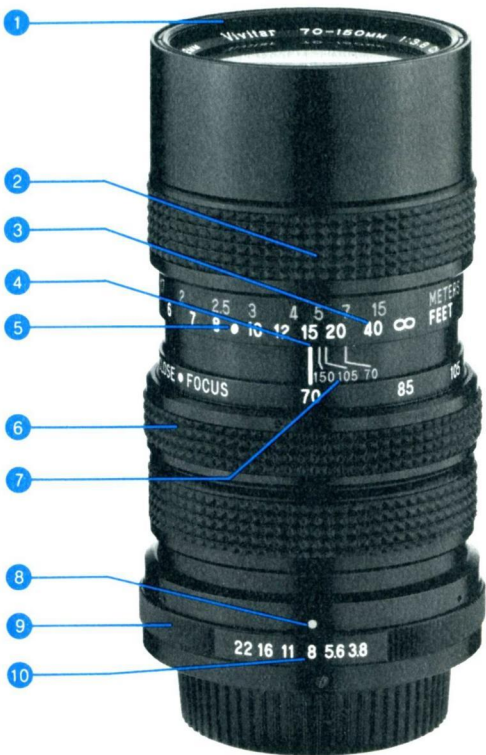


Vivitar®
70mm–150mm f3.8
Close-Focusing
Automatic Fixed Mount
Zoom Lens

Owner's Manual



Before you begin —

Carefully study this Owner's Manual. Keep it with the lens for a guide when questions arise.

Practice with your new Vivitar lens. *Dry-runs* — taking pictures without film — will help you get the *feel* of it.

Shoot a roll of film. After seeing those first great pictures, you'll *know* that you and your new Vivitar lens are ready for an important occasion.

Getting acquainted with your Lens

- 1 Accessory Thread
- 2 Focusing Ring
- 3 Distance Scales
- 4 Distance Index Line
- 5 Yellow Alignment Dot (For Close-Focusing)
- 6 Zoom/Close-Focusing Ring
- 7 Infrared Distance Index Line
- 8 Aperture Reference Dot
- 9 Aperture Ring
- 10 Aperture Scale

Mounting your Lens

Your new Automatic Fixed Mount lens is designed to mount on your camera with the ease and simplicity of your normal lens.

Remember to keep the front lens cap in place during mounting to prevent accidentally touching the front glass element.

Holding your Lens

You'll usually find it best to support the camera/lens combination by placing your left hand under the lens (see photo "A"). This leaves your right hand free to operate the camera controls and assures good balance and stability when shooting.

Zoom and Close-Focusing Operation

The Zoom/Close-Focusing Ring ⑥ controls both Zoom and Close-Focusing operation. A click-stop at the 70mm position identifies the separation between these two operations.

Turning the Zoom/Close-Focusing Ring from the click-stop towards the 150mm marking provides continuous focal length selection between 70mm and 150mm. At all focal lengths, turn the Focusing Ring ② to focus on subjects between 1.5 m (4' 11") and infinity.

Turning the Zoom/Close-Focusing Ring from the click-stop towards the "**CLOSE•FOCUS**" marking allows you to focus on subjects between 40.5 cm (16") and 1.5 m (4' 11") from your camera's film plane.

Close-Focusing Operation

To photograph subjects between 40.5 cm (16") and 1.5 m (4' 11") from your camera's film plane:

- 1** — Set the Zoom/Close-Focusing Ring ⑥ at the click-stop "70" position.
- 2** — The Yellow Alignment Dot ⑤ located between the 8- and 10-foot markings on the Focusing Ring ② should *a/ways* be aligned with the Distance Index Line ④ during Close-Focusing operation. (See photo "B")
- 3** — Move the camera and/or subject until you obtain the image size and composition you want.
- 4** — Focus by turning the Zoom/Close-Focusing Ring between the click-stop "70" position and the "CLOSE•FOCUS" position until the subject appears sharpest in your camera viewfinder.

Helpful Hints for Close-Focusing Operation

- 1** — *Bracket* — shoot several pictures of the same subject at different exposures; exposure in close-up photography is critical. Under- and over-expose by a half to a full stop as well as shooting at "correct" exposure. This *insurance* is well worth a few pennies in film.
- 2** — Use a *tripod* or other *firm support* — slight movements and vibrations can ruin a great close-up photo. If, for some reason, a support can't be used, shoot the photo at the fastest possible shutter speed lighting conditions will allow.
- 3** — Use a *cable release* — the slight movement of your finger pressing the shutter release can cause movement of your camera (even when your camera is mounted on a tripod). After you arrange the photo, make all camera adjustments, and advance the film, wait a moment — then shoot. If your camera has a *self-timer*, use it for movement-free camera operation when a cable release is not available.

