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SINGLE-USE CHEMICAL PERMEATION TESTING GUIDE

ANSI, ASTM F739-12
Average Breakthrough Times
Permeation Rates
Performance Levels
Ratings

Chemical Permeation Testing

Chemical permeation is the process by which chemicals migrate through protective glove material at the molecular level. It is important to note that chemical permeation can occur without any physical or observable changes to glove the material. To be better informed about selecting gloves when working with chemicals, it is important to understand how chemical permeation is tested and measured.

TESTING OVERVIEW

Chemical permeation tests are completed in laboratory conditions where a sample of glove material is placed in a 2-sided chamber. One side of the chamber is filled with the test chemical, the other side with collection medium where measurements are taken to determine the level of chemical permeation over a period of time (480 minutes) and at a fixed temperature (~21°C/69°F).

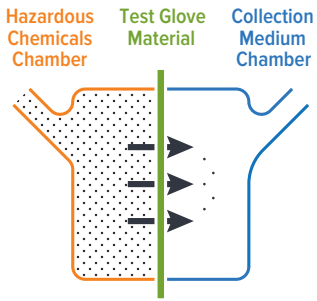

Illustration of chemical testing chamber

Disclaimer: Chemical permeation tests are conducted in controlled laboratory conditions and not in field conditions. Testing cannot replicate specific wear and tear environments under actual application conditions. The information included is provided as a guide only. Using the correct gloves, for specific applications can only by determined by testing in those applications by the purchaser.

TESTING RESULTS KEY

Chemical Permeation (ANSI)		TrueForm®			
Model Number		TF-95LB			
Item Number		N09130X			
Palm Thickness		0.06mm / 2.5mil			
Compliance Requirement		ANSI ISEA 105-2016			
Test Method		ASTM F739-12 e1			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS					
Acetic Acid (Glacial)	64-19-7	<5	2.1	0	NR
Hydrochloric Acid (37%)	7647-01-0	<5	2.6	0	NR
Nitric Acid (70%)	7697-37-2	<5	1.0	0	NR
Sulfuric Acid (96%)	7664-93-9	<5	84.4	0	NR
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR

Breakthrough Times (BTT): The ***elapsed time*** between initial contact of the test chemical with the outside surface of the glove and the time at which permeation rate reaches 0.1µg/cm2/min (ASTM F739-12). A higher number is better or longer.

Permation Rate (PR): The ***average rate*** at which chemicals pass through barrier layer once BTT is achieved. Measured in 0.1µg/cm2/min (ASTM F739-12). A lower number is better.

Performance Level: The ANSI ISEA 105-2016 numerical classification for chemical permeation.

Rating: The destructive change in one or more properties of a material. These are rated on a ***color-coded scale*** (see table below).

Performance Level is based on Breakthrough Time (BTT)

Average BTT (min)	Performance Level
< 10	0
≥ 10	1
≥ 30	2
≥ 60	3
≥ 120	4
≥ 240	5
≥ 480	6

Ratings are based on Breakthrough Time (BTT) in relation to Permeation Rate (PR)

Average BTT (min)	Permeation Rate (ug/min/cm²)	Rating
> 31	< 10	HR
> 31	> 10	R
11-30	< 10	R
11-30	> 10	F
< 10	< 1	F
< 10	1-100	NR
< 10	> 100	NR
11-30	> 1000	NR

HR	Highly Recommended
R	Recommended
F	Fair
NR	Not Recommended

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SW® Single-Use Chemical Permeation Testing Guide - ANSI, ASTM F739-12

