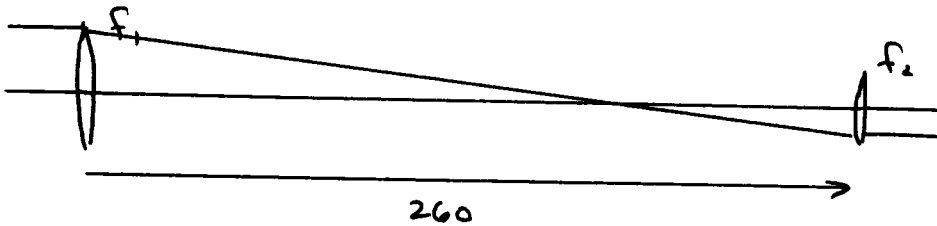


# Keplerian with Specified Eye Relief

Basic Telescope 12X  $m = -1/12$

$$L = 260 \text{ mm}$$



$$L = f_1 + f_2 \quad m = -f_2/f_1$$

$$\underline{f_1 = 240 \text{ mm}} \quad \underline{f_2 = 20 \text{ mm}}$$

Eye relief: image objective through eye lens

$$z = -260 \quad f_2 = 20$$

$$\frac{1}{z'} = \frac{1}{z} + \frac{1}{f} \quad z' = 21.67 \text{ mm}$$

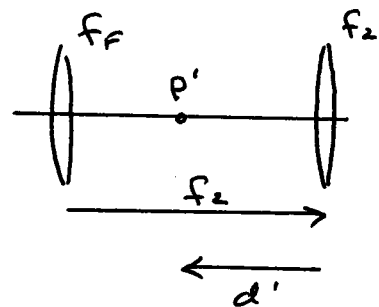
But the required ER is 15 mm. A field lens must be added to shift the rear principal plane of the eyepiece 6.67 mm to the left:

$$d' = -6.67 \text{ mm}$$

$$\phi = 1/f_2$$

$$\phi_F = 1/f_F$$

$$t = f_2$$



$$d' = -\frac{\phi_F}{\phi} t = -\frac{f_2}{f_F} f_2 = -6.67 \text{ mm}$$

$$\underline{f_F = 60 \text{ mm}}$$

Diameters - trace marginal and chief rays:

$$u = 0$$

$$\bar{u} = \tan 2^\circ = .0349$$

At objective:  $y = 20$      $\bar{y} = 0$

	Obj	Field	Eye	XP	
f	240	60	20		
$-\phi$	-.00417	-.0167	-.05		
t	→	240	20	15	
y	20	20	0	-1.667	-1.667
u	0	-.0834	-.0834	0	
$\bar{y}$		0	8.376	6.282	0
$\bar{u}$	.0349	.0349	-.1047	-.419	

Required Aperture (Unvignetted)

$$a = |y| + |\bar{y}|$$

Obj:  $a = 20$

Dia = 40 mm

Field:  $a = 8.376$

Dia = 16.75 mm

Eye:  $a = 7.95$

Dia = 15.9 mm

Specification:

Objective:  $f_1 = 240$  mm

Dia = 40 mm

$t_1 = 240$  mm

Field:  $f_F = 60$  mm

Dia = 16.75 mm

$t_2 = 20$  mm

Eye:  $f_2 = 20$  mm

Dia = 15.9 mm