Zoom Operation

To photograph subjects between 1.5 m (4' 11") and infinity:

- 1** — Set the Zoom/Close-Focusing Ring ⑥ at the click-stop "70" position.
- 2** — Turn the Zoom/Close-Focusing Ring towards the "150" marking until you obtain the image size and composition you want. If you prefer to start with a specific focal length, turn the Zoom/Close-Focusing Ring until the focal length you want aligns with the Distance Index Line ④ and then compose your photograph. For your convenience, the major focal lengths — 70mm, 85mm, 105mm, and 150mm are marked on the Zoom/Close-Focusing Ring.
- 3** — Focus by turning the Focusing Ring ② until the subject appears sharpest in your camera viewfinder. Since a large image can be seen more clearly, you may find it convenient to focus with the lens set at the 150mm focal length and then zoom to the focal length you want. The cam-operated focusing system of your lens will maintain the focus as you zoom. When precise focus is critical to your photograph, recheck the focus after zooming.

Exposure Control

Turning the Aperture Ring ⑨ changes the size of the opening of the lens diaphragm to control the amount of light that can pass through the lens when an exposure is made. The size of this opening is indicated by the f-stop position on the Aperture Scale ⑩ which aligns with the Aperture Reference Dot ⑧. The Aperture Ring has click-stops at each marked f-stop and at each intermediate half-stop except between f16 and f22. Your new Vivitar lens has Automatic Diaphragm Control. With the lens mounted on your camera, the diaphragm remains open to its maximum aperture regardless of the Aperture Ring setting. When you release the shutter, the diaphragm

automatically stops down to your pre-selected f-stop and instantly reopens after the exposure is completed.

NOTE: Universal Thread Mount lenses have an AUTO/MANUAL Switch (see photo "C") which must be set in the "A" (Auto) position for Automatic Diaphragm Control. In the "M" (Manual) position, the diaphragm opens and closes as the Aperture Ring is turned.

Canon Mount lenses have an AUTO/MANUAL Lever (see photo "D") which must be set at the clockwise end of its slot for Automatic Diaphragm Control. With the lever in the counter-clockwise end of its slot, the lens diaphragm opens and closes as the Aperture Ring is turned.

Exposure Measurements

Exposure measurements obtained from "through-the-lens" metering systems may change significantly as you move the camera to change your view of the subject. The proportions of light and dark areas in the total picture area may change as you change view.

To assure proper exposure, set focal length, compose and focus your photograph *before* measuring exposure.

EE Coupled Lenses

The Aperture Ring on Konica Mount lenses locks with a positive click when placed in the "EE" position. To remove Konica Mount lenses from EE operation, press the EE Lock Button (see photo "E") and turn the Aperture Ring to the specific f-stop you want.

Canon Mount lenses have a click-stop at the "0" marked EE position. The Aperture Ring may be set at and removed from this position in the same manner as selecting a specifically marked f-stop.

Estimating Distance

Your new Vivitar lens has two numbered Distance Scales ③ engraved on the Focusing Ring ② .

The *white numbers* indicate distance in *feet* and the *green numbers* indicate distance in *meters*. In the Zoom mode of operation, the approximate distance to an *object-in-focus* is indicated on these scales at the Distance Index Line ④.

Infrared Photography

The red numbers, **70**, **105**, and **150**, engraved below each Infrared Distance Index Line ⑦, correspond to selected lens focal lengths.

Infrared radiation does not focus at the same point as visible light. Approximate focusing at any focal length is achieved by aligning the closest corresponding Infrared Distance Index Lines with the Distance Scale marking for the actual subject-to-film distance.

If this distance is not known, focus the lens on the subject in the normal manner. Then turn the Focusing Ring until the exact point which was aligned with the Distance Index Line ② (see photo "F"), aligns with the closest corresponding Infrared Distance Index Line. (See photo "G")

Since infrared radiation is variable by nature, the Infrared Index Line should be used only as an approximation for focusing.

Depth of Field

Depth of field is the capability of a lens to produce acceptably sharp pictures of objects which are located in an area in front of and behind a subject in focus.