HR Highly Recommended | R Recommended | F Fair | NR Not Recommended

TrueForm®

Chemical Permeation (ANSI)		TrueForm®				TrueForm®				TrueForm®				TrueForm®			
Model Number		TF-95RB				TF-95LG				TF-12LG				TF-95NT			
Item Number		N30134X				N12840X				N02740X				(Hypersense® X9)			
Palm Thickness		0.08mm / 3.1mil				0.09mm / 3.6mil				0.16mm / 6.3mil				L00920X			
Compliance Requirement		ANSI ISEA 105-2016				ANSI ISEA 105-2016				ANSI ISEA 105-2016				0.16mm / 6.3mil			
Test Method		ASTM F739-12 e1				ASTM F739-12 e1				ASTM F739-12 e1				ANSI ISEA 105-2016			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	ASTM F739-12 e1			
														Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS																	
Acetic Acid (Glacial)	64-19-7	8	11.8	0	NR	8	5.9	0	NR	15	129.1	1	F				
Hydrochloric Acid (37%)	7647-01-0	<5	3.5	0	NR	10	0.1	0	F	20	1.0	1	R	23	11.0	1	F
Nitric Acid (70%)	7697-37-2	5	1.0	0	NR	7	1.0	0	NR	13	11.0	1	F	25	0.2	1	R
Sulfuric Acid (96%)	7664-93-9	<5	112.5	0	NR	6	7.3	0	NR	13	196.8	1	F	45	11.2	2	R
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	8	2.4	0	NR
ALKALIS/BASES														>240	0.0	5	HR
Ammonium Hydroxide (25%)	1336-21-6	36	0.1	2	HR	54	0.1	2	HR	95	0.1	3	HR				
Sodium Hydroxide (40%)	1310-73-2	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	25	0.2	1	R
AROMATICS & HYDROCARBONS														>240	0.0	5	HR
Benzene	71-43-2	0	2726.4	0	NR	0	2696.9	0	NR	<5	11285.1	0	NR				
Butyl Acetate	123-86-4	<5	36.4	0	NR	<5	27.7	0	NR	<5	513.2	0	NR	<5	12537.6	0	NR
Chloroform	67-66-3	<5	48384.5	0	NR	<5	40585.0	0	NR	<5	99765.9	0	NR	<5	389.7	0	NR
DMSO	67-68-5	<5	172.9	0	NR	<5	116.0	0	NR	<5	218.0	0	NR	<5	76315.2	0	NR
Heptane	142-82-5	37	0.8	2	HR	34	0.4	2	HR	79	1.0	3	HR	<5	158.1	0	NR
Hexane	110-54-3	22	0.8	1	R	39	1.1	2	HR	49	1.0	2	HR	<5	18123.0	0	NR
Petroleum ether	8032-32-4	17	0.3	1	R	35	0.2	2	HR	37	0.3	2	HR	<5	51611.2	0	NR
Stoddard Solvent	68797-94-4	<5	3.1	0	NR	14	2.8	1	R	21	1.6	1	R	<5	8463.5	0	NR
Xylene	1330-20-7	<5	182.2	0	NR	<5	473.3	0	NR	<5	503.6	0	NR	<5	1.2	0	NR
CARBONYLS														<5	432.5	0	NR
Acetone	67-64-1	<5	7862.6	0	NR	<5	6908.1	0	NR	<5	17110.6	0	NR				
Acetonitrile	75-05-8	<5	4104.4	0	NR	<5	2828.2	0	NR	<5	4716.4	0	NR	<5	6338.1	0	NR
Cyclohexanone	108-94-1	<5	120.9	0	NR	<5	117.5	0	NR	5	84.6	0	NR	<5	72.7	0	NR
ALCOHOLS														<5	263.8	0	NR
2-butoxyethanol	111-76-2	<5	11.6	0	NR	28	2.2	1	R	27	9.1	1	R				
Diacetone alcohol	123-42-2	11	47.4	1	F	25	23.2	1	F	15	100.9	1	F	9	6.8	0	NR
Ethyl alcohol	64-17-5	<5	1060.2	0	NR	<5	117.0	0	NR	<5	383.1	0	NR	11	63.0	1	F
Isopropyl alcohol	67-56-1	5	5856.0	0	NR	25	5.8	1	R	53	2.1	2	HR	<5	3.6	0	NR
Methanol	67-63-0	<5	364.7	0	NR	<5	84.3	0	NR	<5	184.5	0	NR	<5	382.1	0	NR
														<5	1413.1	0	NR

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HR Highly Recommended | R Recommended | F Fair | NR Not Recommended

