Ansell

Understanding the

ANSI ISEA 105-2016

American National Standard for Hand Protection

Ansell

ANSI ISEA 105-2016 AMERICAN NATIONAL STANDARD FOR HAND PROTECTION

INTRODUCTION

ANSI/ISEA 105-2016 is the latest revision of a voluntary industry consensus standard that was first published in 1999 and revised in 2005 and then again in 2011. The document classifies a whole occupational glove or material used in the construction of a glove to help bridge the gap in information and performance-based testing criteria. Such classifications can assist employers and product users in the appropriate selection of gloves for protection against specific workplace exposures. This document references the appropriate test methods for specified criteria, and provides pass/fail criteria that allow users to interpret test results and determine if certain hand protection products meet their needs.

As the market leader in hand protection, Ansell is significantly involved in developing and improving test standards for protection apparel and is a member of the Hand Protection Group of International Safety Equipment Association (ISEA). This group includes 16 other glove and PPE related companies. This standard was approved using consensus procedures prescribed by the American Nation Standards Institute. Every member has a chance to comment, and negative comments must be resolved before standards are put forth. ANSI ISEA 105 is primarily for North American markets but uses globally available test methods.

CLASSIFICATION

This standard addresses the classification and testing of hand protection for specific performance properties related to chemical and industrial applications. Hand protection includes gloves, mittens, partial gloves, or other items covering the hand or a portion of the hand that are intended to provide protection against or resistance to a specific hazard.

Hand protection classifications are subdivided into three main groups:

1. Mechanical Protection (cut, abrasion, puncture)
2. Chemical Protection
3. Other (heat, flame, vibration protection, dexterity, impact protection under development)

This standard provides performance ranges for many different properties based on standardized test methods. Different levels of performance are specified for each property with zero (0) representing the minimal protection or none at all.

The purpose of the 105 standard is to provide manufacturers with a mechanism to classify their products for specified areas of glove performance. The information from this testing and classification can be used to help users to select appropriate hand protection.

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MECHANICAL PROTECTION (CUT, ABRASION, PUNCTURE)

CUT

One of the major changes in this fourth edition of ANSI/ISEA 105 surrounds the determination of classification for cut resistance. The 2011 version allowed the choice of two different test methods (ASTM F1790-97, F1790-05) and two different test machines, the CPPT and/or the TDM.

To reduce variation for purposes of classifying a glove to this standard, a single test method (ASTM F2992-15 for TDM) has been selected in an effort to provide consistent meaning of the ratings from the end-user perspective. In addition, the number of classification levels has been expanded to address the disparate gap among certain levels seen in earlier versions and to model the approach used in similar international standards. ISEA and EN cut levels will be determined with the same piece of test equipment – the TDM – though the methods prescribed in each case (ASTM F2992 vs. ISO 13997) have slight differences.

Relevance to the Market:

The new TDM method should correlate with the previous CPPT method, but because of the inherent variability in cut testing, gloves with cut resistance levels that are near a transition value may see a change.

The biggest effect of the new levels will be more segmentation in the old ANSI cut 4 range. Gloves rated level 4 in the old range can be rated A4, A5 or A6 in the new range. The new high-end levels – A7, A8, A9 – will apply to some food gloves but were created to differentiate high-end cut-resistant gloves.

The new ANSI/ISEA levels harmonize with new EN high cut levels up to level A6/F, but the ANSI/ISEA standard does a better job providing differentiation of high-end cut-resistant gloves above that level, up to 6,000 grams.

PREVIOUS: ISEA 105-2011		NEW: ANSI/ISEA 2016		EUROPE: EN388-2016	
ASTM F1790-2014 (CPPT)*		ASTM F2992-15 (TDM)		ISO 13997 (TDM)	
CPPT or TDM		TDM ONLY		TDM ONLY	
LEVEL	GRAMS	LEVEL	GRAMS	LEVEL	NEWTONS*
1	≥ 200	A1	≥ 200	A	2
2	≥ 500	A2	≥ 500	B	5
3	≥ 1000	A3	≥ 1000	C	10
		A4	≥ 1500	D	15
4	≥ 1500	A5	≥ 2200	E	22
		A6	≥ 3000	F	30
		A7	≥ 4000		
5	≥ 3500	A8	≥ 5000		
		A9	≥ 6000		