You can creatively control the size of this area, making it small to emphasize a single object, or making it large to accurately record every detail of a scene by doing the following:

1 — *Focus* Depth of field becomes smaller as you focus on nearby objects and becomes larger as you focus on those that are farther away. In the Close-Focusing mode of operation, depth of field becomes so small that a single object may not be entirely sharp when photographed (see photo "H"). Sometimes, a simple change of view

will solve this problem. (See photo "I")

2 — Focal Length As you zoom, you'll find that depth of field becomes larger as you shorten focal length. For example, the depth of field at 70mm (see photo "J") is much larger than the depth of field at 150mm. (See photo "K").

3 — Aperture Depth of field becomes larger as you reduce the size of the diaphragm opening. For example, the depth of field at f16 (see photo "L") is much larger than the depth of field at f3.8. (See photo "M")

Depth of Field Preview

Pressing your camera's Depth of Field Preview Button stops down the lens diaphragm to your pre-selected aperture allowing you to see the depth of field in the viewfinder prior to taking the picture.

NOTE: The AUTO/MANUAL Switch on Universal Thread Mount lenses may be used for previewing depth of field by moving the switch to the "M" (Manual) position.

The Depth of Field Tables located in the back of this Owner's Manual provide precise depth of field information for selected focal length/aperture/focus combinations.

Taking care of your Lens

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

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

3 — Keep your lens dust free by making sure both front and rear lens caps are in place when it's not in use.

4 — 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.

5 — Always store your lens in a cool, dry place.

Specifications

Focal Length: 70mm to 150mm

Optical Construction: 15 elements in 10 groups

Angle of Acceptance: 34° at 70mm; 16° at 150mm

Aperture Range: f3.8 to f22 (f16 on Konica Mounts)

Zoom Ratio: 2.14:1

Minimum Focusing Distance From Film Plane —

Telephoto mode: 1.5 m (4' 11")

Close-Focusing mode: 40.5 cm (16")

Maximum Reproduction Ratio: 1:4

Length at ∞ : 112 mm (4 $\frac{3}{8}$ ")

Weight: 550 g (19 $\frac{1}{2}$ oz.)

Maximum Barrel Diameter: 61 mm (2 $\frac{3}{8}$ ")

Accessory Size: Ø52mm

Slip-on Lens Cap Size: Ø59mm

Lens Coating: MC (multicoated)

Accessories Included: Front and Rear Lens Caps

Specifications subject to change without notice.

Length and weight may vary slightly depending on lens mount.

Notes

Depth of Field Tables

70mm

| $\frac{f}{m}$ | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------|---------------|---------------|---------------|----------------|---------------|---------------|
| 5 | 4.88 ~ 5.12 | 4.83 ~ 5.18 | 4.76 ~ 5.27 | 4.68 ~ 5.37 | 4.55 ~ 5.57 | 4.40 ~ 5.82 |
| 6 | 5.82 ~ 6.19 | 5.74 ~ 6.28 | 5.64 ~ 6.42 | 5.52 ~ 6.59 | 5.32 ~ 6.90 | 5.11 ~ 7.32 |
| 7 | 6.75 ~ 7.27 | 6.64 ~ 7.41 | 6.49 ~ 7.60 | 6.32 ~ 7.86 | 6.06 ~ 8.33 | 5.77 ~ 8.98 |
| 8 | 7.66 ~ 8.37 | 7.51 ~ 8.56 | 7.32 ~ 8.83 | 7.10 ~ 9.19 | 6.76 ~ 9.86 | 6.39 ~ 10.82 |
| 10 | 9.45 ~ 10.62 | 9.22 ~ 10.94 | 8.92 ~ 11.40 | 8.58 ~ 12.04 | 8.06 ~ 13.28 | 7.53 ~ 15.19 |
| 12 | 11.20 ~ 12.93 | 10.86 ~ 13.42 | 10.44 ~ 14.15 | 9.96 ~ 15.17 | 9.25 ~ 17.28 | 8.53 ~ 20.78 |
| 15 | 13.74 ~ 16.53 | 13.22 ~ 17.37 | 12.58 ~ 18.64 | 11.87 ~ 20.53 | 10.85 ~ 24.73 | 9.85 ~ 32.90 |
| 20 | 17.76 ~ 22.90 | 16.87 ~ 24.61 | 15.82 ~ 27.32 | 14.68 ~ 31.72 | 13.12 ~ 43.49 | 11.65 ~ 79.02 |
| 40 | 31.68 ~ 54.39 | 28.85 ~ 65.63 | 25.80 ~ 90.74 | 22.79 ~ 174.76 | 19.11 ~ ∞ | 16.04 ~ ∞ |
| ∞ | 145.67 ~ ∞ | 98.85 ~ ∞ | 69.19 ~ ∞ | 50.32 ~ ∞ | 34.60 ~ ∞ | 25.16 ~ ∞ |

