

The Importance of Mask Fit Check and its Effect when donning a particulate respirator

KOKEN LTD. began to sell a respirator with built-in fit checker from 1960's. Since 2006 the company helped many factories conduct a mask fit measurement in their worker education on the proper wearing of a mask.

We present here the research findings on the methods and effects of mask fit check.

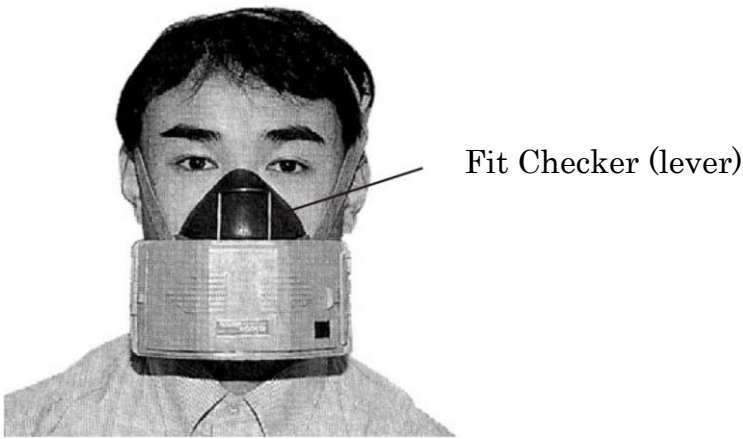
The necessity of mask fit check has not changed between now and the past.

To protect workers from inhalation of hazardous particulates, particulate respirators are worn by them in various fields of work.

Japan's Industrial Safety and Health Law (ISHL) was amended in June, 2016, which makes it compulsory for companies to conduct risk assessments on hazardous or harmful chemicals that are subject to safety data sheets (SDSS). Due to this change, companies have to increasingly strengthen their measures to prevent worker exposure to hazardous substances, resulting in the increase of the use of respiratory protective devices.

Although the specifications and performance of particulate respirators were defined in the national standards in 1994, frequent amendments since then have made the test methods increasingly rigorous and the mask performance itself has been improved. Despite this, the necessity of performing a mask fit check has not changed between then and now in order to make full use of the protective performance of a particulate respirator.

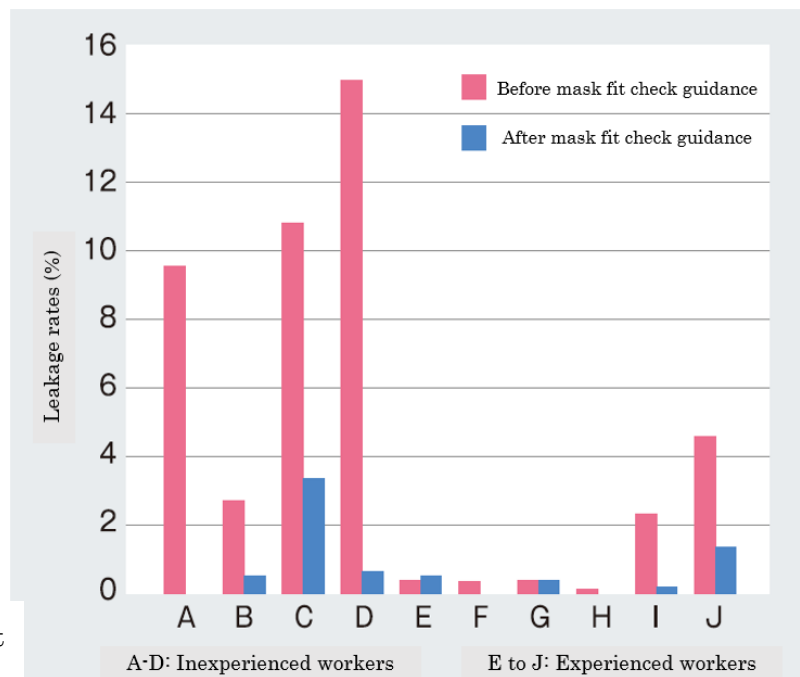
If you fail to perform a mask fit check properly, hazardous particulates may be allowed to leak into a mask.



*Particulate respirator Model 1005 series with built-in checker used in 1985's.

