

3M™ Eyewear Fit System

Background

Occupational use of safety eyewear must be in compliance with applicable health and safety standards. In the U.S., employers must comply with the OSHA personal protective equipment (PPE) standard (29 CFR 1910.132) and the eye and face standard (29 CFR 1910.133) which guide selection, use and maintenance of protective eyewear. The performance testing of safety eyewear is guided by the American National Standards Institute (ANSI) standard “American National Standard Practice for Occupational and Educational Personal Eye and Face Protective Devices,” ANSI Z87.1. In other regions consult the applicable standard(s) for your jurisdiction.

Current standards suggest careful consideration should be given to eyewear fit; however, no specific guidance is provided on how to evaluate fit on an individual. For example, OSHA in its PPE standard (29CFR132 (d)(1)(iii)) states employers should “Select PPE that properly fits each affected employee.” No additional information is provided to help guide employers on how to assess fit and how frequently to fit test.

Improperly fitted or incorrectly worn safety eyewear may not provide adequate protection and may increase the chance of eye injury. Every day approximately 2,000 U.S. workers sustain a work-related eye injury that requires medical treatment.¹ This is a problem for both employers and their workers because about 1 in 10 injuries require one or more missed workdays to recover.² Approximately 40% of those injured were wearing safety glasses at the time of the injury.² The most common types of eye injuries include having foreign bodies such as splinters, dust or chips in the eye, cuts, chemical burns, abrasions and scratches.

The following fit evaluation method is designed to help compare different styles or models of eyewear on an individual in order to select the best fitting model(s). This method, utilizing the Coverage and Gap Gauge, will help you assess four elements of protective eyewear fit as described in Table 1.

Table 1: 4-Elements of Protective Eyewear Fit

View	Wearer should be able to see in all directions of eye rotation without major obstruction to the field of view. The eyewear frame should not interfere with visibility to do work tasks.
Security	The eyewear stays in place on the head and the frame should not fall off when wearer bends over.
Coverage	The wearer should have coverage from the brow to cheek bone as well as lateral coverage to help protect the soft tissues of the eye.
Gaps	There should be minimal gap between eyewear and the wearer’s face. There should be no clear path for a flying projectile to proceed through the eyewear gap to the wearer’s eyes. For goggles there should be no visible gap.

There are no regulatory requirements regarding the frequency of fitting eyewear. 3M recommends eyewear fit testing prior to initial use of a new eyewear model and periodically thereafter. In addition, worksites should consider conducting a fit test whenever the employee reports, or the employer, supervisor, or program administrator makes visual observations of changes in the employee’s physical condition that could affect eyewear fit. Such conditions could include but are not limited to, dental changes, cosmetic surgery, broken nose, or an obvious change in body weight. When other personal protective equipment (PPE), such as a half facepiece respirator or a welding shield, will be worn in addition to safety eyewear, ensure both types of PPE fit properly when used in combination.

The 3M™ Eyewear Fit System is applicable to various types of safety eyewear including spectacles and goggles. This document covers the steps to evaluate spectacles. Contact 3M Technical Service for additional information on applying these evaluation steps to fit goggles.

The Coverage and Gap Gauge may be wiped down as needed with soap and water or an eyewear cleaning wipe and dried with a soft cloth.

Spectacle Evaluation Method

Supplies

- A selection of safety eyewear appropriate for the job hazards and tasks
- 2 Coverage and Gap Gauges (Gauge 1: sphere sizes approx. 6 mm and 8 mm (~ 0.24 and 0.31 in); Gauge 2: sphere sizes approx. 10 mm and 12 mm (~0.39 and 0.47 in))
- Fit Evaluation Forms
- Pen or pencil

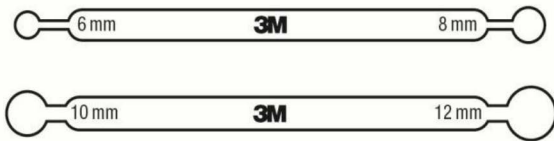


Figure 1A: Coverage and Gap Gauges front side

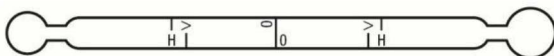


Figure 1B: Coverage and Gap Gauges back side

Method

Before beginning the fit evaluation process, inform the wearer that you will be asking a series of questions to help assess eyewear comfort, view, and security. The Coverage and Gap Gauge will be used to measure coverage and gaps. The wearer may experience a slight “tickling” or pressure on the face as the gauge is moved around the perimeter of the eyewear to measure gaps.