PowerForm®

Chemical Permeation (ANSI)		PowerForm®				PowerForm®				PowerForm®				PowerForm®				PowerForm®				PowerForm®			
Model Number		PF-95BK				PF-95TL				PF-95GW				PF-95LG				PF-95BL				PF-95GY			
Item Number		N71688X				N20036X				N18947X				N12940X				N10655X				N26050X			
Palm Thickness		0.13mm / 5mil				0.13mm / 5mil				0.12mm / 4.9mil				0.13mm / 5.1mil				0.16mm / 6.1mil				0.16mm / 6.2mil			
Compliance Requirement		ANSI ISEA 105-2016				ANSI ISEA 105-2016				ANSI ISEA 105-2016				ANSI ISEA 105-2016				ANSI ISEA 105-2016				ANSI ISEA 105-2016			
Test Method		ASTM F739-12 e1				ASTM F739-12 e1				ASTM F739-12 e1				ASTM F739-12 e1				ASTM F739-12 e1				ASTM F739-12 e1			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS																									
Acetic Acid (Glacial)	64-19-7	15	13.0	1	F	20	36.7	1	F	5	1.0	0	NR	6	0.3	0	F	15	12.0	1	F	7	0.4	0	F
Hydrochloric Acid (37%)	7647-01-0	14	0.1	1	R	23	0.1	1	R	13	0.1	1	R	14	0.1	1	R	32	11.1	2	R	17	0.1	1	R
Nitric Acid (70%)	7697-37-2	9	1.0	0	NR	20	14.2	1	F	9	1.0	0	NR	9	11.1	0	NR	28	15.0	1	F	12	11.0	1	F
Sulfuric Acid (96%)	7664-93-9	8	10.5	0	NR	15	19037.1	1	NR	7	9.7	0	NR	8	10.5	0	NR	21	26359.1	1	NR	10	13.0	1	NR
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR
ALKALIS/BASES																									
Ammonium Hydroxide (25%)	1336-21-6	77	1.0	3	HR	70	1.4	3	HR	71	0.2	2	HR	77	0.2	3	HR	97	2.0	3	HR	95	0.2	3	HR
Sodium Hydroxide (40%)	1310-73-2	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR	>240	0.0	5	HR
AROMATICS & HYDROCARBONS																									
Benzene	71-43-2	0	3895.5	0	NR	0	16561.6	0	NR	0	3595.8	0	NR	0	3895.5	0	NR	0	22931.4	0	NR	0	4794.5	0	NR
Butyl Acetate	123-86-4	<5	40.0	0	NR	5	709.1	0	NR	<5	37.0	0	NR	<5	40.0	0	NR	7	981.9	0	NR	<5	49.3	0	NR
Chloroform	67-66-3	<5	58622.8	0	NR	<5	103940.7	0	NR	<5	54113.4	0	NR	<5	58622.8	0	NR	<5	143917.8	0	NR	<5	72151.1	0	NR
DMSO	67-68-5	<5	167.6	0	NR	9	181.5	0	NR	<5	154.7	0	NR	<5	167.6	0	NR	12	251.3	0	NR	<5	206.2	0	NR
Heptane	142-82-5	48	0.5	2	HR	38	1.8	2	HR	45	0.5	2	HR	48	0.5	2	HR	42	2.5	2	HR	60	0.7	3	HR
Hexane	110-54-3	27	1.0	1	R	21	8.7	1	R	27	1.1	1	R	29	1.2	1	R	11	2.9	1	R	36	1.5	2	HR
Petroleum ether	8032-32-4	50	0.3	2	HR	19	0.3	1	R	46	0.2	2	HR	50	0.3	2	HR	26	0.4	1	R	61	0.3	3	HR
Stoddard Solvent	68797-94-4	20	2.0	1	R	5	3.6	0	NR	18	1.9	1	R	20	2.0	1	R	7	5.0	0	NR	24	2.5	1	R
Xylene	1330-20-7	<5	683.7	0	NR	<5	376.1	0	NR	<5	631.1	0	NR	<5	683.7	0	NR	<5	520.8	0	NR	<5	841.5	0	NR
CARBONYLS																									
Acetone	67-64-1	<5	9978.4	0	NR	<5	23929.6	0	NR	<5	9210.9	0	NR	<5	9978.4	0	NR	<5	33133.2	0	NR	<5	12281.1	0	NR
Acetonitrile	75-05-8	<5	4085.2	0	NR	<5	23847.8	0	NR	<5	3771.0	0	NR	<5	4085.2	0	NR	<5	33020.1	0	NR	<5	5028.0	0	NR
Cyclohexanone	108-94-1	<5	169.7	0	NR	11	463.8	1	NR	<5	156.6	0	NR	<5	169.7	0	NR	15	642.2	1	NR	5	208.9	0	NR
ALCOHOLS																									
2-butoxyethanol	111-76-2	40	3.2	2	HR	49	8.8	2	HR	37	2.9	1	HR	40	3.2	2	HR	68	12.1	3	R	49	3.9	2	HR
Diacetone alcohol	123-42-2	35	33.5	2	R	18	131.4	1	F	33	30.9	1	R	35	33.5	2	R	25	181.9	1	F	44	41.2	2	R
Ethyl alcohol	64-17-5	8	169.0	0	NR	17	6.4	1	R	<5	156.0	0	NR	<5	169.0	0	NR	24	8.9	1	R	<5	208.0	0	NR
Isopropyl alcohol	67-56-1	15	144.9	0	F	63	2.5	3	HR	15	10.6	1	F	17	11.5	1	F	61	2.9	3	HR	20	14.1	1	F
Methanol	67-63-0	<5	121.7	0	NR	7	1088.7	0	NR	<5	112.3	0	NR	<5	121.7	0	NR	10	1507.5	0	NR	<5	149.8	0	NR

