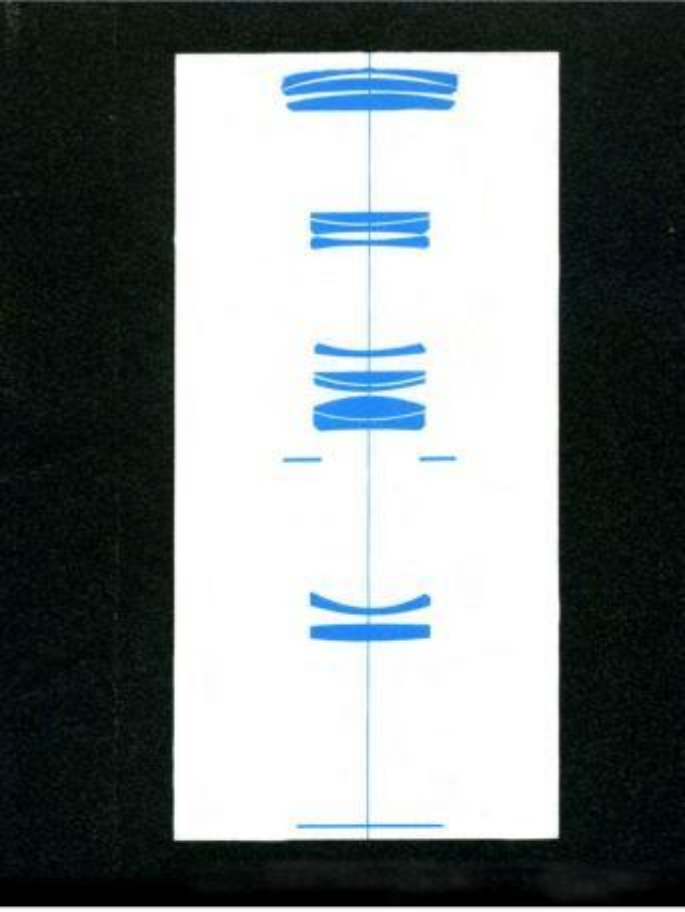

Vivitar®

85mm-205mm f3.8

Close Focusing Automatic Fixed Mount Zoom Lens

Owner's Manual
Gebrauchsanleitung
Manuel du propriétaire
Manual del propietario


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Before you begin . . .

to use your new Vivitar Close Focusing Zoom Lens, please take time out to carefully study this Owner's Manual. Keep it handy as a guide and refer to it whenever questions arise on the care of your lens. The information it contains should help you get maximum enjoyment from your lens . . . enjoyment that comes from the satisfaction of taking pictures with that "professional touch."

Getting acquainted with your Lens

1. Filter Thread
2. Retractable Lens Hood
3. Focusing Ring
4. Distance Scales
5. Distance Index Line
6. Zoom/Close Focusing Ring
7. Infrared Index Marks
8. Mounting Grip
9. Aperture Reference Dot
10. Aperture Ring
11. Aperture Scale
12. Lens Mount

Mounting your Lens

Your Vivitar Close Focusing Zoom Lens has been designed to mount on your camera with the simplicity and ease of your normal lens. However, because it is longer than your normal lens, special care should be taken when aligning it to the camera.

For best results, hold the lens firmly around the Mounting Grip ⑧ when attaching it to your camera. This will enable you to achieve better balance during the mounting procedure. (See photo "A")

Holding your Lens

When using your lens it is best to support the camera/lens combination by placing your left hand underneath the lens as shown (see photo "B"). This leaves your other hand free to operate the controls of your camera and assures proper balance and stability.

Focusing and Zoom Control

After mounting your Vivitar Close Focusing Zoom Lens on your camera, focus on your subject as you would with your normal lens by turning the Focusing Ring ③ until the subject appears sharpest in the camera viewfinder.

To zoom from one focal length to another, turn the Zoom/Close Focusing Ring ⑥ until the subject is composed as you wish it to appear in the final picture. For convenience, the major focal lengths — 85mm, 105mm, 135mm, 150mm, 180mm and 205mm — are engraved on the Zoom/Close Focusing Ring, allowing you to set a specific image size. Should you wish to use a specific focal length, turn the Zoom/Close Focusing Ring until the engraved focal length is opposite the Distance Index Line ⑤.