Step 1: Select a Style of Eyewear to Test

Instruct the wearer to try on the available eyewear models and select a style from those pre-determined by the worksite to be appropriate for the hazards and tasks. The choices may vary depending on the job classification. It is suggested that only clear or lightly tinted lenses that allow a clear view of the wearer’s pupil be used for fitting. Most tinted lens models are also available in a clear version that could be used for the purpose of fitting the wearer. If the chosen style has adjustable features the wearer should adjust for best wearing comfort and perceived fit before proceeding with the fit evaluation.

Step 2: Ergonomic Check

It is recommended to check the ergonomics and wearing comfort of the selected eyewear model prior to assessing fit. If a particular eyewear model is not comfortable the wearer may not keep them on during all times they are exposed to eye hazards. Verify the following:

- A. Temple tips should not pinch in the area around the wearer’s ear.
- B. Pressure on the head from the temples or side arms should be acceptable (not too loose or too tight).
- C. Nosepiece shouldn’t pinch or slide.
- D. If the nose pads are adjustable, check fit and adjust as needed, the full surface of the nosepiece or nose pads should touch the wearer’s nose.
- E. The weight of the eyewear should be comfortable on the face.

If unacceptable discomfort is noted by the wearer and the eyewear has adjustable features, then have the wearer try adjusting for a more comfortable fit. If a more comfortable adjustment setting cannot be achieved or the eyewear is not adjustable it is suggested the wearer select another style of eyewear.

Step 3: Evaluate the Fit of the Eyewear: View, Security, Coverage, and Gaps

View: Verify the wearer can see in all directions of eye rotation without major obstruction to the field of view that would interfere with visibility to perform work tasks. If the selected pair limits the field of view, the wearer should select another style or model and start a new fit evaluation.

Security: Ask the wearer to do gentle head and body movements including shaking the head, turning the head from side to side, and moving the head up and down. Verify that the eyewear stays in place on the wearer’s head and the frame does not fall off with head movement. If the selected pair is not secure, the wearer may want to try a lanyard for added stability. If a secure fit cannot be obtained, select another style or model and start a new fit evaluation.

Coverage: Check how well the safety eyewear covers the soft tissue area around the eyes. Use the ruler on one of the Coverage and Gap Gauges to check the brow to cheek bone and lateral coverage of the eyewear. It is recommended that only clear or lightly tinted lenses that allow a clear view of the wearer’s pupil be used when evaluating coverage. Most tinted lens models are also available in a clear version that could be used for the purpose of fitting the wearer.

- A. Select one of the Coverage and Gap Gauges and hold it vertically. Instruct the wearer to look straight ahead and keep their face relaxed (i.e. do not smile, frown, raise eyebrows, etc). Center the “0” line approximately in the middle of the wearer’s pupil. Using the ruler on the Coverage and Gap Gauge, evaluate the distance from the center of the pupil to the upper and lower edge of the eyewear.

This distance should meet or exceed the lines on the gauge marked with a “V” (Figure 2). Include the frame in the evaluation. Record the result on the Fit Evaluation Form under the “vertical measurement” column. Repeat with the other eye.



Figure 2: Vertical Coverage

B. Rotate the Coverage and Gap Gauge to the horizontal position and again center the “0” line approximately in the middle of the wearer’s pupil. Check the distance between the pupil and the inner edge (near the nose bridge) and the outer edge of the eyewear. The distance from the center of the pupil to the inner and outer edge of the eyewear should meet or exceed the lines on the gauge marked with an “H” (Figure 3). Include the frame in the evaluation. Record the result on the Fit Evaluation Form under the “horizontal measurement” column. Repeat with the other eye.

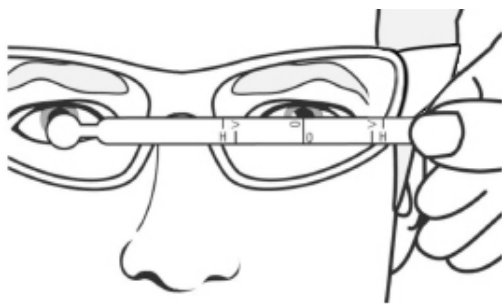


Figure 3: Horizontal Coverage

C. Adequate coverage from brow to cheek bone as well as lateral side to side coverage is important to help protect the soft tissues of the eye from projectiles and debris. From the center of the pupil, the vertical and horizontal lines on the ruler on the Coverage and Gap Gauge are set to measure a distance of approximately 17 mm and 20 mm respectively (~0.67 and 0.79 in).