NOTE: 1 Newton is approximately equivalent to 102 grams

ABRASION

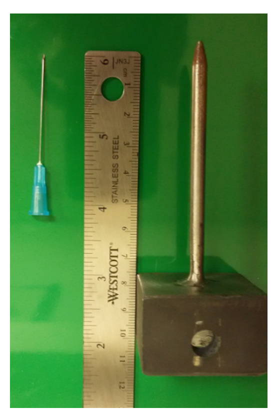
These ASTM test methods (D3389-10 and D3884-09) shall be followed using H-18 abrasion wheels with a 500 gram load for levels 0 to 3 and a 1000 gram load for levels 4 to 6. The test method has a 4-inch circular test specimen mounted on a horizontal axis platform while being abraded to failure under a specified vertical weight load (500 or 1000 grams) by the sliding rotation of two vertically oriented abrading wheels. The abrading wheels are comprised of vitrified clay and silicon carbide abrasive particles. The results, recorded in revolutions, are classified by ANSI/ISEA 105 Hand Selection Criteria as follows:

Taber Abrasion		
ASTM D3389-10, ASTM D3884-09		
Weight (Grams)	**Level**	**Revolutions**
500	0	<100
500	1	>100
500	2	>500
500	3	>1000
1000	4	>3000
1000	5	>10000
1000	6	>20000

PUNCTURE

The standard puncture test remains the same, using the EN388 puncture probe. An additional update is the inclusion of a needlestick puncture test, recognizing that this is a common potential exposure for the medical, sanitation and recycling industries.

As seen at right in the photo, the standard EN388 probe is very large. There is a segment of users who need protection from smaller hypodermic needles, requiring a significantly different puncture device – very thin and very sharp – and calling for using a new testing method and rating scale. The new method uses a 25-gauge needle as a probe, pictured at left.



The normal industrial puncture test is done in accordance with clause 6.4 of EN 388:2003 (updated in 2016). A circular test specimen cut from the glove palm is mounted in a holder and punctured with a stylus of specified sharpness attached to a tensile tester. The force required to puncture the specimen to failure is measured. Results are classified into five performance levels; the higher the result, the better the performance. The average of 12 specimens (minimum) shall be used to determine the classification level.

See chart, over

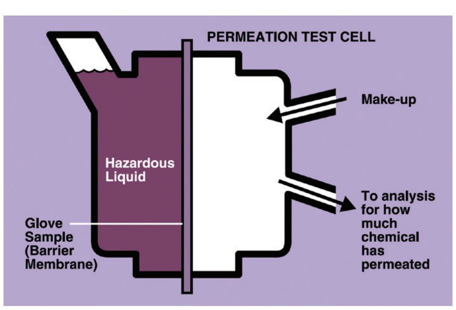
Résistance à la perforation	
EN388, clause 6.4	
NIVEAU	NEWTONS
0	<10
1	>10
2	> 20
3	> 60
4	> 100
5	> 150

Perforation par aiguille hypodermique	
ASTM F2878 av/aiguille de calibre 25	
NIVEAU	NEWTONS
0	<2
1	>2
2	>4
3	>6
4	>8
5	>10

CHEMICAL PROTECTION (NO CHANGE)

Permeation testing is done in accordance with ASTM Method F 739 standards. A specimen is cut from the glove and clamped into a test cell as a barrier membrane (see illustration). The "exterior" side of the specimen is exposed to a hazardous chemical. At timed intervals, the unexposed "interior" side of the test cell is checked for the presence of the permeated chemical and the extent to which it may have permeated the glove material. A Gas Chromatograph with a Flame Ionization Detector is used. This standard allows a variety of options in analytical technique and collection media. At Ansell, dry nitrogen is the most common medium and gas chromatography with FID detection is the most common analytical technique. An average of three specimens shall be used to report the data.

Chemical Permeation Resistance	
ASTM F739-12	
Standard Breakthrough Time	
Level	(minutes)
0	<10
1	>10
2	>30
3	>60
4	>120
5	>240
6	>480



Relevance to the Market:

Ansell tests to ASTM F739-12 for chemical permeation, but finds that it adds value to rate its gloves based on chemical breakthrough times, chemical permeation rates, and chemical degradation.

