

# Standard Safety Specification for Stationary Exercise Bicycles<sup>1</sup>

This standard is issued under the fixed designation F 1250; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

## 1. Scope

1.1 This safety specification covers the safety design features of stationary exercise bicycles. The device shall be assembled in accordance with the manufacturer's instructions for safe use.

1.2 This standard is limited to exercise bicycles of:

1.2.1 *Class A*—Non-free-wheeling exercise bicycles with a directly driven flywheel.

1.2.2 *Class B*—Free-wheeling exercise bicycles.

1.2.3 *Class C*—Ergometer bicycles, or, those bicycles used to precisely measure work.

1.2.4 *Class D*—Units designed to convert road bicycles to stationary exercise bicycles.

1.3 This specification is intended to reduce the demonstrated hazards associated with the use of stationary exercise bicycles.

1.4 This specification is written to provide reasonable safety standards for the user of stationary exercise bicycles during storage, movement, entry, use, and exit from the product.

1.5 *This standard does not purport to address all the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

F 1749 Specification for Fitness Equipment Facility Safety Signage and Labels<sup>2</sup>

## 3. Terminology

3.1 *Definitions:*

3.1.1 *consumer exercise bicycle, n*—stationary exercise bicycle intended for use by one person or family unit in a home environment.

3.1.2 *flywheel, n*—a heavy wheel for opposing and moderating, by its inertia, fluctuations of speed in the exercise bicycle on which it revolves.

<sup>1</sup> This safety specification is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee F08.30 on Fitness Products.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 15.07.

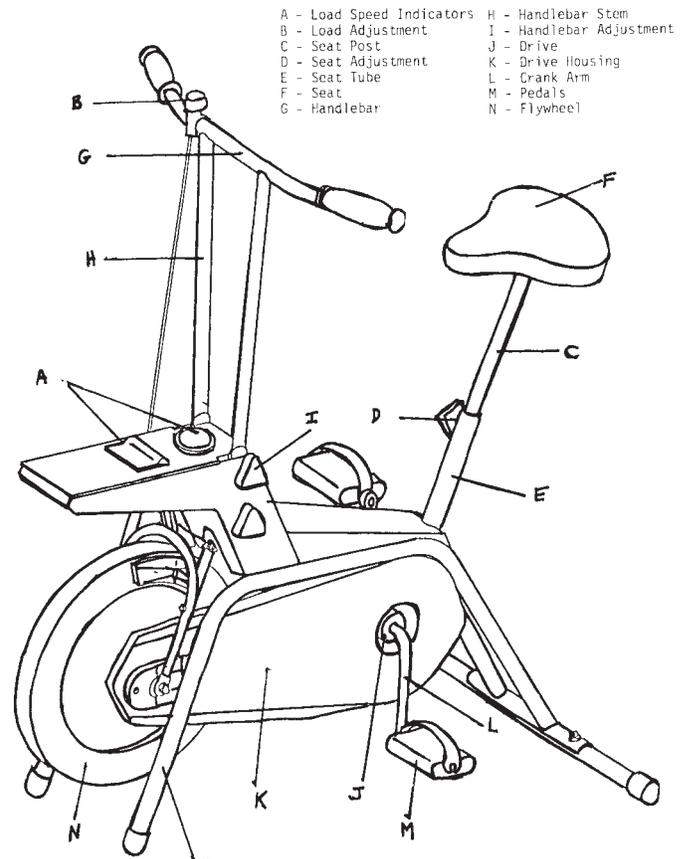


FIG. 1 Illustration of Bicycle Terms

3.1.3 *freewheel, n*—a device that allows the driver bicycle wheel to run on, free from the drive sprocket when motion of the pedals is stopped.

3.1.4 *institutional exercise bicycle, n*—stationary exercise bicycle intended for use by numerous persons in a commercial or institutional, as opposed to a home, environment.

3.1.5 *stationary exercise bicycle, n*—a “bicycle-like” fixed device, on which performance is achieved by means of a pedaling motion applied by the user. Depending on the class, the pedaling motion can be braked, whereby the load is modified.