These values are derived from the performance testing of safety eyewear standard “American National Standard Practice for Occupational and Educational Personal Eye and Face Protective Devices,” ANSI Z87.1¹³. In 2010 ANSI issued a new edition of Z87.1, replacing Z87.1-2003. The 2010 edition defines a minimum design coverage area for eyewear of 40 mm in width by 33 mm in height (~1.6 by 1.3 in) measured through the geometric center of the lens. Due to the uniqueness of each individual’s face and head this level of coverage may not be achieved for an individual. If the selected pair of eyewear doesn’t meet or exceed the coverage area vertically and horizontally the wearer should select another style or model and start a new fit evaluation.

Gaps: For spectacles, the smaller the gap between the eyewear and the face the less likely it is that debris and projectiles will pass through to the soft tissues of the eye. Use the spheres on the Coverage and Gap Gauge to check for excessive gaps between the eyewear and the face.

A. Review the check points in Figure 4. Pay close attention to the location of positions 1 and 6 on the top of the eyewear and 7 and 12 on the bottom of the eyewear.

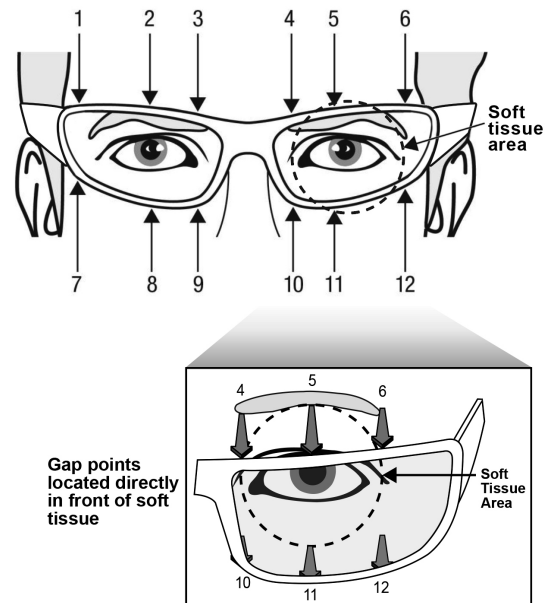


Figure 4: Gap check locations

B. Starting with the Coverage and Gap Gauge with sphere sizes of 10 mm and 12 mm, hold the gauge vertically. Instruct the wearer to ensure the eyewear is still securely in place and hasn’t slipped out of position and to look straight ahead.

C. Gently probe the gap clearance around the perimeter of the eyewear, checking the top and the bottom of the frame as well as the nose bridge area in the locations marked in Figure 4. For each location, mark only **one** gap measurement value on the Fit Evaluation Form by checking the appropriate box. The gap measurement is the sphere size that best matches the space between the face and the eyewear at the check points. It is recommended to start with the 12 mm sphere.

It is important to have a good line of sight to the gap locations in order to be able to judge the fit of the sphere into the gap. It may be helpful to stand while measuring the top locations and to sit down while measuring the bottom locations. Starting with the 12 mm sphere, if the middle of the 12 mm sphere is able to pass between the eyewear and the face, check the “12 mm” box on the Fit Evaluation Form. If the 12 mm sphere does not fit into the gap, check the gap with the 10 mm sphere. If the 10 mm sphere fits into the gap, check the “10 mm” box on the Fit Evaluation Form. If the 10 mm sphere doesn’t fit continue checking using progressively smaller sphere sizes until the test sphere fits tightly between the eyewear and the face. Record the sphere size on the Fit Evaluation Form. Continue this process using both Coverage and Gap Gauges as needed to check all 12 locations recording a single gap measurement value for each location. Figures 5A and 5B show examples of two different gap sizes. Figure 5A illustrates an example of a 6 mm gap while Figure 5B shows a 10 mm gap.

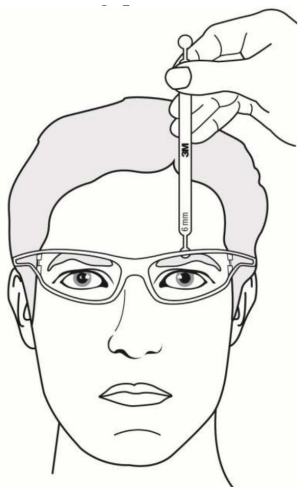


Figure 5A: Checking Gap



Figure 5B: Checking Gap

D. While there is no maximum gap size currently specified in standards and regulations, the smaller the gap between the eyewear and the face the less likely it is for debris and projectiles to pass through to the soft tissues of the eye. A gap size of less than 6, 6 or 8 mm is preferred. If there are gaps of 10 mm or 12 mm it is recommended to evaluate another style or model of eyewear.

