

Respirex Testing Laboratory Protocol and Experimental Conditions for Chemical Permeation Testing

We request that customers supply us with either an A4 size piece of material or 2 pairs of gloves, size L or XL, per chemical requested.

Unless otherwise requested by a customer, the Respirex Testing Laboratory shall perform chemical permeation testing covered by UKAS accreditation in the following way:

- All samples will be subject to a minimum 24 hour conditioning period prior to testing.
- In the case of gloves, homogeneity will be assigned if not already done so by a client. Where gloves are of homogeneous design, three samples shall be taken from the palm area. In the case of non-homogeneous design, samples shall be taken from the palm, back and wrist of glove. Gloves made of multiple constructions and/or with seams will require additional testing and incur additional charges.
- A full test report shall be issued. Should customers wish to receive a brief test report which offers a summary only, they can request this in writing.

Experimental conditions for in-house procedures are as follows:

CP20 – Open loop system with dry nitrogen as the collecting medium. Fourier Transform Infrared (FT-IR) Spectroscopy is used as means of detection.

CP30 – Closed loop system with potassium chloride solution as the collecting medium. Conductivity by hydrogen ion selective electrode is used as means of detection.

CP40 – Closed loop system with TISAB:distilled water (1:1) as the collecting medium (Total Ionic Strength Adjustment Buffer). Conductivity by fluoride ion selective electrode is used as means of detection.

CP50 – Open loop system with dry air as the collecting medium. Photo ionisation Detection (PID) is used as means of detection.

Open loop – refers to a testing mode in which fresh collection medium flows continuously through the collection chamber of the test cell and is not reused or recycled.

Closed loop – refers to a testing mode in which the collection medium is fixed.

Based on the analytical techniques employed at Respirex Testing Laboratory:

- An aqueous collection medium is routinely used for detection of water soluble challenge chemicals
- A gaseous collection medium is routinely used for detection of volatile challenge chemicals.

Of the four detection methods currently available:

- pH (hydrogen ion selective electrode) is used as a means of detecting acids and alkalis in aqueous solution
- ISE (ion selective electrode) is used as a means of detecting fluoride ions (F^-) in aqueous solution

- FT-IR is used as a means of detecting gaseous phase chemicals that absorb infra-red energy
- PID is used as a means of detecting gaseous phase chemicals that are susceptible to photo ionisation.

In some cases, only one combination of collection medium and detection technique would be appropriate, in some cases two or three options may be appropriate. There are some chemicals that Respirex Testing Laboratory will not currently be able to collect and detect.

Where a chemical can be collected by more than one collection medium, it is widely acknowledged that results may differ depending on whether the medium is aqueous or gaseous.

Respirex Testing Laboratory can advise on:

- Where more than one option is available
- Which is the optimum collection medium and detection technique for a given challenge chemical
- Which system has the lowest lead time from receipt of samples

The customer may specify which of the possible alternatives is preferable to them; however, a statement to this effect will be included on the report in this case.

Unless otherwise specified, a 1" test cell shall be used for closed loop testing and a 2" test cell shall be used for open loop testing. This allows maximum sensitivity to be achieved for each system. A European test cell shall be used in cases of small volumes of challenge chemical due to cost and/or availability, and in cases of aggressive chemicals that corrode metal or glass.

The thickness of each material specimen is carried out to the nearest 0.02mm. This is a deviation from that required by EN374-3 but in accordance with ISO 6529 and ASTM F739. As thickness is not required in any calculations of permeation this is not considered significant to the test results in our opinion.

For each system the temperature is maintained at $23 \pm 1^\circ\text{C}$ for the duration of the test.

Uncertainty of Measurement, UoM.

The uncertainty of measurement of each analytical system has been calculated as follows and on the basis of the samples tested, the Respirex Testing Laboratory is 95% confident that the "true" result lies somewhere within this range:

CP20 breakthrough time ± 67 seconds
CP30 breakthrough time ± 69 seconds
CP40 breakthrough time ± 67 seconds
CP50 breakthrough time ± 67 seconds

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Where appropriate, UoM information will be included on reports when any of the following circumstances are met:

- The customer requests it
- UoM information is relevant to the validity of the test result
- The magnitude of the UoM affects compliance with a specification limit

Where results fall close to class boundaries, Respirex Testing Laboratory shall provide a calculated probability of compliance of the result to the relevant class level.

Tests are performed under laboratory conditions on new material and not under actual usage conditions. The test result relates only to the sample tested.

Samples are accepted by the laboratory as being representative of the material required to be tested. No responsibility is accepted for samples submitted which do not reflect the true nature of the material.