Education on mask fit check is the primary role of a manager in charge of personal protective equipment (PPE)

It is very important to educate and train workers on how to perform mask fit check in order to make full use of the performance of a particulate respirator. Worker education on mask fit check is one of the important responsibilities of a PPE manager as defined by Japanese regulation of the selection and use of particulate respirator in 2005. The proper guidance resulted in the significant decrease in leakage rates as shown in the table below. As the graph 1 shows, after a proper mask fit check guidance, there was a significant decrease in leakage rates for relatively inexperienced workers from A to D among 10 subject workers.



*Before and After mask fit check guidance

(An excerpt of Japan's MHLW regulation)

Regulation on selection and use of particulate respirators

Section 1 Matters that employers must consider

1. General matter

An employer must note the following guidelines regarding the selection and use of particulate respirators:

- (1) An employer must appoint a manager in charge of personal protective equipment (PPE) for each workplace from those persons who have enough knowledge and experience of occupational health including health administrators and operations chiefs and request him/her to instruct workers on the proper selection, use and maintenance of particulate respirators.
- (2) An employer must select particulate respirators suitable for work environment and provide the workers who are required to wear a particulate respirator with a proper education and training on the right wearing and use of a particulate respirator and the method of checking the airtightness between the face and the facepiece based on the use manuals, guidebook, brochures etc.



*Pic. 1: Close off the air inlet hole by pinching off the tip of the rubber fit checker



*Fit checker (made of rubber) to close off the air inlet hole



*Pic.2 Negative pressure check
A mask with built-in fit checker



*Pic.3 Inhalation opening is closed
by just lifting a fit checker up.

Types of a mask fit check

There are two types of a mask fit check: positive pressure check and negative pressure check.

< Positive pressure check >

Close off the exhalation valve by using a fit checker or by covering with the palm of the hand(s). Exhale gently into the mask. If a slight positive pressure can be built up inside the mask and the facepiece remains inflated without any evidence of outward leakage of air, the face fit is considered satisfactory.

< Negative pressure check >

Close off the inlet opening of a filter by using a fit checker or by covering with the palm of the hand(s). Inhale gently so that the mask collapses slightly. If the mask remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the mask is considered satisfactory. With this negative pressure check you may also see if there is any deterioration of the exhalation valve or there are foreign objects in the mask.

Experimental study on the effectiveness of a qualitative mask fit check

We conducted an experimental study on (1) to what extent we can judge a leak when wearing a mask and (2) whether or not a training can improve the accuracy of a mask fit check.

The result of this experimental study was reported to the 2014 conference of International Society for Respiratory Protection (ISRP) as follows:

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Subject: Experimental Study on a Negative Pressure Check of a Particulate Respirator By KOKEN, LTD.

<Purpose of the Study>

In order to examine the effectiveness of a qualitative mask fit check, we conducted a mask fit check and measurement of leakage on subject workers who are relatively inexperienced in wearing a mask.

- To what extent can we judge a leak by conducting a qualitative mask fit check?
- Will the rates of leakage be reduced after a mask fit guidance?

(Participants and masks used in the experiment)

Participants: 43 inexperienced workers who have not received a mask fit guidance.

Masks used: KOKEN's particulate respirators Models 1005R, 1010A and 1180

Measuring instrument: Mask Fitting Tester Model MT-03 made by Shibata Scientific Technology Ltd.



*Fig.1 Leak rates without performing a qualitative mask fit check

<Test Procedure>

Step 1: In order to learn what will happen to the leakage if the subjects wear a mask without performing a mask fit check prior to use, measure the actual amount of leakage when wearing a mask without purposely performing a mask fit check.

Test result was shown in the graph 1 of Fig.1.

Step 2: After donning a mask as instructed in Step 1 participants were asked to perform a qualitative mask fit check as required by the regulation and “leak” or “no-leak” was judged.

As a result, all participants who recorded the leak rates of more than 2% were also judged as “leak” in this qualitative mask fit check. See Fig.2 on the right.

Step 3: After giving instructions to those participants who were judged as “leak” in the qualitative mask fit check, measure the actual amount of leakage again.

As a result, the leak rates for all those participants who received instructions were reduced to less than 2%. See Fig.3.