## 4. General Requirements

4.1 *Stability:*

4.1.1 The bicycle shall be stable in a statically loaded condition and shall not tip forward, backward or sideward.

4.1.2 The bicycle base of support shall not tilt when force is applied.

4.1.3 The bicycle structure to which the horizontal force is applied shall not break or be permanently deformed.

4.1.4 The tests for stability shall be conducted in accordance with 7.1.

4.2 Exterior Design:

4.2.1 All edges of parts accessible to the user or to bystanders shall be burr-free, rounded, or otherwise guarded.

4.2.2 The design of rotating and moving parts which are accessible to the user shall avoid shear, pinch, or catch points.

4.2.3 Spokes must not be accessible.

4.2.4 Dangerous points of drive train components shall be guarded.

4.2.5 Adjustment devices such as knobs and pins and frame components, and so forth, (for example, handlebars) shall not be within the range of normal leg movements.

4.2.6 The tests for the safety of exterior design shall be conducted in accordance with 7.2.

5. Performance Requirements

5.1 Overheating:

5.1.1 No accessible metallic part shall have a temperature of more than 140°F (60°C). No accessible nonmetallic part shall have a temperature greater than 185°F (85°C).

5.1.2 The test for overheating shall be conducted in accordance with 7.3.

5.2 Frame and Seat Post Retention Assembly—The test for frame and seat post clamp assembly shall be conducted in accordance with 7.4.

5.3 Seat Post and Seat:

5.3.1 The seat shall be adjustable as prescribed by the manufacturer’s specifications.

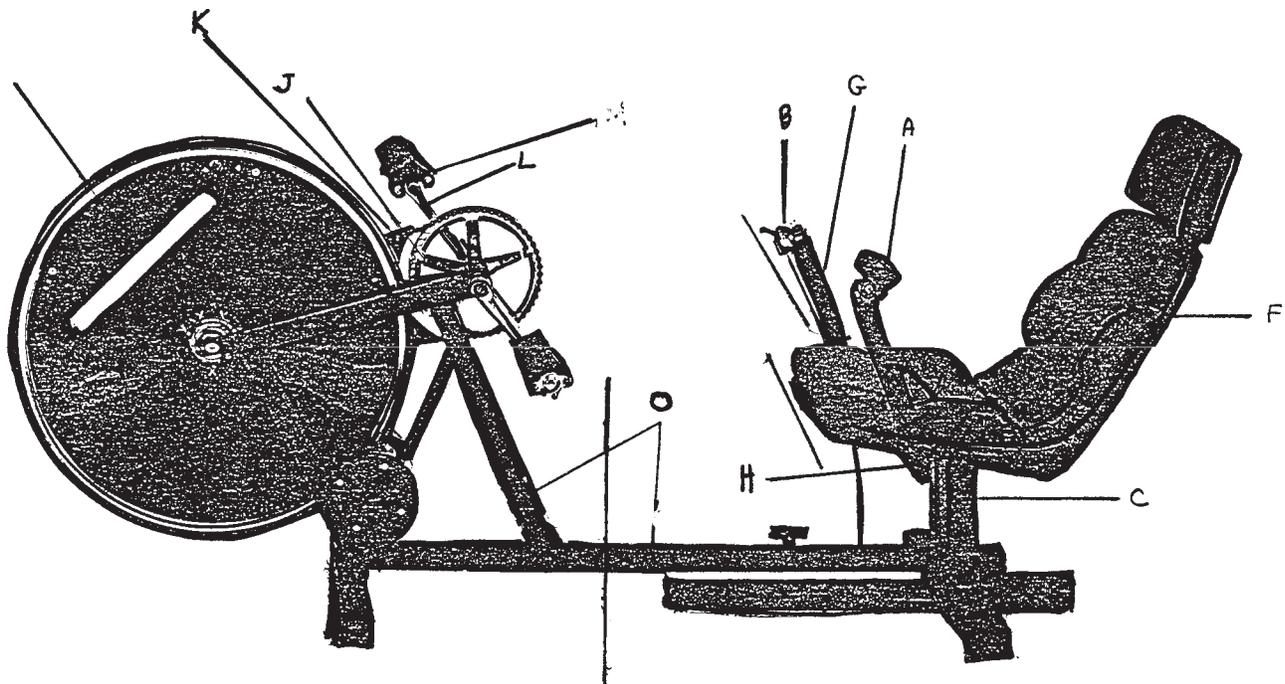
5.3.1.1 The seat post shall have a permanent visual mark indicating a maximum extension. At maximum extension, no less than 2.0 in. (5.1 cm) of the seat post shall be engaged in the support structure. No mark is required if the minimum insertion depth is already provided by the design. The seat shall be mounted onto the post with a steel seat pan, shouldered seat post, capped seat bracket, or any other device that protects the user from impalement in case of failure of the seat or seat post.