Since a higher magnification allows you to see your subject more clearly you may find it convenient to focus first at the 205mm focal length (see photo "C"). Once focused on your subject, the cam-operated focusing system of your lens maintains focus even as you change the zoom position (see photo "D"). However, where critical focusing is necessary, it is always recommended that you re-focus your lens at the new focal length.

Distance Scales

Your lens has two Distance Scales ④ which give you the distance from the subject in focus to the film plane. The white numbers denote this distance in feet while those in green represent the distance in meters. (See photo "E")

Distance Index Line

The Distance Index Line ⑤ is the reference point for the correct focus position of your lens. Reading the number of feet or meters indicated on the Distance Scales opposite this line allows you to estimate the distance from the subject in focus to the film plane. (See photo "F")

Infrared Index Marks

Your lens has three Infrared Index Marks ⑦ for use with infrared film. These marks appear at the right of the Distance Index Line on the lens barrel and represent three of the major focal lengths, i.e., 85mm, 135mm and 205mm (see photo "G"). When using infrared film, focus normally on your subject and read the distance on the Distance Scales as indicated opposite the Distance Index Line. Then, turn the Focusing Ring ③ until the distance reading is opposite the Infrared Index Mark for the focal length you are using. Your lens will then be focused for average infrared photography.

Note: For focal lengths other than those engraved, estimate the position of the focal length between the Infrared Index Marks and adjust the Focusing Ring accordingly.

Infrared radiation is variable by nature and therefore the Infrared Index Marks should be used as approximations only.

Aperture Control

The automatic diaphragm operation of your lens allows you to focus and compose your picture with the diaphragm at maximum aperture or "wide open." When shooting, the diaphragm will automatically stop down to the preselected aperture at the moment of exposure and immediately re-open as the exposure is completed.

EE Coupled Lenses

Some cameras have an EE feature which automatically determines the correct aperture for a given photographic situation when a specific shutter speed is selected.

Vivitar Close Focusing Zoom Lenses designed with EE coupling mechanisms differ from the other lenses as follows:

Aperture Scale —
Since cameras with EE mechanisms work automatically to f16 only, the aperture range of the EE coupled Vivitar Zoom Lens goes to f16 only. (See photo "H")

EE Lock Button —
To ensure that the lens is not accidentally removed from EE operation, the Aperture Ring locks with a positive click when placed in the "**EE**" position. When you wish to set the aperture manually, press the EE Lock Button to move the Aperture Ring from the "**EE**" position. (See photo "I")

Depth of Field

Depth of field is the area of acceptable sharpness in front of and behind the subject in focus. This depth is determined by the aperture you have selected and the distance from the subject in focus to the film plane. As you get closer to your subject, or as you open your lens (e.g., from f16 to f3.8), the depth of field becomes shallower (see photo "J"). By stopping your lens down (e.g., from f3.8 to f16) or getting farther away from your subject, this depth of field or zone of acceptable sharpness can be increased. (See photo "K")

Another factor in determining depth of field is the focal length at which you are shooting. As a rule, the longer the focal length of a lens the shallower the zone of acceptable sharpness becomes. Therefore, as you change the focal length of your Vivitar Close Focusing Zoom Lens from 85mm to 205mm, the depth of field becomes shallower. You can compensate for this by stopping your lens down. However, a shallow depth of field can add creative impact to your pictures by providing you with pleasing out-of-focus foregrounds or backgrounds to make your subject stand out.

Depth of Field Preview

You can see the depth of field in your camera's viewfinder by using the depth of field preview control which is located either on the camera body or on your lens. Vivitar Close Focusing Zoom Lenses designed for use on cameras not having depth of field preview controls on the camera body provide either a Preview Button or an Auto/Manual Switch built into the Lens Mount ⑫. By pressing the Preview Button or setting the Auto/Manual Switch to "**M**," the diaphragm of the lens is stopped down enabling you to see the depth of field for the particular f-stop you have selected.

Preview Button

Press to stop diaphragm down. When released, diaphragm returns to auto operation. (See photo "L")

Auto/Manual Switch

Set to "**M**" position to stop diaphragm down. Return to "**A**" to re-activate auto diaphragm mechanism. (See photo "M")

Close Focusing Operation

The Close Focusing feature of your lens allows you to focus on subjects as close as 12½ inches from the front of the lens.