| $\frac{f}{m}$ | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------|---------------|---------------|--------------|---------------|--------------|--------------|
| 1.5 | 1.47 ~ 1.54 | 1.45 ~ 1.55 | 1.43 ~ 1.58 | 1.41 ~ 1.61 | 1.37 ~ 1.67 | 1.32 ~ 1.74 |
| 1.7 | 1.65 ~ 1.75 | 1.63 ~ 1.77 | 1.61 ~ 1.81 | 1.57 ~ 1.85 | 1.52 ~ 1.93 | 1.47 ~ 2.03 |
| 2.0 | 1.93 ~ 2.07 | 1.90 ~ 2.11 | 1.87 ~ 2.16 | 1.82 ~ 2.22 | 1.75 ~ 2.34 | 1.67 ~ 2.51 |
| 2.5 | 2.39 ~ 2.62 | 2.34 ~ 2.68 | 2.28 ~ 2.77 | 2.21 ~ 2.88 | 2.10 ~ 3.10 | 1.99 ~ 3.42 |
| 3.0 | 2.84 ~ 3.18 | 2.77 ~ 3.28 | 2.68 ~ 3.41 | 2.58 ~ 3.60 | 2.43 ~ 3.96 | 2.27 ~ 4.51 |
| 4.0 | 3.71 ~ 4.35 | 3.58 ~ 4.53 | 3.43 ~ 4.81 | 3.26 ~ 5.21 | 3.01 ~ 6.05 | 2.76 ~ 7.52 |
| 5.0 | 4.54 ~ 5.57 | 4.35 ~ 5.89 | 4.12 ~ 6.38 | 3.87 ~ 7.12 | 3.52 ~ 8.84 | 3.17 ~ 12.53 |
| 7.0 | 6.11 ~ 8.21 | 5.76 ~ 8.94 | 5.36 ~ 10.16 | 4.93 ~ 12.26 | 4.35 ~ 18.77 | 3.82 ~ 52.73 |
| 15.0 | 11.32 ~ 22.32 | 10.14 ~ 29.08 | 8.91 ~ 48.92 | 7.75 ~ 342.05 | 6.37 ~ ∞ | 5.26 ~ ∞ |
| ∞ | 44.40 ~ ∞ | 30.13 ~ ∞ | 21.09 ~ ∞ | 15.34 ~ ∞ | 10.55 ~ ∞ | 7.67 ~ ∞ |

85mm

| $\frac{f}{m}$ | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------|---------------|---------------|---------------|---------------|----------------|---------------|
| 5 | 4.92 ~ 5.09 | 4.88 ~ 5.13 | 4.83 ~ 5.18 | 4.77 ~ 5.26 | 4.67 ~ 5.38 | 4.56 ~ 5.54 |
| 6 | 5.87 ~ 6.13 | 5.82 ~ 6.20 | 5.74 ~ 6.29 | 5.65 ~ 6.40 | 5.51 ~ 6.60 | 5.35 ~ 6.86 |
| 7 | 6.82 ~ 7.19 | 6.74 ~ 7.28 | 6.64 ~ 7.41 | 6.51 ~ 7.58 | 6.31 ~ 7.88 | 6.09 ~ 8.27 |
| 8 | 7.76 ~ 8.26 | 7.65 ~ 8.38 | 7.51 ~ 8.56 | 7.35 ~ 8.79 | 7.09 ~ 9.21 | 6.80 ~ 9.78 |
| 10 | 9.67 ~ 10.42 | 9.44 ~ 10.64 | 9.22 ~ 10.94 | 8.96 ~ 11.34 | 8.56 ~ 12.09 | 8.12 ~ 13.13 |
| 12 | 11.43 ~ 12.63 | 11.18 ~ 12.96 | 10.86 ~ 13.42 | 10.49 ~ 14.05 | 9.93 ~ 15.25 | 9.33 ~ 17.01 |
| 15 | 14.09 ~ 16.04 | 13.70 ~ 16.58 | 13.22 ~ 17.37 | 12.66 ~ 18.48 | 11.82 ~ 20.68 | 10.97 ~ 24.17 |
| 20 | 18.38 ~ 21.95 | 17.70 ~ 23.01 | 16.87 ~ 24.61 | 15.95 ~ 26.96 | 14.62 ~ 32.10 | 13.29 ~ 41.72 |
| 40 | 33.78 ~ 49.09 | 31.47 ~ 55.03 | 28.85 ~ 65.68 | 26.14 ~ 86.72 | 22.62 ~ 187.40 | 19.50 ~ ∞ |
| ∞ | 207.98 ~ ∞ | 141.13 ~ ∞ | 98.79 ~ ∞ | 71.85 ~ ∞ | 49.40 ~ ∞ | 35.92 ~ ∞ |

