THE STANDARD BEHIND

CHEMICAL RESISTANT GLOVES

EN ISO 374-1: 2016

PENETRATION TEST.
PERMEATION TEST.
DEGRATION TEST.

#Gloves Guide

Nastah
The Hand Protector

INTRODUCTION

When you are looking for gloves to handle chemicals, we guess you are not just merely looking for gloves. You are looking for protection, reliability and most importantly, safety.

What criteria would you look at? Would you look at the packaging design? Glove's appearance? Thickness? Grip? Or the glove's materials?

When it comes to protective gloves for handling chemicals, since it is a PPE, there are a lot of consideration, and hence you will find many unfamiliar information being presented at the gloves packaging or on the gloves itself.

Those information makes the gloves look professional and reliable, but unfortunately, the majority do not really understand what those information are all about.

As a gloves manufacturer, since we are the one who produce the gloves and send our products for testing and get certified, we think that we are in a position to communicate those complicated information in a simplified manner.

Nastah
The Hand Protector

In our previous articles, we have been explaining what is CE, what is EN388 is all about as well as what are the meaning of the glass and fork, knife and fork pictograms.

No matter you are the purchasing manager, safety officer, company owner or even end user that come across to this blog today, we hope that our info center will help you in gaining more knowledge about gloves products while you are researching for the right gloves.

So, back to the question:

If you are looking for gloves to protect your skin from direct contact with chemicals, how do you know which gloves is good in chemical resistance and how would you make your decision?

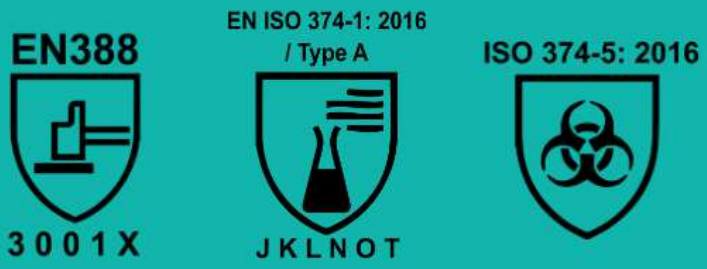
Short answer to the question:
Look at the standard.

Well, a piece of glove might not have a sophisticated appearance, but the tests that it undergo are certainly complex and professional.

Do you actually understand these information?

Nastah
The Hand Protector

Gloves that undergo standardized certification can provide necessary protection agaisnt hazardous chemicals to the users.



This is to make sure that gloves that have undergo standardized certification can provide necessary protection against hazardous chemicals to the users.

So, what kind of tests can a piece of glove undergo in order to test their ability to withstand against dangerous chemicals?

The answer can be found in EN ISO 374-1:2016 standard.

In this blog post, we will explain 3 major tests for chemical and microorganism hazards in accordance to the EN ISO 374-1:2016 standard.

This standard will guide you on how to determine a good chemical resistant glove. These tests are:

- EN 374-2:2014 Penetration test
- EN 16523-1:2015 Permeation test (previously EN374-3)
- EN 374-4: 2013 Degradation test

Nastah
The Hand Protector

#1

EN374-2 Penetration test

#2

EN16523-1:2015 Permeation test

#3

EN374-4 Degradation test

Nastah
The Hand Protector

#1

#1 : EN374-2 Penetration test

What is penetration?

The term “penetration” is defined in EN 374 as the movement of a liquid and/or micro-organism through porous materials, seams, pinholes, or other imperfections in a protective glove material at a nonmolecular level.

Chemicals can penetrate through holes and other defects in the glove material. To secure a glove to be approved as a chemical protection glove, the glove shall not leak water or air when tested.

What is penetration test?

Under EN374-2:2014, two tests will be carried out to assess the resistance of the glove to penetration (or freedom from holes). The two tests are as below:

Air leak test:
This test involves inflating a glove with air pressure & then submerging it in a tank of water. Any leaks are identified by visible bubbles.

Water leak test:
This test involves suspending a glove filled with water and examining its outer surface for water droplets.

Nastah
The Hand Protector

EN374-2:2014

AIR LEAK TEST

This test involves inflating a glove with air pressure and then submerging it in a tank of water.

Any leaks are identified by visible bubbles.

WATER LEAK TEST

This test involves suspending a glove filled with water and examining its outer surface for water droplets.

We have talked about these two tests in our previous article where we have come into an interesting discussion of how rubber gloves are tested and graded as waterproof, which is by carry out air leak test and water leak test.

So, how do we know if the gloves have pass the air leak and water leak test?

Take a look if the pictogram exist on the gloves marking or at the gloves packaging.