5.3.2 When properly adjusted according to the manufacturer’s specifications, the seat shall not tilt.

5.3.3 The test for seats shall be conducted in accordance with 7.5.

5.4 Handlebars:

5.4.1 If a vertical shaft adjustment is used, a visual permanent mark of 2.5 in. (6.35 cm) above the end of the handlebar support shall indicate the minimum insertion depth. No mark is required if the minimum insertion depth is already provided by the design.



- |                          |                                 |                   |
|--------------------------|---------------------------------|-------------------|
| A - Load/Speed Indicator | F - Seat                        | K - Drive Housing |
| B - Load Adjustment      | G - Handlebar                   | L - Crank Arm     |
| C - Seat Post            | H - Handlebar Stem              | M - Pedals        |
| D - Seat Adjustment      | I - Handlebar Height Adjustment | N - Flywheel      |
| E - Seat Tube            | J - Drive                       | O - Frame         |

FIG. 2 Illustration of Bicycle Terms

5.4.2 The handlebars shall not rotate around its horizontal axis when a moment of 45 ft-lb (61.00 N-m) is applied (excepting when the handle is purposely in motion as part of the exercise).

5.4.3 The handlebar stem shall not rotate around its vertical axis when a moment of 35 ft-lb (47.00 N-m) is applied (excepting when the handle is purposely in motion as part of the exercise).

5.4.4 The test for handlebars shall be conducted in accordance with 7.6.

#### 5.5 Pedals:

5.5.1 Pedals shall have right hand/left hand symmetry. A nonslip tread surface shall be present on the surface presented to the rider's foot. A minimum clearance of 1.5-in. (3.81-cm) shall be provided below the pedals when they are in a horizontal position at the lowest level. The pedals shall not permanently deform under use.

5.5.2 The test of the pedals shall be conducted in accordance with 7.7.

## 6. Documentation

6.1 *Owner's/User's Manual*—An owner's/user's manual shall be provided with the exercise bicycle. Paragraphs 6.2-6.8 set forth the sections to be covered in this manual. The first topic of the manual shall be a comprehensive listing of the safety precautions applicable to the exercise bicycle. This listing shall alert the reader to the following:

6.1.1 Read all warnings posted on the exercise bicycle.

6.1.2 Read the owner's/user's manual and follow it carefully before using the exercise bicycle.

6.1.3 Keep children away from the exercise bicycle.

6.1.4 Set up and operate the exercise bicycle on a solid level surface.

6.1.5 Inspect the exercise bicycle for worn or loose components prior to use. Tighten/replace any loose or worn components prior to using.

6.1.6 Consult a physician prior to commencing an exercise program. If, at any time during exercise, you feel faint, dizzy, or experience pain, stop and consult your physician.

6.1.7 Do not wear loose or dangling clothing while using the exercise bicycle.

6.1.8 Care should be taken in mounting or dismounting the exercise bicycle.

6.1.9 Consumer exercise bicycles shall contain notification that the exercise bicycle is for consumer use only.

6.2 *Assembly Instructions*—If the exercise bicycle requires assembly, a manual shall be supplied detailing the assembly procedures for the bicycle.

6.2.1 Exercise bicycles requiring assembly shall include a listing of the tools required for assembly, even if the tools are provided by the manufacturer.

6.2.2 Exercise bicycles shall include the parts listing for the given model, including specific part references.

6.2.3 The area required for safe access and operation of the exercise bicycles shall be defined in these instructions.

6.2.4 Information relating to the proper adjustment of the seat and handlebars including their minimum insertion depth of the adjustment posts shall be provided.