To focus in the Close Focusing Mode:

1 — Set the Focusing Ring ③ to infinity (∞).

2 — Turn the Zoom/Close Focusing Ring ⑥ so that the Distance Index Line ⑤ is within the Close Focusing area (between the "**85**" and the "**CLOSE•FOCUS**" engraved on the Ring, see photo "N"). A click stop at the "**85**mm" setting on the Zoom/Close Focusing Ring separates the zoom control from the close focusing control.

3 — Move the camera and/or subject back and forth to get the desired image size in the viewfinder. When shooting in the Close Focusing Mode, the subject can be anywhere between 12½ inches and about 6 feet from the front of the lens.

4 — Turn the Zoom/Close Focusing Ring ⑥ until the subject appears sharpest in the camera viewfinder.

Depth of Field in Close-up Photography

In close-up photography, depth of field is directly related to magnification and aperture.

As magnification increases, depth of field decreases drastically. In most cases you are working with a zone of acceptable sharpness that measures in inches and fractions of inches, particularly at higher magnifications. Since depth of field increases as the aperture becomes smaller (e.g., from f3.8 to f22), you can compensate for this shallow depth of field by stopping your lens down as far as lighting conditions will allow.

If inadequate lighting conditions prevent you from stopping your lens down for satisfactory depth of field, add supplementary artificial lighting or adjust your shutter speed until the proper exposure can be obtained. If this is not possible, make sure you focus carefully on your subject and position it in a way that great depth of field is not critical to a good photograph. For example, if you place an elongated subject on a plane parallel to the film plane, the need for greater depth of field is virtually eliminated.

Great depth of field not required for sharp pictures. (See photo "O")

Requires great depth of field for entire subject to be in focus. (See photo "P")

Helpful Hints for Close Focusing Operation

1 — To assure maximum sharpness when shooting in the Close Focusing mode, it is recommended that you keep your lens focused at infinity (∞).

2 — Because exposure in close-up photography is critical to getting the best possible picture, it's a good idea to shoot several pictures of the same subject varying the exposure slightly. This method, called "bracketing," involves shooting the pictures at the f-stop indicated by your through-the-lens meter, underexposing by ½ to 1 stop and overexposing by ½ to 1 stop. The results will be well worth the few pennies it may add to your film cost.

3 — Always try to use a tripod or other support for your camera when shooting at higher magnifications to assure that slight movements or vibrations do not degrade the picture quality. If for some reason a support cannot be used, take the picture at the fastest possible shutter speed lighting conditions will allow.

4 — In Close Focusing operation, it's always a good idea to use a cable release to trigger the shutter of your camera. Even the slight movement caused by your

hand pressing the shutter release can affect the quality of pictures taken at high magnification. If your camera has a self-timer, you can use it to prevent this movement if a cable release is not available.

Using the Lens Hood

Your lens has a built-in Retractable Lens Hood ② which should be used to protect against extraneous light striking the lens and causing unwanted glare. To extend or retract the lens hood, use a gentle, twisting motion. (See photo "Q")

Taking care of your Lens

A — It's a good idea to keep a filter (such as a UV Filter) on your lens at all times. This not only improves results, but also protects the front element from scratches.

B — When attaching threaded accessories (filters, etc.) to your lens, align the accessory very carefully with the Filter Thread ① to prevent any possibility of damage.

C — Keep your lens dust-free by making sure both front and rear lens caps are in place when it is not in use.

D — Clean your lens with an air brush, anti-static brush, or wipe it lightly with a camel-hair brush or lens tissue. In EXTREME cases use a clean, soft cotton cloth moistened with denatured alcohol. *NEVER RUB THE LENS SURFACE WITH YOUR FINGER, CLOTHING OR ANY OTHER ABRASIVE MATERIAL.* Cleaning your lens in this way will scratch the lens coating and can cause damage to the element surface.

E — Always store your lens in a cool, dry place. It's a good idea to store it with the silica gel packet supplied with your lens especially during humid or wet weather.