| $\frac{f}{m}$ | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------|---------------|---------------|---------------|--------------|---------------|--------------|
| 1.5 | 1.48 ~ 1.52 | 1.46 ~ 1.54 | 1.45 ~ 1.55 | 1.43 ~ 1.57 | 1.40 ~ 1.61 | 1.37 ~ 1.66 |
| 1.7 | 1.67 ~ 1.73 | 1.65 ~ 1.75 | 1.63 ~ 1.77 | 1.61 ~ 1.80 | 1.57 ~ 1.85 | 1.53 ~ 1.92 |
| 2.0 | 1.95 ~ 2.05 | 1.93 ~ 2.07 | 1.90 ~ 2.11 | 1.87 ~ 2.15 | 1.82 ~ 2.23 | 1.76 ~ 2.33 |
| 2.5 | 2.42 ~ 2.58 | 2.39 ~ 2.62 | 2.34 ~ 2.68 | 2.29 ~ 2.76 | 2.21 ~ 2.89 | 2.11 ~ 3.08 |
| 3.0 | 2.89 ~ 3.12 | 2.83 ~ 3.19 | 2.77 ~ 3.28 | 2.69 ~ 3.39 | 2.57 ~ 3.61 | 2.45 ~ 3.92 |
| 4.0 | 3.79 ~ 4.24 | 3.70 ~ 4.36 | 3.58 ~ 4.53 | 3.45 ~ 4.77 | 3.25 ~ 5.24 | 3.04 ~ 5.94 |
| 5.0 | 4.67 ~ 5.38 | 4.53 ~ 5.59 | 4.35 ~ 5.89 | 4.15 ~ 6.31 | 3.86 ~ 7.18 | 3.56 ~ 8.61 |
| 7.0 | 6.35 ~ 7.80 | 6.08 ~ 8.26 | 5.76 ~ 8.95 | 5.41 ~ 10.00 | 4.90 ~ 12.45 | 4.41 ~ 17.70 |
| 15.0 | 12.21 ~ 19.47 | 11.23 ~ 22.68 | 10.14 ~ 29.11 | 9.05 ~ 45.18 | 7.68 ~ 607.16 | 6.51 ~ ∞ |
| ∞ | 63.39 ~ ∞ | 43.02 ~ ∞ | 30.11 ~ ∞ | 21.90 ~ ∞ | 15.06 ~ ∞ | 10.95 ~ ∞ |