6.2.5 Information relating to the procedure for leveling the exercise bicycle shall be provided.

6.2.6 Functional and visual inspection of the equipment shall be made after assembly is complete.

6.2.7 Review of all warnings affixed to the machine shall be provided.

6.3 *Operational Instructions*—The function of the exercise bicycle shall be explained in operation instructions. Where possible, the use of graphics shall be provided to assist in proper depiction of the use of the equipment. The operation instructions shall include instructions on how to vary the load or resistance.

6.4 *Maintenance Instructions*—Care and necessary maintenance advice shall be provided. This shall include a review of all applicable warning notices and how replacement warning labels can be obtained. Special attention shall be drawn to components most susceptible to wear.

6.4.1 The safety and integrity designed into the machine can only be maintained when the exercise bicycle is regularly examined for damage and repair. It is the sole responsibility of the user/owner or facility operator to ensure that regular maintenance is performed. Worn or damaged components shall be replaced immediately or the exercise bicycle removed from service until the repair is made. Only manufacturer-supplied components shall be used to maintain/repair the equipment. The maintenance instructions shall call the reader's attention to these facts.

6.5 *Installation Instructions*—Instructions shall be provided with exercise bicycles that indicates the minimum clearance required around each bicycle for safe access to and passage around the bicycle. These instructions shall provide specifications detailing the dimensions of the exercise bicycle at rest and during operation (if different). Procedures for proper storage and movement of the exercise bicycle shall be provided in these instructions.

6.6 *User Weight Restrictions*—Maximum user weight limits for the exercise bicycle shall be affixed to the bicycle where the user can easily read them.

6.7 *Warnings/Warning Labels*—Adequate warnings alerting users, third parties, and service personnel to hazards associated with exercise bicycles shall be provided. Warning labels shall be designed in accordance with Specification F 1749. Warning labels shall include those specified in Specification F 1749, additional warnings appropriate and specific to a manufacturer's given exercise bicycle, and the following:

6.7.1 Keep children away.

6.7.1.1 *Class A Exercise Bicycle Warning Labels*—Class A exercise bicycles with inertia exceeding 14 lb-ft<sup>2</sup> (0.6 kg-m<sup>2</sup>), as tested in accordance with 7.8.1 shall be affixed with a label in a prominent location addressing the following:

(1) Spinning pedals can cause injury.

(2) This bike does not free-wheel.

(3) Pedal speed should be reduced in a controlled manner.

(4) The exercise bicycle should only be used after a thorough review of the operation manual (consumer exercise bicycles) or under the direct supervision of a trained instructor (institutional exercise bicycles).

6.8 *Marking*—Exercise bicycles shall have identification affixed to the product indicating the following:

6.8.1 The manufacturer's or distributor's, or both, name, address, and telephone number.

6.8.2 Serial and model numbers.

6.8.3 Date of manufacture or code number, which includes the date of manufacture.

6.8.4 Classification of the product, if it is intended for consumer (noninstitutional) use only.

## 7. Test Methods

### 7.1 *Stability:*

7.1.1 These test methods are intended to simulate the stability of the exercise bicycle in a statically loaded condition.

#### 7.1.2 *Apparatus:*

7.1.2.1 The force measuring or force application systems shall be of any type that is repeatable and calibrated.

##### 7.1.2.2 Suggested devices include:

- (1) Pulley-weight cable pan system.
- (2) Cable tensiometer and strap.
- (3) Strain-gage transducer and cable and strap.
- (4) Push-lunge force tester.

#### 7.1.3 *Procedure:*

7.1.3.1 Raise the seat to its highest intended safety use position. The test is to be conducted on level nonskid surface. The bike is to be assembled in accordance with the manufacturer's directions.

7.1.3.2 Place  $220 \text{ lb} \pm 2\%$  ( $979 \text{ N} \pm 2\%$ ) load on seat so that center of gravity of mass is on or above seat level with 6 in. (15.2 cm) from the top of the seat. The loading area shall be equal to or less than  $1 \text{ ft}^2$  (12 by 12 in.) (30.5 by 30.5 cm).

7.1.3.3 Attach a device to apply a horizontal force at a height 30 in. (76.20 cm) from the floor on the seat support member. If the maximum seat height is below 30 in., apply force 3 in. (7.62 cm) below maximum seat height.

