shall be met under the following temperature conditions: Functional air temperature range: -10 to +25ºC Operational air temperature range: + 0 to +15ºC Air temperature gradient at night: +0.5 to -0.9 °C/hour
ENV02	Humidity	All requirements shall be met under the following humidity conditions: Operational humidity: 0-80 % RH (not condensing).
ENV03	Storing Temperature	-30°C to 55°C

Contact point:

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