105mm

| <div><div>ft.</div><div>f</div></div> | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------------------------------|---------------|---------------|---------------|---------------|---------------|----------------|
| 5 | 4.95 ~ 5.05 | 4.92 ~ 5.08 | 4.89 ~ 5.12 | 4.85 ~ 5.16 | 4.78 ~ 5.24 | 4.71 ~ 5.34 |
| 6 | 5.92 ~ 6.08 | 5.88 ~ 6.13 | 5.83 ~ 6.18 | 5.77 ~ 6.25 | 5.67 ~ 6.38 | 5.56 ~ 6.53 |
| 7 | 6.88 ~ 7.12 | 6.83 ~ 7.18 | 6.76 ~ 7.26 | 6.67 ~ 7.36 | 6.54 ~ 7.54 | 6.38 ~ 7.77 |
| 8 | 7.84 ~ 8.16 | 7.77 ~ 8.24 | 7.68 ~ 8.35 | 7.56 ~ 8.50 | 7.38 ~ 8.74 | 7.18 ~ 9.07 |
| 10 | 9.74 ~ 10.27 | 9.63 ~ 10.40 | 9.48 ~ 10.59 | 9.30 ~ 10.83 | 9.01 ~ 11.25 | 8.69 ~ 11.82 |
| 12 | 11.62 ~ 12.40 | 11.45 ~ 12.60 | 11.24 ~ 12.88 | 10.97 ~ 13.25 | 10.57 ~ 13.92 | 10.12 ~ 14.82 |
| 15 | 14.40 ~ 15.66 | 14.13 ~ 15.99 | 13.79 ~ 16.45 | 13.39 ~ 17.08 | 12.77 ~ 18.24 | 12.11 ~ 19.86 |
| 20 | 18.92 ~ 21.22 | 18.45 ~ 21.85 | 17.85 ~ 22.76 | 17.17 ~ 24.01 | 16.14 ~ 26.44 | 15.06 ~ 30.12 |
| 40 | 35.74 ~ 45.45 | 34.02 ~ 48.59 | 31.98 ~ 53.54 | 29.76 ~ 61.38 | 26.69 ~ 81.32 | 23.76 ~ 133.83 |
| ∞ | 321.09 ~ ∞ | 217.88 ~ ∞ | 152.52 ~ ∞ | 110.92 ~ ∞ | 76.26 ~ ∞ | 55.46 ~ ∞ |

| <div><div>m</div><div>f</div></div> | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|-------------------------------------|---------------|---------------|---------------|---------------|--------------|---------------|
| 1.5 | 1.48 ~ 1.52 | 1.48 ~ 1.52 | 1.47 ~ 1.53 | 1.46 ~ 1.55 | 1.44 ~ 1.57 | 1.41 ~ 1.60 |
| 1.7 | 1.68 ~ 1.72 | 1.67 ~ 1.73 | 1.66 ~ 1.75 | 1.64 ~ 1.76 | 1.62 ~ 1.80 | 1.59 ~ 1.84 |
| 2.0 | 1.97 ~ 2.03 | 1.96 ~ 2.05 | 1.94 ~ 2.07 | 1.91 ~ 2.10 | 1.88 ~ 2.14 | 1.84 ~ 2.20 |
| 2.5 | 2.45 ~ 2.55 | 2.43 ~ 2.58 | 2.40 ~ 2.61 | 2.36 ~ 2.66 | 2.30 ~ 2.74 | 2.24 ~ 2.84 |
| 3.0 | 2.92 ~ 3.08 | 2.89 ~ 3.12 | 2.85 ~ 3.17 | 2.79 ~ 3.24 | 2.71 ~ 3.37 | 2.61 ~ 3.53 |
| 4.0 | 3.86 ~ 4.15 | 3.80 ~ 4.22 | 3.72 ~ 4.33 | 3.63 ~ 4.47 | 3.48 ~ 4.72 | 3.32 ~ 5.07 |
| 5.0 | 4.78 ~ 5.24 | 4.68 ~ 5.37 | 4.56 ~ 5.54 | 4.41 ~ 5.78 | 4.19 ~ 6.22 | 3.96 ~ 6.85 |
| 7.0 | 6.56 ~ 7.50 | 6.38 ~ 7.76 | 6.14 ~ 8.15 | 5.88 ~ 8.68 | 5.48 ~ 9.76 | 5.07 ~ 11.48 |
| 15.0 | 13.07 ~ 17.62 | 12.32 ~ 19.21 | 11.44 ~ 21.85 | 10.52 ~ 26.40 | 9.27 ~ 40.55 | 8.12 ~ 114.80 |
| ∞ | 97.87 ~ ∞ | 66.41 ~ ∞ | 46.49 ~ ∞ | 33.81 ~ ∞ | 23.24 ~ ∞ | 16.90 ~ ∞ |