Specifications

Focal Length: 85mm to 205mm
Zoom Ratio: 2.4:1
Angle of Acceptance: 28° at 85mm to 12° at 205mm
Optical Construction: 13 elements in 9 groups
Aperture Range: f3.8 to f22 (EE coupled lenses to f16 only)
Minimum Focusing Distance —
From Front Element in Zoom: 5'7" (1.7 m)
From Front Element in Close Focusing Mode: 12½" (31.8 cm)
Maximum Magnification in Close Focusing Mode: 1:4X
Length at ∞: 7¼" (184.2 mm)
Maximum Barrel Diameter: 2½" (63.5 mm)
Weight: 28 oz. (793.8 g)
Lens Hood: Built-in, retractable
Accessory Size: 58mm
Slip-on Lens Cap Size: 65mm
Accessories Included: Front and Rear Lens Caps, Silica Gel Packet

Specifications subject to change without notice.
Length and weight may vary slightly depending on lens mount.

Depth of Field Tables
Tiefenschärfetabellen
Tableaux de profondeur de champ
Tablas de Profundidad de Campo

85mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.9 ~ 7.1	6.8 ~ 7.2	6.7 ~ 7.3	6.6 ~ 7.5	6.4 ~ 7.7	6.2 ~ 8.0
8	7.8 ~ 8.2	7.7 ~ 8.3	7.6 ~ 8.4	7.4 ~ 8.6	7.2 ~ 8.9	6.9 ~ 9.4
9	8.7 ~ 9.3	8.6 ~ 9.4	8.4 ~ 9.6	8.2 ~ 9.9	8.0 ~ 10.3	7.6 ~ 11.0
10	9.6 ~ 10.3	9.5 ~ 10.5	9.3 ~ 10.8	9.1 ~ 11.1	8.7 ~ 11.7	8.3 ~ 12.6
12	11.5 ~ 12.5	11.3 ~ 12.8	11.0 ~ 13.2	10.6 ~ 13.8	10.1 ~ 14.7	9.5 ~ 16.3
15	14.2 ~ 15.9	13.8 ~ 16.4	13.4 ~ 17.1	12.8 ~ 18.1	12.1 ~ 19.8	11.2 ~ 22.9
20	18.6 ~ 21.8	17.9 ~ 22.8	17.2 ~ 24.1	16.2 ~ 26.3	15.0 ~ 30.4	13.6 ~ 38.9
30	26.8 ~ 34.5	25.4 ~ 37.2	23.9 ~ 41.1	22.0 ~ 48.5	19.8 ~ 65.1	17.3 ~ 128
60	48.2 ~ 83	43.7 ~ 101	39.1 ~ 139	34.2 ~ 301	28.9 ~ ∞	23.8 ~ ∞
∞	220 ~ ∞	148 ~ ∞	105 ~ ∞	74.6 ~ ∞	52.9 ~ ∞	37.5 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.96 ~ 2.04	1.94 ~ 2.06	1.92 ~ 2.08	1.89 ~ 2.12	1.85 ~ 2.17	1.80 ~ 2.25
2.5	2.44 ~ 2.57	2.41 ~ 2.60	2.37 ~ 2.65	2.32 ~ 2.71	2.25 ~ 2.81	2.17 ~ 2.97
3	2.90 ~ 3.11	2.86 ~ 3.16	2.80 ~ 3.23	2.73 ~ 3.34	2.63 ~ 3.50	2.51 ~ 3.77
4	3.82 ~ 4.21	3.74 ~ 4.32	3.64 ~ 4.47	3.51 ~ 4.69	3.33 ~ 5.05	3.12 ~ 5.67
5	4.72 ~ 5.35	4.58 ~ 5.54	4.40 ~ 5.79	4.22 ~ 6.19	3.97 ~ 6.87	3.65 ~ 8.15
7	6.43 ~ 7.76	6.18 ~ 8.18	5.88 ~ 8.77	5.51 ~ 9.78	5.06 ~ 11.70	4.50 ~ 16.27
10	8.85 ~ 11.70	8.35 ~ 12.71	7.80 ~ 14.26	7.15 ~ 17.25	6.39 ~ 24.6	5.55 ~ 64.1
20	15.73 ~ 28.6	14.17 ~ 36.0	12.6 ~ 53.1	10.92 ~ 162	9.18 ~ ∞	7.50 ~ ∞
∞	67.1 ~ ∞	45.1 ~ ∞	32.0 ~ ∞	22.7 ~ ∞	16.1 ~ ∞	11.4 ~ ∞

105mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.90 ~ 7.10	6.85 ~ 7.15	6.79 ~ 7.22	6.71 ~ 7.32	6.60 ~ 7.46	6.45 ~ 7.67
8	7.86 ~ 8.14	7.80 ~ 8.22	7.72 ~ 8.31	7.61 ~ 8.44	7.45 ~ 8.64	7.25 ~ 8.95
9	8.81 ~ 9.20	8.72 ~ 9.30	8.62 ~ 9.42	8.47 ~ 9.61	8.27 ~ 9.89	8.00 ~ 10.3
10	9.77 ~ 10.2	9.66 ~ 10.3	9.53 ~ 10.5	9.34 ~ 10.7	9.10 ~ 11.1	8.77 ~ 11.6
12	11.6 ~ 12.3	11.4 ~ 12.5	11.2 ~ 12.8	11.0 ~ 13.2	10.6 ~ 13.7	10.1 ~ 14.6
15	14.4 ~ 15.6	14.1 ~ 15.9	13.8 ~ 16.3	13.4 ~ 17.0	12.8 ~ 18.0	12.1 ~ 19.7
20	18.9 ~ 21.2	18.4 ~ 21.8	17.9 ~ 22.6	17.2 ~ 24.0	16.2 ~ 26.2	15.0 ~ 30.1
30	27.6 ~ 32.9	26.6 ~ 34.5	25.4 ~ 36.8	23.8 ~ 40.6	22.0 ~ 47.7	19.8 ~ 63.6
60	50.9 ~ 73.7	47.3 ~ 82.9	43.5 ~ 98.2	39.0 ~ 133	34.1 ~ 271	28.9 ~ ∞
∞	315 ~ ∞	211 ~ ∞	150 ~ ∞	106 ~ ∞	75.5 ~ ∞	53.5 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.97 ~ 2.02	1.96 ~ 2.04	1.94 ~ 2.05	1.92 ~ 2.08	1.89 ~ 2.11	1.85 ~ 2.17
2.5	2.45 ~ 2.54	2.43 ~ 2.57	2.41 ~ 2.60	2.37 ~ 2.64	2.32 ~ 2.71	2.25 ~ 2.81
3	2.93 ~ 3.07	2.90 ~ 3.11	2.86 ~ 3.15	2.80 ~ 3.22	2.73 ~ 3.33	2.63 ~ 3.49
4	3.87 ~ 4.14	3.81 ~ 4.21	3.73 ~ 4.31	3.64 ~ 4.45	3.51 ~ 4.67	3.34 ~ 5.02
5	4.79 ~ 5.23	4.69 ~ 5.35	4.58 ~ 5.52	4.42 ~ 5.76	4.22 ~ 6.15	3.97 ~ 6.82
7	6.56 ~ 7.49	6.39 ~ 7.76	6.17 ~ 8.12	5.88 ~ 8.70	5.51 ~ 9.68	5.07 ~ 11.5
10	9.14 ~ 11.09	8.76 ~ 11.7	8.33 ~ 12.5	7.8 ~ 14.0	7.15 ~ 16.9	6.39 ~ 23.9
20	16.7 ~ 25.1	15.4 ~ 28.7	14.1 ~ 35.0	12.6 ~ 50.5	10.9 ~ 139	9.20 ~ ∞
∞	96.1 ~ ∞	64.5 ~ ∞	45.7 ~ ∞	32.4 ~ ∞	23.0 ~ ∞	16.3 ~ ∞

135mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.94 ~ 7.06	6.91 ~ 7.10	6.88 ~ 7.13	6.83 ~ 7.18	6.76 ~ 7.27	6.66 ~ 7.39
8	7.91 ~ 8.08	7.87 ~ 8.12	7.82 ~ 8.17	7.75 ~ 8.25	7.65 ~ 8.37	7.52 ~ 8.53
9	8.89 ~ 9.11	8.83 ~ 9.17	8.76 ~ 9.25	8.67 ~ 9.35	8.54 ~ 9.51	8.37 ~ 9.75
10	9.85 ~ 10.1	9.78 ~ 10.2	9.70 ~ 10.3	9.58 ~ 10.4	9.42 ~ 10.6	9.21 ~ 10.9
12	11.7 ~ 12.2	11.6 ~ 12.3	11.5 ~ 12.4	11.3 ~ 12.6	11.1 ~ 12.9	10.8 ~ 13.4
15	14.6 ~ 15.3	14.4 ~ 15.5	14.2 ~ 15.7	13.9 ~ 16.1	13.6 ~ 16.6	13.1 ~ 17.4
20	19.3 ~ 20.6	19.0 ~ 21.0	18.6 ~ 21.4	18.1 ~ 22.1	17.5 ~ 23.2	16.6 ~ 24.9
30	28.4 ~ 31.5	27.7 ~ 32.4	26.9 ~ 33.6	25.8 ~ 35.4	24.5 ~ 38.4	22.8 ~ 43.6
60	53.7 ~ 66.8	51.2 ~ 71.1	48.4 ~ 77.3	45.0 ~ 88	40.9 ~ 110	36.2 ~ 173
∞	524 ~ ∞	351 ~ ∞	249 ~ ∞	176 ~ ∞	125 ~ ∞	88 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.98 ~ 2.01	1.97 ~ 2.02	1.96 ~ 2.03	1.95 ~ 2.04	1.93 ~ 2.06	1.91 ~ 2.09
2.5	2.47 ~ 2.52	2.45 ~ 2.54	2.44 ~ 2.55	2.42 ~ 2.58	2.38 ~ 2.62	2.34 ~ 2.67
3	2.95 ~ 3.04	2.93 ~ 3.06	2.91 ~ 3.08	2.87 ~ 3.12	2.83 ~ 3.18	2.76 ~ 3.27
4	3.91 ~ 4.07	3.87 ~ 4.12	3.83 ~ 4.17	3.76 ~ 4.25	3.68 ~ 4.37	3.56 ~ 4.54
5	4.86 ~ 5.12	4.80 ~ 5.19	4.72 ~ 5.28	4.62 ~ 5.42	4.49 ~ 5.62	4.31 ~ 5.93
7	6.72 ~ 7.26	6.60 ~ 7.41	6.45 ~ 7.60	6.26 ~ 7.90	6.00 ~ 8.36	5.67 ~ 9.11
10	9.42 ~ 10.5	9.17 ~ 10.9	8.88 ~ 11.3	8.51 ~ 12.0	8.03 ~ 13.1	7.43 ~ 15.2
20	17.7 ~ 22.5	16.8 ~ 24.1	15.8 ~ 26.5	14.6 ~ 30.8	13.2 ~ 40.2	11.6 ~ 70.8
∞	159 ~ ∞	107 ~ ∞	76 ~ ∞	53 ~ ∞	38.1 ~ ∞	27.0 ~ ∞

150mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.95 ~ 7.05	6.92 ~ 7.095	6.89 ~ 7.10	6.85 ~ 7.15	6.80 ~ 7.22	6.71 ~ 7.31
8	7.93 ~ 8.07	7.90 ~ 8.10	7.86 ~ 8.15	7.80 ~ 8.21	7.72 ~ 8.30	7.61 ~ 8.44
9	8.91 ~ 9.09	8.86 ~ 9.14	8.81 ~ 9.20	8.73 ~ 9.29	8.62 ~ 9.41	8.48 ~ 9.60
10	9.88 ~ 10.12	9.83 ~ 10.18	9.76 ~ 10.25	9.67 ~ 10.3	9.53 ~ 10.5	9.35 ~ 10.7
12	11.8 ~ 12.1	11.7 ~ 12.2	11.6 ~ 12.3	11.5 ~ 12.5	11.3 ~ 12.8	11.0 ~ 13.1
15	14.7 ~ 15.3	14.5 ~ 15.4	14.4 ~ 15.6	14.1 ~ 15.9	13.8 ~ 16.3	13.4 ~ 16.9
20	19.4 ~ 20.5	19.2 ~ 20.8	18.9 ~ 21.2	18.5 ~ 21.7	17.9 ~ 22.6	17.2 ~ 23.9
30	28.7 ~ 31.3	28.2 ~ 32.0	27.5 ~ 33.0	26.6 ~ 34.4	25.4 ~ 36.6	23.9 ~ 40.4
60	55.2 ~ 66.0	53.6 ~ 69.4	50.6 ~ 74.2	47.5 ~ 82.1	43.7 ~ 96.9	39.3 ~ 130.5
∞	643 ~ ∞	431 ~ ∞	309 ~ ∞	217 ~ ∞	153 ~ ∞	108 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.98 ~ 2.01	1.98 ~ 2.02	1.97 ~ 2.02	1.96 ~ 2.04	1.94 ~ 2.05	1.92 ~ 2.08
2.5	2.47 ~ 2.52	2.46 ~ 2.53	2.45 ~ 2.55	2.43 ~ 2.56	2.41 ~ 2.60	2.37 ~ 2.64
3	2.96 ~ 3.03	2.95 ~ 3.05	2.93 ~ 3.07	2.90 ~ 3.10	2.86 ~ 3.15	2.81 ~ 3.22
4	3.93 ~ 4.07	3.90 ~ 4.10	3.86 ~ 4.14	3.81 ~ 4.21	3.74 ~ 4.30	3.64 ~ 4.44
5	4.89 ~ 5.11	4.84 ~ 5.17	4.78 ~ 5.24	4.70 ~ 5.34	4.58 ~ 5.50	4.43 ~ 5.75
7	6.79 ~ 7.23	6.69 ~ 7.35	6.56 ~ 7.51	6.40 ~ 7.74	6.18 ~ 8.09	5.89 ~ 8.66
10	9.56 ~ 10.5	9.35 ~ 10.7	9.11 ~ 11.1	8.79 ~ 11.6	8.36 ~ 12.5	7.83 ~ 13.9
20	18.2 ~ 22.2	17.4 ~ 23.5	16.6 ~ 25.3	15.5 ~ 28.3	14.2 ~ 34.3	12.6 ~ 49.1
∞	196 ~ ∞	131 ~ ∞	93 ~ ∞	66 ~ ∞	46 ~ ∞	33.1 ~ ∞

180mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.96 ~ 7.03	6.95 ~ 7.05	6.93 ~ 7.07	6.90 ~ 7.10	6.86 ~ 7.14	6.80 ~ 7.20
8	7.95 ~ 8.04	7.93 ~ 8.07	7.90 ~ 8.10	7.86 ~ 8.14	7.81 ~ 8.20	7.73 ~ 8.29
9	8.93 ~ 9.06	8.90 ~ 9.09	8.86 ~ 9.13	8.81 ~ 9.19	8.74 ~ 9.27	8.63 ~ 9.39
10	9.92 ~ 10.08	9.88 ~ 10.12	9.83 ~ 10.17	9.77 ~ 10.24	9.68 ~ 10.34	9.55 ~ 10.50
12	11.88 ~ 12.12	11.82 ~ 12.18	11.75 ~ 12.25	11.65 ~ 12.36	11.51 ~ 12.52	11.33 ~ 12.76
15	14.8 ~ 15.19	14.71 ~ 15.29	14.59 ~ 15.42	14.43 ~ 15.6	14.21 ~ 15.88	13.91 ~ 16.28
20	19.63 ~ 20.36	19.46 ~ 20.55	19.25 ~ 20.80	18.96 ~ 21.15	18.56 ~ 21.67	18.03 ~ 22.47
30	29.1 ~ 30.8	28.7 ~ 31.3	28.2 ~ 31.9	27.6 ~ 32.8	26.7 ~ 34.1	25.6 ~ 36.2
60	56.5 ~ 63.7	54.9 ~ 65.8	53.1 ~ 68.6	50.8 ~ 73.1	47.8 ~ 80.5	44.1 ~ 94.0
∞	960 ~ ∞	637 ~ ∞	452 ~ ∞	320 ~ ∞	226 ~ ∞	160 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.99 ~ 2.00	1.98 ~ 2.01	1.98 ~ 2.01	1.97 ~ 2.02	1.96 ~ 2.03	1.95 ~ 2.05
2.5	2.48 ~ 2.51	2.47 ~ 2.52	2.46 ~ 2.53	2.45 ~ 2.54	2.43 ~ 2.56	2.41 ~ 2.59
3	2.97 ~ 3.02	2.96 ~ 3.03	2.95 ~ 3.05	2.93 ~ 3.07	2.90 ~ 3.10	2.86 ~ 3.14
4	3.95 ~ 4.04	3.93 ~ 4.06	3.90 ~ 4.09	3.87 ~ 4.13	3.82 ~ 4.19	3.75 ~ 4.28
5	4.92 ~ 5.07	4.89 ~ 5.11	4.85 ~ 5.15	4.79 ~ 5.22	4.71 ~ 5.32	4.60 ~ 5.47
7	6.85 ~ 7.15	6.78 ~ 7.23	6.69 ~ 7.33	6.57 ~ 7.47	6.42 ~ 7.69	6.20 ~ 8.03
10	9.68 ~ 10.3	9.54 ~ 10.49	9.37 ~ 10.7	9.13 ~ 11.0	8.82 ~ 11.5	8.41 ~ 12.3
20	18.7 ~ 21.4	18.1 ~ 22.1	17.5 ~ 23.2	16.6 ~ 24.9	15.6 ~ 27.7	14.3 ~ 33.2
∞	289 ~ ∞	194 ~ ∞	137 ~ ∞	97 ~ ∞	69 ~ ∞	48.8 ~ ∞