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HR Highly Recommended | R Recommended | F Fair | NR Not Recommended

PowerForm®

Chemical Permeation (ANSI)		PowerForm®				PowerForm®			
Model Number		PF-95OR				PF-12TL			
Previous Name		N99175X				N12736X			
Palm Thickness		0.14mm / 5.5mil				0.18mm / 6.2mil			
Compliance Requirement		ANSI ISEA 105-2016				ANSI ISEA 105-2016			
Test Method		ASTM F739-12 e1				ASTM F739-12 e1			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS									
Acetic Acid (Glacial)	64-19-7	15	13.0	1	F	8	0.5	0	F
Hydrochloric Acid (37%)	7647-01-0	25	0.4	1	R	19	0.1	1	R
Nitric Acid (70%)	7697-37-2	22	15.0	1	F	13	10.7	1	F
Sulfuric Acid (96%)	7664-93-9	16	20501.5	1	NR	11	14.6	1	F
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR	>240	0.0	5	HR
ALKALIS/BASES									
Ammonium Hydroxide (25%)	1336-21-6	75	1.5	3	HR	107	0.2	3	HR
Sodium Hydroxide (40%)	1310-73-2	>240	0.0	5	HR	>240	0.0	5	HR
AROMATICS & HYDROCARBONS									
Benzene	71-43-2	0	17835.6	0	NR	0	5393.8	0	NR
Butyl Acetate	123-86-4	5	763.7	0	NR	<5	55.4	0	NR
Chloroform	67-66-3	<5	111936.1	0	NR	<5	81170.0	0	NR
DMSO	67-68-5	10	195.5	0	NR	<5	232.0	0	NR
Heptane	142-82-5	41	2.0	2	HR	67	0.7	3	HR
Hexane	110-54-3	23	9.4	1	R	40	1.7	2	HR
Petroleum ether	8032-32-4	20	0.3	1	R	69	0.4	3	HR
Stoddard Solvent	68797-94-4	5	3.9	0	NR	27	2.8	1	R
Xylene	1330-20-7	<5	405.1	0	NR	<5	946.7	0	NR
CARBONYLS									
Acetone	67-64-1	<5	25770.3	0	NR	<5	13816.3	0	NR
Acetonitrile	75-05-8	<5	25682.3	0	NR	<5	5656.5	0	NR
Cyclohexanone	108-94-1	12	499.5	1	NR	6	235.0	0	NR
ALCOHOLS									
2-butoxyethanol	111-76-2	53	9.4	2	HR	55	4.4	2	HR
Diacetone alcohol	123-42-2	19	141.5	1	F	49	46.4	2	R
Ethyl alcohol	64-17-5	18	6.9	1	R	<5	234.0	0	NR
Isopropyl alcohol	67-56-1	49	3.4	2	HR	23	15.9	1	F
Methanol	67-63-0	8	1172.5	0	NR	<5	168.5	0	NR