150mm

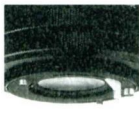
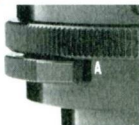
| <div><div>ft.</div><div>f</div></div> | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|---------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 5 | 4.97 ~ 5.03 | 4.96 ~ 5.04 | 4.94 ~ 5.06 | 4.92 ~ 5.08 | 4.89 ~ 5.12 | 4.85 ~ 5.17 |
| 6 | 5.96 ~ 6.04 | 5.94 ~ 6.06 | 5.91 ~ 6.09 | 5.88 ~ 6.13 | 5.83 ~ 6.18 | 5.77 ~ 6.26 |
| 7 | 6.94 ~ 7.06 | 6.91 ~ 7.09 | 6.88 ~ 7.13 | 6.83 ~ 7.18 | 6.76 ~ 7.26 | 6.67 ~ 7.37 |
| 8 | 7.92 ~ 8.08 | 7.88 ~ 8.12 | 7.83 ~ 8.18 | 7.77 ~ 8.24 | 7.67 ~ 8.36 | 7.56 ~ 8.50 |
| 10 | 9.87 ~ 10.13 | 9.81 ~ 10.20 | 9.73 ~ 10.29 | 9.63 ~ 10.40 | 9.47 ~ 10.60 | 9.29 ~ 10.84 |
| 12 | 11.81 ~ 12.20 | 11.72 ~ 12.30 | 11.60 ~ 12.43 | 11.46 ~ 12.60 | 11.23 ~ 12.90 | 10.97 ~ 13.27 |
| 15 | 14.69 ~ 15.32 | 14.55 ~ 15.48 | 14.36 ~ 15.70 | 14.14 ~ 15.98 | 13.78 ~ 16.48 | 13.38 ~ 17.11 |
| 20 | 19.44 ~ 20.60 | 19.18 ~ 20.89 | 18.85 ~ 21.30 | 18.46 ~ 21.84 | 17.84 ~ 22.80 | 17.15 ~ 24.08 |
| 40 | 37.72 ~ 42.58 | 36.74 ~ 43.92 | 35.50 ~ 45.86 | 34.07 ~ 48.54 | 31.93 ~ 53.79 | 29.70 ~ 61.87 |
| ∞ | 635.06 ~ ∞ | 430.93 ~ ∞ | 301.65 ~ ∞ | 219.38 ~ ∞ | 150.83 ~ ∞ | 109.69 ~ ∞ |

| <div><div>m</div><div>f</div></div> | 3.8 | 5.6 | 8 | 11 | 16 | 22 |
|-------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 1.5 | 1.49 ~ 1.51 | 1.49 ~ 1.51 | 1.48 ~ 1.52 | 1.48 ~ 1.52 | 1.47 ~ 1.53 | 1.46 ~ 1.55 |
| 1.7 | 1.69 ~ 1.71 | 1.68 ~ 1.72 | 1.68 ~ 1.72 | 1.67 ~ 1.73 | 1.66 ~ 1.75 | 1.64 ~ 1.77 |
| 2.0 | 1.98 ~ 2.02 | 1.98 ~ 2.02 | 1.97 ~ 2.03 | 1.96 ~ 2.05 | 1.94 ~ 2.07 | 1.91 ~ 2.10 |
| 2.5 | 2.47 ~ 2.53 | 2.46 ~ 2.54 | 2.45 ~ 2.56 | 2.43 ~ 2.58 | 2.40 ~ 2.62 | 2.36 ~ 2.66 |
| 3.0 | 2.96 ~ 3.04 | 2.94 ~ 3.06 | 2.92 ~ 3.08 | 2.89 ~ 3.12 | 2.85 ~ 3.18 | 2.79 ~ 3.25 |
| 4.0 | 3.93 ~ 4.07 | 3.90 ~ 4.11 | 3.85 ~ 4.16 | 3.80 ~ 4.22 | 3.72 ~ 4.33 | 3.62 ~ 4.48 |
| 5.0 | 4.89 ~ 5.12 | 4.83 ~ 5.18 | 4.77 ~ 5.26 | 4.69 ~ 5.36 | 4.56 ~ 5.55 | 4.41 ~ 5.79 |
| 7.0 | 6.77 ~ 7.24 | 6.67 ~ 7.37 | 6.54 ~ 7.54 | 6.38 ~ 7.76 | 6.14 ~ 8.17 | 5.87 ~ 8.71 |
| 15.0 | 13.96 ~ 16.22 | 13.51 ~ 16.87 | 12.96 ~ 17.82 | 12.34 ~ 19.18 | 11.42 ~ 21.99 | 10.49 ~ 26.71 |
| ∞ | 193.56 ~ ∞ | 131.35 ~ ∞ | 91.94 ~ ∞ | 66.87 ~ ∞ | 45.97 ~ ∞ | 33.43 ~ ∞ |



A

B



C

D

E



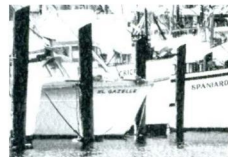
F

G



H

I



J

K



L

M

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