7.1.3.4 Apply the following forces in the following directions for one test each:

- (1) Forward force of  $40 \text{ lb} \pm 2\%$  ( $178 \text{ N} \pm 2\%$ ).
- (2) Backward force of 25 lb.
- (3) Side (right and left) force of  $20 \text{ lb} \pm 2\%$  ( $89 \text{ N} \pm 2\%$ ).

7.1.3.5 Each test in each direction shall be held for 10 s.

### 7.2 *Exterior Design:*

7.2.1 All edges of parts directly accessible to the user or to bystanders shall be tested by visual and tactile inspection to ensure that they are burr-free, rounded, or otherwise guarded.

7.2.2 *Spokes*—Spokes shall be tested by visual inspection, measurement, use of a standard tapered test probe, or, any combination thereof, shall be used to determine accessibility. The standard Underwriters Laboratory (UL) tapered, flexible probe shall be used.<sup>3</sup>

7.2.3 *Drive Train*—A measuring rod with a diameter of 0.365-in. (0.93-cm) and a length of 3.0-in. (7.62-cm) shall be held to all potentially accessible points between drive train components from all directions. The rod shall not be caught.

7.2.4 Safety of adjustment devices (4.2.8) shall be tested by visual inspection.

### 7.3 *Overheating:*

7.3.1 Tests for overheating shall be conducted at a room temperature of  $75 \pm 9^\circ\text{F}$  ( $23^\circ \pm 5^\circ\text{C}$ ) and a relative humidity of 55 to 75 %. If it is not possible to maintain these conditions then the results shall be corrected to 75°F.

7.3.2 The stationary exercise bicycle shall be operated at 200 W (31.9 N-m or 24 lb-ft for a torque dynamometer) and 60 crank r/min for 3 periods of 20 min with 5-min rest intervals for consumer exercise bicycles or one continuous 60-min period for institutional exercise bicycles.

7.3.3 Temperature is to be recorded without delay at the conclusion of the test period (third 20-min test period for consumer exercise bicycles).

### 7.4 *Frame and Seat Post Retention Assembly:*

7.4.1 The stationary exercise bicycle shall be set up on a smooth level surface and the seat positioned at the highest intended safety use position. The friction between the exercise bicycle and the ground shall be reduced as much as possible, for example, with the use of rollers.

7.4.2 A load of  $220 \text{ lb} \pm 2\%$  ( $979 \text{ N} \pm 2\%$ ) shall be placed on the seat for 1 min. Upon removal of the load, a reference measurement shall be taken from the top of the seat supporting structure to the floor as measured vertically. A load of  $440 \text{ lb} \pm 2\%$  ( $1960.00 \text{ N} \pm 2\%$ ) shall be applied to the seat for 5 min. After removing the load, the measurement shall be repeated. If the preceding specification is not met, the manufacturer shall state the maximum load capacity for the seat post.

7.4.3 *Acceptance Criteria*—No permanent deflection greater than 0.50 in. (1.27 cm) is allowed.

### 7.5 *Seat Post and Seat:*

7.5.1 Seat adjustability (5.1.1) shall be tested by visual inspection.

#### 7.5.2 *Tilt:*

7.5.2.1 The seat post and seat are adjusted in accordance with the manufacturer's specifications. A vertical force of  $150 \text{ lb} \pm 2\%$  ( $667.20 \text{ N} \pm 2\%$ ) is applied at a point 1.0 in. (2.54 cm) or less from either the front or rear of the seat. The test forces shall be applied in such a way that the greatest moment is applied to the seat/seat post attachment. The load shall be applied for 5 min.

7.5.2.2 *Acceptance Criteria*—No permanent tilt movement (except for that allowed by through bolt hole clearance) shall occur.

### 7.6 *Handlebars:*

#### 7.6.1 *Horizontal Axis Torque Test:*

7.6.1.1 Assemble and tighten the handlebars at the highest adjustment position in accordance with the manufacturer's instructions.

7.6.1.2 Clamp a horizontal reference bar to the handlebars and measure and record the distance to the floor from a reference point on the bar. Apply a torque of 45 ft-lb (61 N-m) to the handle bars for 5 min. After 5 min cease the application of torque and remeasure the vertical distance to the floor from the reference point on the bar.