PowerChem®

Chemical Permeation (ANSI)		PowerChem®				PowerChem®			
Model Number		PC-95GR				PC-115GR			
Item Number		K00140X				K07140X			
Palm Thickness		0.12mm / 4.7mil				0.15mm / 5.9mil			
Compliance Requirement		ANSI ISEA 105-2016				ANSI ISEA 105-2016			
Test Method		ASTM F739-12 e1				ASTM F739-12 e1			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS									
Acetic Acid (Glacial)	64-19-7	25	37.2	1	F	25	37.2	1	F
Hydrochloric Acid (37%)	7647-01-0	0	0.1	1	NR	0	0.1	1	NR
Nitric Acid (70%)	7697-37-2	10	0.4	1	F	12	11.4	1	F
Sulfuric Acid (96%)	7664-93-9	6	1.2	0	NR	7	1.5	0	NR
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR	>240	0.0	5	HR
ALKALIS/BASES									
Ammonium Hydroxide (25%)	1336-21-6	38	0.5	2	HR	48	0.6	2	HR
Sodium Hydroxide (40%)	1310-73-2	>240	0.0	5	HR	>240	0.0	5	HR
AROMATICS & HYDROCARBONS									
Benzene	71-43-2	<5	4768.0	0	NR	<5	5960.1	0	NR
Butyl Acetate	123-86-4	<5	238.9	0	NR	<5	298.6	0	NR
Chloroform	67-66-3	<5	63053.1	0	NR	<5	78816.4	0	NR
DMSO	67-68-5	<5	187.2	0	NR	<5	234.0	0	NR
Heptane	142-82-5	6	2099.2	0	NR	7	2624.0	0	NR
Hexane	110-54-3	<5	1571.5	0	NR	0	1571.5	0	NR
Petroleum ether	8032-32-4	<5	48.9	0	NR	<5	61.2	0	NR
Stoddard Solvent	68797-94-4	<5	2.4	0	NR	5	2.9	0	NR
Xylene	1330-20-7	<5	434.1	0	NR	<5	542.7	0	NR
CARBONYLS									
Acetone	67-64-1	<5	8915.2	0	NR	<5	11144.0	0	NR
Acetonitrile	75-05-8	<5	726.0	0	NR	5	907.5	0	NR
Cyclohexanone	108-94-1	<5	268.5	0	NR	<5	335.6	0	NR
ALCOHOLS									
2-butoxyethanol	111-76-2	30	5.3	2	R	37	6.7	2	HR
Diacetone alcohol	123-42-2	15	47.6	1	F	19	59.5	1	F
Ethyl alcohol	64-17-5	17	1.9	1	R	21	2.4	1	R
Isopropyl alcohol	67-56-1	<5	55.0	0	NR	25	3.5	1	R
Methanol	67-63-0	<5	38.4	0	NR	<5	48.0	0	NR

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HR Highly Recommended | R Recommended | F Fair | NR Not Recommended

MegaMan®

Chemical Permeation (ANSI)		MegaMan®			
Model Number		MM-11BK			
Item Number		N26088X / N26488X (VP)			
Palm Thickness		0.22mm / 8.5mil			
Compliance Requirement		ANSI ISEA 105-2016			
Test Method		ASTM F739-12 e1			
Chemical	CAS Number	Average BTT (min)	Permeation Rate (ug/min/cm²)	Performance Level	Rating
ACIDS					
Acetic Acid (Glacial)	64-19-7	15	11.3	1	F
Hydrochloric Acid (37%)	7647-01-0	8	7.3	0	NR
Nitric Acid (70%)	7697-37-2	15	105.9	1	F
Sulfuric Acid (96%)	7664-93-9	13	11543.6	1	NR
Phosphoric acid (85%)	7664-38-2	>240	0.0	5	HR
ALKALIS/BASES					
Ammonium Hydroxide (25%)	1336-21-6	93	0.2	3	HR
Sodium Hydroxide (40%)	1310-73-2	>240	0.0	5	HR
AROMATICS & HYDROCARBONS					
Benzene	71-43-2	<5	1707.4	0	NR
Butyl Acetate	123-86-4	<5	22.8	0	NR
Chloroform	67-66-3	<5	88412.9	0	NR
DMSO	67-68-5	<5	269.5	0	NR
Heptane	142-82-5	65	0.8	3	HR
Hexane	110-54-3	21	3.7	1	R
Petroleum ether	8032-32-4	39	0.5	2	HR
Stoddard Solvent	68797-94-4	25	1.0	1	R
Xylene	1330-20-7	<5	177.0	0	NR
CARBONYLS					
Acetone	67-64-1	<5	24792.0	0	NR
Acetonitrile	75-05-8	<5	2230.1	0	NR
Cyclohexanone	108-94-1	5	104.9	0	NR
ALCOHOLS					
2-butoxyethanol	111-76-2	37	5.0	2	HR
Diacetone alcohol	123-42-2	5	179.2	0	NR
Ethyl alcohol	64-17-5	<5	265.7	0	NR
Isopropyl alcohol	67-56-1	63	2.5	3	HR
Methanol	67-63-0	<5	108.0	0	NR

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