For gloves that have passed the water leak and air leak test, it also means that microbes won't be able to pass through the gloves. Hence it is being awarded the pictogram for microorganism hazards.

Please note that without the word "virus" beneath the pictogram, it means that the glove is not tested against virus.

EN ISO 374-5: 2016

Nastah
The Hand Protector

#2

#2 : EN16523-1:2015 Permeation test

What is permeation?

Permeation is the process of which chemicals move through a glove at a molecular level.

The resistance of a protective glove material to permeation by a solid or liquid chemical is determined by measuring the normalized breakthrough time (NBT) of the chemical through the glove material.

In another words, through the permeation test results, we will get to know which glove is more chemical resistant than the other.

What is permeation test?

Testing is carried out in accordance with EN 16523-1:2015.

In the permeation test apparatus, the glove material separates the test chemical from the collecting medium.

The collecting medium, which can be a gas, a liquid or a solid, is analyzed quantitatively for its concentration of the chemical and thereby the amount of that chemical that has permeated the barrier as a function of time.

Test results are reported based upon the normalized breakthrough time (NBT) achieved.

There are six permeation performance levels: the highest level of protection being level 6, which shows a breakthrough time of greater than 480 minutes.

Normalized Breakthrough Time (in minutes)	Performance Level
> 10	level 1
> 30	level 2
> 60	level 3
> 120	level 4
> 240	level 5
> 480	level 6

Nastah
The Hand Protector

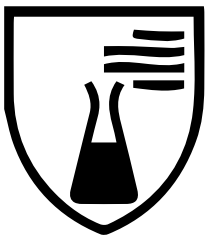
The standard only requires a permeation level 2 to show the letter beneath the pictogram but there are 6 levels, so depending on the actual chemical used and the level of protection required, you may want to take this into consideration during the gloves selection process.

Before we move on to explain further about the classes of the chemicals for the chemical permeation test, let me show you the example of how the letters will be presented beneath the pictogram.

Not sure how to interpret those letters? Read further and you will find the answer.

EN ISO 374-1: 2016

TYPE B



K N O

Chemical classes for the chemical permeation test

Under EN ISO 374-1:2016, gloves manufacturer can select 18 classes of chemicals for the chemical permeation test based on their product composition.

So which are those 18 classes of chemicals? Take a look at the table below. Each chemical comes with a code letter, CAS no. as well as the chemical class.

If you would like to understand what kind of chemical can the gloves resist, or if you would like to find out if the gloves are suitable for your application area, compare the letters at the pictogram with the table on the next page.

Nastah
The Hand Protector

Code letter	Chemical	CAS No.	Class
A	Methanol	67-56-1	Primary alcohol
B	Acetone	67-64-1	Kentone
C	Acetonitrile	75-05-8	Nitrile compound
D	Dichloromethane	75-09-2	Chlorinated hydrocarbon
E	Carbon disulphide	75-15-0	Sulphur containing organic compound
F	Toluene	108-88-3	Aromatic hydrocarbon
G	Diethylamine	109-89-7	Amine
H	Tetrahydrofuran	109-99-9	Heterocyclic and ether compound
I	Ethyl acetate	141-78-6	Ester
J	n-Heptane	142-82-5	Saturated hydrocarbon
K	Sodium hydroxide 40%	1310-73-2	Inorganic base
L	Sulphuric acid 96%	7664-93-9	Inorganic mineral acid, oxidizing
M	Nitric acid 65%	7697-37-2	Inorganic mineral acid, oxidizing
N	Acetic acid 99%	64-19-7	Organic acid
O	Ammonium hydroxide 25%	1336-21-6	Organic base
P	Hydrogen peroxide 30%	7722-84-1	Peroxide
S	Hydrofluoric acid 40%	7664-39-3	Inorganic mineral acid
T	Formaldehyde 37%	50-00-0	Aldehyde

What is Type A chemical resistant gloves?

And if you have noticed that there is a term above the pictogram written as "Type A", it means that the glove is being certified as Type A chemical resistant gloves due to its ability to withstand a minimum breakthrough time of 30 minutes against minimum 6 test chemicals.

As a summary, the glove must withstand a minimum breakthrough time below to be certified as either Type A or Type B or Type C chemical resistant gloves.

No. of test chemicals that pass minimum performance level	Minumum performance level of each test chemical	Certified as
6	Level 2	**Type A** Chemical Resistant Gloves
3	Level 2	**Type B** Chemical Resistant Gloves
1	Level 1	**Type C** Chemical Resistant Gloves

Nastah
The Hand Protector

#3

#3 : EN374-4 Degradation test

What is degradation?

When chemical protective gloves come into contact with chemicals for a period of time, acting like a sponge soaking up liquids and holding them against the skin, this can degrades the gloves.