Fig.1 Leak rates without performing a qualitative mask fit check

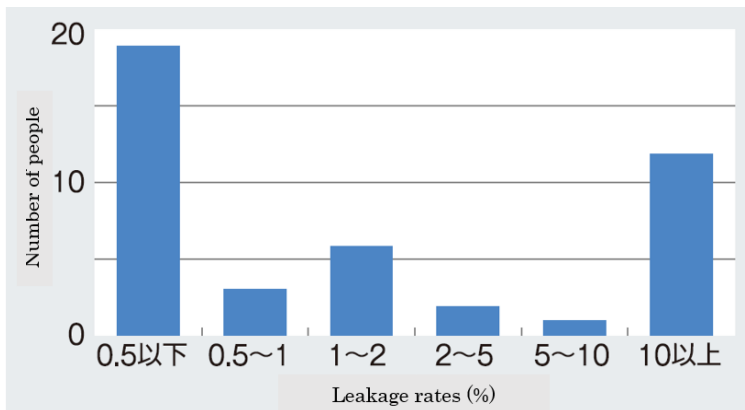


Fig.2 Result of “leak” or “no-leak” in a qualitative mask fit check

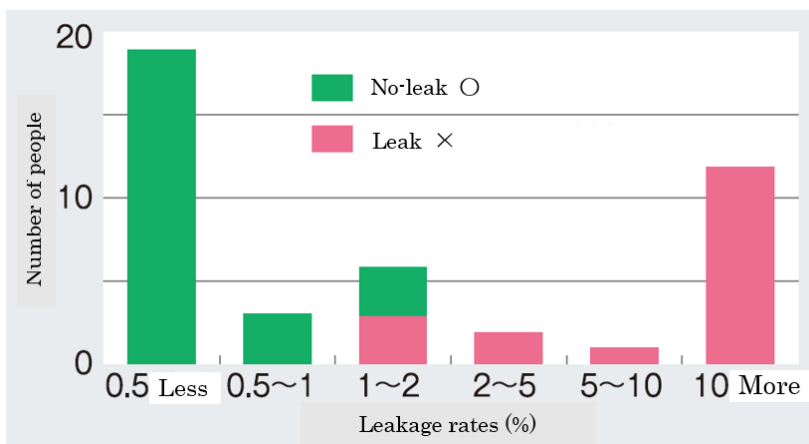
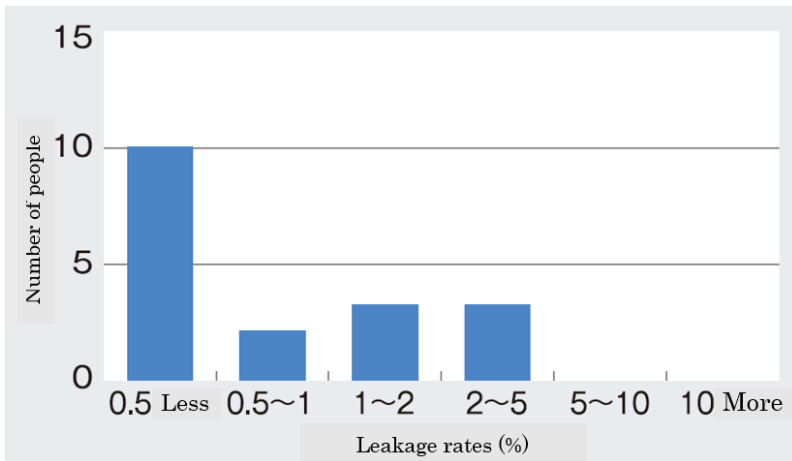


Fig.3 Leak results after instructing those participants who were judged as “leak”



< Conclusion >

The experiment on participants who are relatively inexperienced in wearing a mask revealed the followings:

- Those participants whose rates of leakage were more than 2% were judged as “leak” in the qualitative mask fit check.
- The guidance of the proper wearing of a mask and mask fit check instruction enabled the leak rates to decrease even for inexperienced mask wearers.

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Educational tools to help mask fit education by KOKEN

Despite that mask fit check is important in wearing a particulate respirator, it may be overlooked. To avoid this, we are happy to provide an educational DVD to promote a mask fit check free of charge. The DVD explains why a mask fit check is important and instruction points are summarized for 14 minutes for easy use in a classroom. It is recommended that you use this DVD to realize the zero occupational disease in your workplace.



* Pic.3 Inhalation opening is closed by just lifting a fit checker up.