<sup>3</sup> Probes may be obtained from Underwriters Laboratories, 1285 Walt Whitman Rd., Melville, NY 11747.

7.6.1.3 *Acceptance Criteria*—No permanent rotational movement or vertical displacement of the reference point shall have occurred.

7.6.2 *Vertical Axis Torque Test:*

7.6.2.1 Assemble and tighten the handlebars in accordance with the manufacturer’s instructions.

7.6.2.2 Clamp a reference bar to the handlebars and measure and record the distance from a reference point on the bar to vertical reference such as a wall. Apply a torque of 35 ft-lb (47 N-m) to the handle bars for 5 min. After 5 min cease the application of torque and remeasure the distance to the vertical reference from the reference point on the bar.

7.6.2.3 *Acceptance Criteria*—No permanent rotational movement or horizontal displacement of the reference point shall have occurred.

7.7 *Pedals:*

7.7.1 *Deformation Test:*

7.7.1.1 Assemble and tighten the pedals in accordance with the manufacturer’s instructions.

7.7.1.2 Fixture the pedals so that they are parallel to the floor and so that the crank does not rotate. Measure and record the vertical distance from a point on the top surface of the pedal to the floor. Apply a 220-lb (979-N) load to the center of the pedal for 5 min. After 5 min remove the load and remeasure the vertical distance from the floor to the reference point on the pedal.

7.7.1.3 *Acceptance Criteria*—No permanent vertical displacement of the of the pedal shall have occurred.

7.8 *Inertia:*

7.8.1 *Inertia Test*—To determine the inertia of the flywheel system on Class A exercise bicycles, begin by raising and supporting the exercise bicycle at least 24 in. (0.61 m) above the floor with the driven (or crack) axle extending over the edge of the test table. Set the resistance level to the minimum setting. Remove the pedal crank from the axle, mount a 3-in. diameter drum to the axle, wrap, and secure a cable to it. Suspend a 20-lb (9.1-kg) mass from the end of the cable. From the underside of the mass measure 18 in. (0.46 cm) down towards the floor and secure the reference surface. Release the mass and record the amount of time required for it to travel to the reference surface. Repeat the process obtaining at least 5 readings and then average the results. Refer to Table 1 and determine the flywheel inertia. The values in Table 1 were derived from the following equation:

$$J = m \times r^2 [g\Delta t/2h - 1] = 3.35\Delta t^2 - 0.31 \quad (1)$$

where:

- $J$  = moment of inertia for the flywheel,
- $m$  = mass of the test weight = 20 lb,
- $R$  = drum radius where the test weight is attached = 0.13 ft,
- $g$  = gravitational constant = 32.2 ft/s<sup>2</sup>,
- $\Delta t$  = time required for test mass to reach reference surface, and
- $h$  = distance from mass to reference surface = 1.5 ft.

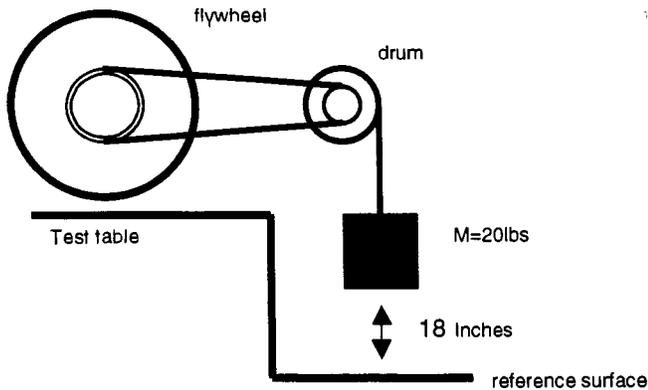


FIG. 3 Inertia Test Setup

TABLE 1 Flywheel Inertia Values (See Fig. 3)

$\Delta t$ , s	$J$ , lb-ft <sup>2</sup>	$J$ , kg-m <sup>2</sup>
1.00	3.04	0.13
1.50	7.23	0.30
2.00	13.09	0.55
2.50	20.62	0.87
3.00	29.84	1.26
3.50	40.72	1.72
4.00	53.29	2.25
5.00	83.44	3.52

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