205mm

ft. \ f	3.8	5.6	8	11	16	22
7	6.97 ~ 7.03	6.95 ~ 7.04	6.94 ~ 7.06	6.91 ~ 7.08	6.88 ~ 7.12	6.83 ~ 7.18
8	7.96 ~ 8.04	7.94 ~ 8.06	7.91 ~ 8.08	7.88 ~ 8.12	7.83 ~ 8.17	7.77 ~ 8.25
9	8.94 ~ 9.05	8.92 ~ 9.08	8.88 ~ 9.11	8.84 ~ 9.16	8.77 ~ 9.23	8.69 ~ 9.34
10	9.93 ~ 10.07	9.90 ~ 10.10	9.86 ~ 10.14	9.80 ~ 10.21	9.72 ~ 10.30	9.61 ~ 10.42
12	11.90 ~ 12.10	11.85 ~ 12.16	11.79 ~ 12.22	11.70 ~ 12.31	11.58 ~ 12.45	11.42 ~ 12.65
15	14.83 ~ 15.17	14.75 ~ 15.26	14.65 ~ 15.37	14.51 ~ 15.52	14.32 ~ 15.75	14.06 ~ 16.09
20	19.69 ~ 20.32	19.54 ~ 20.48	19.36 ~ 20.69	19.10 ~ 20.99	18.76 ~ 21.43	18.29 ~ 22.10
30	29.2 ~ 30.7	28.9 ~ 31.1	28.5 ~ 31.6	27.9 ~ 32.4	27.1 ~ 33.5	26.1 ~ 35.2
60	57.0 ~ 63.3	55.7 ~ 65.1	54.1 ~ 67.4	52.0 ~ 71.0	49.2 ~ 77.0	45.8 ~ 87.3
∞	1104 ~ ∞	741 ~ ∞	525 ~ ∞	372 ~ ∞	263 ~ ∞	186 ~ ∞

m \ f	3.8	5.6	8	11	16	22
2	1.99 ~ 2.00	1.99 ~ 2.01	1.98 ~ 2.01	1.97 ~ 2.02	1.97 ~ 2.03	1.95 ~ 2.04
2.5	2.48 ~ 2.51	2.48 ~ 2.52	2.47 ~ 2.52	2.46 ~ 2.54	2.44 ~ 2.55	2.42 ~ 2.58
3	2.98 ~ 3.02	2.97 ~ 3.03	2.95 ~ 3.04	2.94 ~ 3.06	2.91 ~ 3.08	2.88 ~ 3.12
4	3.96 ~ 4.04	3.94 ~ 4.05	3.92 ~ 4.08	3.89 ~ 4.11	3.84 ~ 4.17	3.78 ~ 4.24
5	4.93 ~ 5.06	4.90 ~ 5.09	4.87 ~ 5.13	4.82 ~ 5.19	4.75 ~ 5.28	4.65 ~ 5.40
7	6.87 ~ 7.13	6.81 ~ 7.20	6.74 ~ 7.28	6.63 ~ 7.41	6.49 ~ 7.59	6.31 ~ 7.87
10	9.73 ~ 10.28	9.61 ~ 10.43	9.46 ~ 10.62	9.25 ~ 10.89	8.97 ~ 11.31	8.60 ~ 11.97
20	18.9 ~ 21.2	18.4 ~ 21.8	17.8 ~ 22.7	17.1 ~ 24.1	16.1 ~ 26.4	14.9 ~ 30.4
∞	336 ~ ∞	225 ~ ∞	160 ~ ∞	113.5 ~ ∞	80.2 ~ ∞	56.8 ~ ∞

A

B


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F

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