The 8th edition of Ansell's Chemical Permeation Guide (available on its website) provides data for gloves tested against different chemicals. Breakthrough times are listed, and rates and degradation values categorized from Excellent to Very Good, Good, Fair or Poor. (Some gloves are "Not rated.") Complex measurements are color coded to simplify the selection of the best gloves for a specific chemical: Green for excellent-good, Yellow for acceptable (with caution advised), or Red for poor-not recommended.

OTHER PROTECTION
(HEAT, FLAME, VIBRATION, DEXTERITY AND IMPACT)

FLAME AND HEAT RESISTANCE [no change]

Flame Resistance

When tested in accordance with ASTM F1358-16, the glove material's ignition resistance and burning behavior shall be classified against the levels listed in the table below, using the ignition time and burn time. In order to be classified at a specific level, the glove material shall meet each of the criteria at that specific level. The average of 3 specimens (minimum) shall be used to determine the classification level.

Heat Degradation Resistance

When tested in accordance with ISO 17493:2000, the glove material's heat degradation resistance shall be classified against the levels listed in the table below. The classification of the glove shall be at the temperature in which there is no evidence of charring, ignition, melting, dripping, and separation, and there is no shrinkage greater than 5%. Convective heat resistance testing shall be performed on whole gloves. The average of 3 specimens (minimum) shall be used to determine the classification level.

Conductive Heat Resistance

When tested in accordance with ASTM F1060-08, the glove's conductive heat resistance shall be classified against the levels listed in the table below. Classification of glove performance shall be based on the contact (surface) temperature at which both the time-to-second degree burn is equal to or greater than 15 seconds, and the alarm time is greater than 4 seconds. The average of 5 specimens (minimum) shall be used to determine the classification level.

Flame Resistance ASTM F1358-16		
Level	Flame exposure(s)	After-Flame time(s)
0	3	>2
1	3	<2
2	12	>2
3	12	<2
4	No ignition in either 3- or 12-second exposure period	

Heat Degradation Resistance ISO 17493:2000	
Level	Temperature Celsius
0	<100
1	100
2	180
3	260
4	340

Conductive Heat Resistance ASTM 1060-08	
Level	Temperature Celsius
0	<80
1	80
2	140
3	200
4	260
5	320

Relevance to the Market:

In North America, Ansell tests its gloves to the ASTM D6413 vertical flame test, with 3 glove exposures: fingers in flame, edge of palm in flame and cuff/over-edge in flames, considered by Ansell to be more realistic than the folded edge in flame of ASTM F1358). Gloves are rated as passing on flame resistance if they have less than 2 seconds after flame, and failing if the after flame is longer. As a global company, Ansell flame- and heat-resistant gloves are tested against the EN407 standard in Europe and Brazil, and the ratings can provide more information.

EN407 ratings Levels 1 to 4, with 4 being the best	
A	*Resistance to Flammability* Burning behavior after flame time and after glow time (whole glove)
B	*Contact Heat Resistance* (10°C increase) Contact temperature and Threshold time (glove palm)
C	*Convective Heat Resistance* (24°C increase) Heat transfer index (glove palm & back)
D	*Radiant Heat Resistance* (24°C increase) Heat transfer (back of glove)
E	*Resistance to Small Splashes of Molten Metal* (40°C increase) Number of droplets (glove palm & back)
F	*Resistance to Large Quantities of Molten Metal* (damage to a simulated PVC skin) Mass of molten iron (glove palm)

Vibration Reduction

When tested in accordance with ANSI S2.73-2002 (ISO 10819), the glove's vibration reduction shall be classified as "pass/fail." According to this standard, a glove shall only be considered an "anti-vibration glove" if it fulfills both of the following criteria: TRM < 1.0 and TRH < 0.6

NOTE: For purposes of this standard, only full fingered gloves shall be classified as "anti-vibration" gloves.

Relevance to the Market:

A new ISEA working group has been established to re-evaluate and refine this standard, but these actions typically take 2 years or more to be determined and enacted. Ansell is participating in this effort.

Dexterity

When tested in accordance with clause 6.2 of EN 420:2009, the dexterity shall be classified against the levels in the table below, using the diameter of the smallest stainless steel pin that can be picked up. The average of 4 pairs of gloves shall be used to report the classification level.