Step 4: Worker Education

Verify the wearer has been trained on the proper use, maintenance, and limitations of safety eyewear. The worker should wear their safety eyewear in the manner it was designed to be worn during all required functions and tasks. Also ensure the worker is trained on site-specific procedures such as cleaning and storage of eyewear.

Consult the *User Instructions* supplied by the manufacturer of the eyewear for use information. User Information for 3M safety spectacles is provided on the next page.

- Occupational use of spectacles must be in compliance with applicable health and safety standards. In the U.S., employers must comply with the OSHA personal protective equipment (PPE) standard (29 CFR 1910.132) and the eye and face standard (29 CFR 1910.133). In Canada, consult the applicable standard(s) for your jurisdiction.
- 3M spectacles help protect from flying particles or objects. Some operations may require special filter or tinted lenses, machine guards, goggles, face shields or other safety equipment. Special filter or tinted lenses may alter color perception – care should be taken in their selection and use, especially where color recognition is important, i.e. traffic signals, wire splicing, visual displays, etc.
- 3M non-prescription spectacles have polycarbonate lenses which provide 99.9% UVA and UVB protection.
- 3M does not recommend use of spectacles alone for operations that expose your eyes to harmful levels of optical radiation such as burning, cutting or welding with torches, electric (arc) welding, furnace or molten metal operations or glass blowing. Do not use spectacles for chemical splash or vapor protection, laser light, athletic sports, paintball or simulated combat games. Do not use spectacles for protection against severe impacts from events such as explosions or fragmenting grinding or abrasive wheels.
- Always use both hands to put on and remove eyewear.
- Inspect the eyewear frequently and replace it immediately if you notice cracking, crazing, pitting, scratching, deformation or other signs of damage. Do not make any modifications to spectacles.
- Clean lenses and frames with water or mild soap solution and dry with a soft cloth. Cleaning eyewear with solvents or chemicals such as MEK, acetone, or toluene may damage the frames, lenses and/or coatings and reduce their protective characteristics. Store eyewear in a clean area protected from contamination, damage, particulates, debris, direct sunlight, chemicals, high heat or extreme cold.
- For additional information on selection or use, contact 3M PSD Technical Service in the USA at 1-800-243-4630, in Canada at 1-800-267-4414, or visit our website: 3M.com/workersafety

Step 5: Ergonomic Recheck

Now that the wearer has had the eyewear on for a short period of time verify it is still comfortable and doesn't slip, slide, pinch, etc. If unacceptable discomfort is noted by the wearer and the eyewear has adjustable features, then have the wearer try adjusting for a more comfortable fit. If a more comfortable adjustment setting cannot be achieved or the eyewear is not adjustable it is suggested the wearer select another style of eyewear. If adjustments are made or another style of eyewear is selected, repeat the fit evaluation.

Step 6: Records

Record the brand (manufacturer), model number, and other applicable information for the selected style in the space provided in the Fit Evaluation Form. Retain fit records in compliance with applicable regulations, standards, and company policies.

Summary

Occupational use of safety eyewear must be in compliance with applicable health and safety standards. In the U.S., employers must comply with the OSHA personal protective

equipment (PPE) standard (29 CFR 1910.132) and the eye and face standard (29 CFR 1910.133) which guide selection, use and maintenance of protective eyewear. OSHA requires a worksite assessment be conducted to determine if hazards are present, or are likely to be present, which necessitate the use of safety eyewear and to determine the appropriate type of eyewear to use for the identified hazards. The 3M™ Eyewear Fit System may be used as one part of a comprehensive eyewear program which includes elements such as a hazard assessment and worker training. It is designed to help compare different styles or models of eyewear on an individual in order to select the best fitting model(s) from those pre-determined by the worksite to be appropriate for the hazards and tasks. Contact 3M PSD Technical Service at 1-800-243-4630 for questions regarding the 3M™ Eyewear Fit System.

References

- 1 www.cdc.gov/niosh © 2012 National Institute for Occupational Safety and Health.
- 2 www.preventblindness.org © 2011 Prevent Blindness America.
- 3 American National Standard Practice for Occupational and Educational Personal Eye and Face Protective Devices, ANSI Z87.1-2010