When degradation occur, it also means that the barrier function of the gloves against chemicals and also the physical characteristics of the gloves started to change.

But how do we identify that the gloves have undergo degradation?

Well, there are some indications of degradation such as flaking, swelling, disintegration, embrittlement, colour change, dimensional change, appearance, hardening, softening, etc.

What is degradation test?

Degradation test is to determine the resistance of a protective glove material to degradation by a liquid chemical with continuous contact.

It is determined by measuring the puncture resistance change of the glove material before and after continuous contact with the challenge test chemical.

The force required to push a stylus through the glove material is measured, both before and after the exposure of the gloves specimens to the challenge chemical.

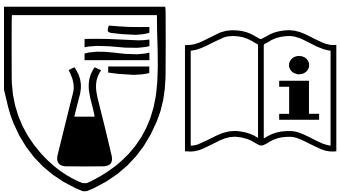
Degradation shall be determined according to EN374-4:2013 for each chemical claimed on the product marking.

There is no minimum requirement for degradation performance but the results of the tests in percentage (%) must be reported in the user information.

Nastah
The Hand Protector

Chemical Hazard

ISO 374-1: 2016/ Type A



JKLNOT

Risk against substance and mixtures which are hazardous to health

Code	Chemcial	Permeation Perfomance Level	Degradation (DR)
J	n- Heptane (142-82-5)	6	15.7%
K	Sodium hydroxide 40% (1310-73-2)	6	8.9%
L	Sulphuric acid 96% (7664-93-9)	2	86.1%
N	Acetic Acid 96% (64-19-7)	2	94.6%
O	Ammonium hydroxide 25% (1336-21-6)	4	34.4%
T	Formaldehyde 37% (50-00-0)	6	33.9%

Above is an example of the user information for our Type A chemical resistance nitrile gloves. Degradation result for each challenge chemical is being reported in the user information.

Now you may ask, **what sorts of information we can interpret from this user information?**

Since we have covered about the permeation performance level and also the code of chemicals in the previous section where we explained about permeation test, we will now focus on the degradation results in percentage at this part.

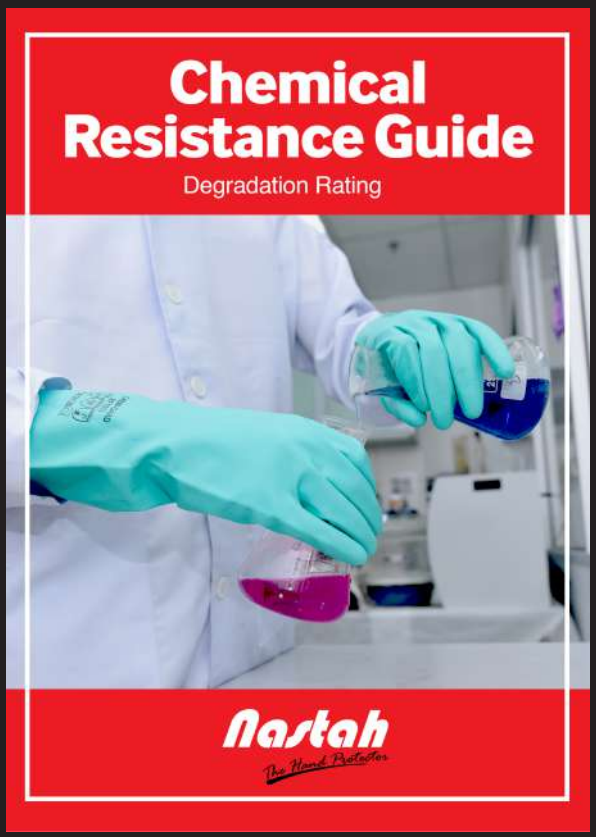
The percentage means that the force for puncture dropped by x% as compared to the control test where the glove specimen is not exposed to any challenged chemical.

The smaller the degradation percentage, the higher the permeation performance level, meaning that the protective gloves have a better resistance to the degradation of the challenged chemical.

Nastah
The Hand Protector

DOWNLOAD NOW!

Chemical Resistance Guide



If you wish to know more about which type of gloves are recommended for which chemical, in this article, we have get ready a chemical resistance guide with degradation rating for you. Click the picture above to download the guide.

Nastah
The Hand Protector

Conclusion

When looking for gloves, it is especially important to communicate your application needs with the glove manufacturer.

As different working environment and users will have different needs, it is advisable that the users or the responsible safety officers to define the individual requirements and ask the gloves manufacturer for the specific protective performance of the gloves.

Feel free to reach out to our gloves expert in the link , they will get back to you within 1 working day.

Nastah
The Hand Protector