EN 420 Dexterity (Smallest pin picked up determines rating)	
1	11 mm diameter
2	9.5 mm
3	8 mm
4	6.5 mm
5	5 mm

Impact Resistance

Currently, there is no standard in North America addressing glove impact. An ISEA Impact Dorsal Committee has been established to implement a back of the hand impact standard for gloves. The test method will be very similar to the new EN388 impact method, but the plan is to establish rates for more areas of the glove: fingers, thumb, knuckle, and back of hand/wrist bumpers. The rating system will have levels to differentiate protection. The EN388 impact standard is essentially pass/fail and only concerned with the knuckle area.

Relevance to the Market:

This is a new standard under development and so may take at least a year to be put into place. Ansell, along with other manufacturers, is participating in establishing this standard.

GLOSSARY

General Terms

Resistance (to a stressor): property of a glove that permits it to withstand change when stressed.

Protection (from a stressor): property that prevents or reduces deleterious effects on the wearer of a glove when stressed.

Degradation: reduction in one or more physical properties of a glove material due to contact with a chemical. Certain glove materials may become hard, stiff or brittle, or they may grow softer, weaker, and swell to several times their original size. If a chemical has a significant impact on the physical properties of a glove material, its permeation resistance is quickly impaired.

FID or ***Flame Ionization Detector***: scientific instrument that measures the concentration of organic species in a gas stream.

Permeation: process by which a chemical can pass through a protective film without going through pinholes, pores or other visible openings. Individual molecules of the chemical enter the film, and "squirm" through by passing between the molecules of the glove compound or film. In many cases, the permeating material (designated as "the permeate") may appear unchanged to the human eye.

Organizations

ANSI – American National Standards Institute. A society of standardization societies which approves official American National Standards and which represents the USA in international standardization efforts. *www.ansi.org*

ASTM – still officially the American Society for Testing and Materials, but they now recruit members from other countries (and prefer to be known by the acronym). The largest single standards-writing body in the USA, a society which has over 130 technical committees covering a wide variety of topics. ASTM F23 is the Committee on Protective Clothing. *www.astm.org*

CEN (Comité Européen de Normalisation) – European Committee for Standardization. The standards they write are mandatory for relevant products sold in the European Community. *www.cen.eu*

ISEA (International Safety Equipment Association) – Society of manufacturers and other suppliers of safety equipment that writes ANSI-approved standards for these types of products. *www.safetyequipment.org*

ISO (International Organization for Standardization) – Independent, non-governmental international organization with a membership of 161 national standards bodies. Brings together experts to share knowledge and develop voluntary, consensus-based, market-relevant International standards that support innovation and provide solutions to global challenges. *www.iso.org*

For more information on ANSI ISEA 105-2016
visit www.ansell.com/regulatory-compliance or call 1.800.800.0444

WARNING: Products that provide “cut resistance” and “cut protection” or “puncture resistance” and “puncture protection” do not completely prevent or eliminate the potential for cuts or punctures, and are not intended or tested to provide protection against powered blades serrated or other sharp or rotating equipment. Products that provide vibration resistance, “abrasion resistance” or “abrasion protection” do not completely prevent or eliminate the potential for vibration or abrasion-related injuries. Products that provide chemical resistance” or “chemical protection” do not completely prevent or eliminate the potential for injury due to chemical exposure. Products that provide “resistance” to oil or grease or which are “oil repellant” do not completely prevent or eliminate the potential for oil or liquid penetration or absorption. Products that provide “snag resistance” or “snag protection” do not completely preventor eliminate the potential for snags or friction-related injuries. Products that provide protection against sparks or flames are not “fireproof” and do not completely prevent or eliminate the potential for burns or associated injuries. Products that provide protection or resistance against heat or cold are not intended for use in extreme temperatures – use only as specified. Products containing natural rubber latex may cause allergic reactions in some individuals. Users are encouraged to always use caution and care when handling sharp or abrasive materials, chemicals, or other hazardous or dangerous substances. Any information or data provided is based upon Ansell’s current knowledge and understanding of the subject matter, and is offered solely as a possible suggestion for use in making your own decisions or product choices. Product users should conduct all appropriate testing or other evaluations to determine the suitability of Ansell products for a particular purpose or use within a particular environment. It is the responsibility of a product user to assess the level of risk and to determine the protective equipment required or appropriate for the user’s particular purpose. Ansell may revise this information as new information, knowledge or experience becomes available. ANSELL DISCLAIMS ALL WARRANTIES OTHER THAN AS EXPRESSLY PROVIDED.

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