Gloves on Isolator

Agenda

- Annex 1 on gloves
- Glove Types
- Glove Selection for isolator
- Glove Substitution in isolator
- Glove Contamination Risk
  - Source
  - Holes (critical places & shapes)
  - Glove Tests
  - Glove Risk Management
  - Control Measures
    - Quantifiable Pinholes
    - Risk acceptance
    - Pinhole prediction

- Gloves are subjected to same conditions as isolator working chamber
- Gloves should be capable to perform manual intervention

Picture : https://skan.com/de/produkt/isolatoren/skanfog-spectra/

Annex 1

- Gloves should be regularly disinfected during operations. Garments and gloves should be changed immediately if they become damaged and present any risk of product contamination.

- The materials used for glove systems (for both isolators and RABS), should be demonstrated to have appropriate mechanical and chemical resistance. The frequency of glove replacement should be defined within the CCS.
  - Leak testing of the glove system should be performed using a methodology demonstrated to be suitable for the task and criticality
  - Testing should be performed at defined intervals
  - Generally, glove integrity testing should be performed at a minimum frequency of the beginning and end of each batch or campaign
  - Additional glove integrity testing may be necessary depending on the validated campaign length.
  - Glove integrity monitoring should include a visual inspection associated with each use and following any manipulation that may affect the integrity of the system.

- Glove surface sampling by taking prints (swab test or touch test) during defined intervals

Source: https://www.pda.org/docs/default-source/website-document-library/scientific-and-regulatory-affairs/annex1/2020_annex1ps_sterile_medicinal_products_en.pdf

Glove Types
Glove Selection
Glove Substitution

Types of Gloves

- One Piece or Two Piece

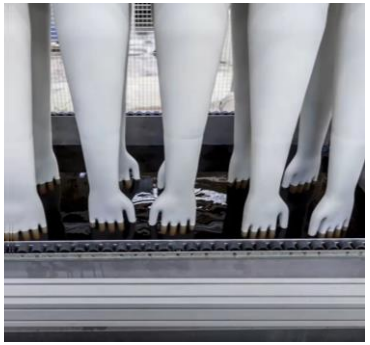
- Material:
  - CSM (Hypalon)
  - Neoprene
  - EPDM
  - Etc.

- Dimensions:
  - Length (750 mm – 850 mm)
  - Diameter
  - Hand size (7-11)
  - Thickness*
  - Handshape (Ambidextrous, Fully anatomical version)

Pictures : google image search

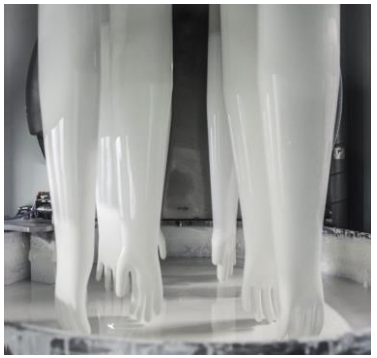
General overview of glove manufacturing

Ceramic / Aluminium



Washed and Dried

Chemical bath



Dipped into liquid rubber

Dried

Quality Control

Marking

Packed

Pictures :Piercan website

How to read glove labellings?

Piercan labelling

Characteristics	
Material:	
Length:	
Diameter:	
Glove Size:	
Thickness:	
Expiry date:	

Glove Selection

1. Operational Requirement
   - Use of glove port
   - Materials / products in contact with
2. Glove Mounting
   - Complexity of glove mounting
   - Impact of glove stretchers
3. Operator Comfort
   - Rigidity, Softness.
3. Persistence of gloves
   - Visual difference
   - Surface Roughness
4. Adsorption of H2O2
5. Decontamination factor

Pictures: https://www.youtube.com/watch?v=UD8KZ5WUcJg

Glove Substitution

- Scenario 1: New gloves of the same part number is installed

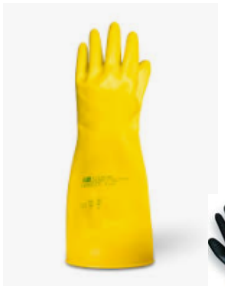
Change according to SOP defined by company

Recommendation:
-Not in production mode.
-Wearing surgical gloves
-Avoid using sharp objects
-Clean the glove

-Perform Leak test

Pictures : SKAN

Glove Substitution



- Scenario 2 : existing glove is exchanged with a glove
  - 1. having different material
  - 2. different dimensions
  - 3. from different manufacturer
  - 4. having two piece/ one piece

Honeywell

JUGITEC® Safety Gloves

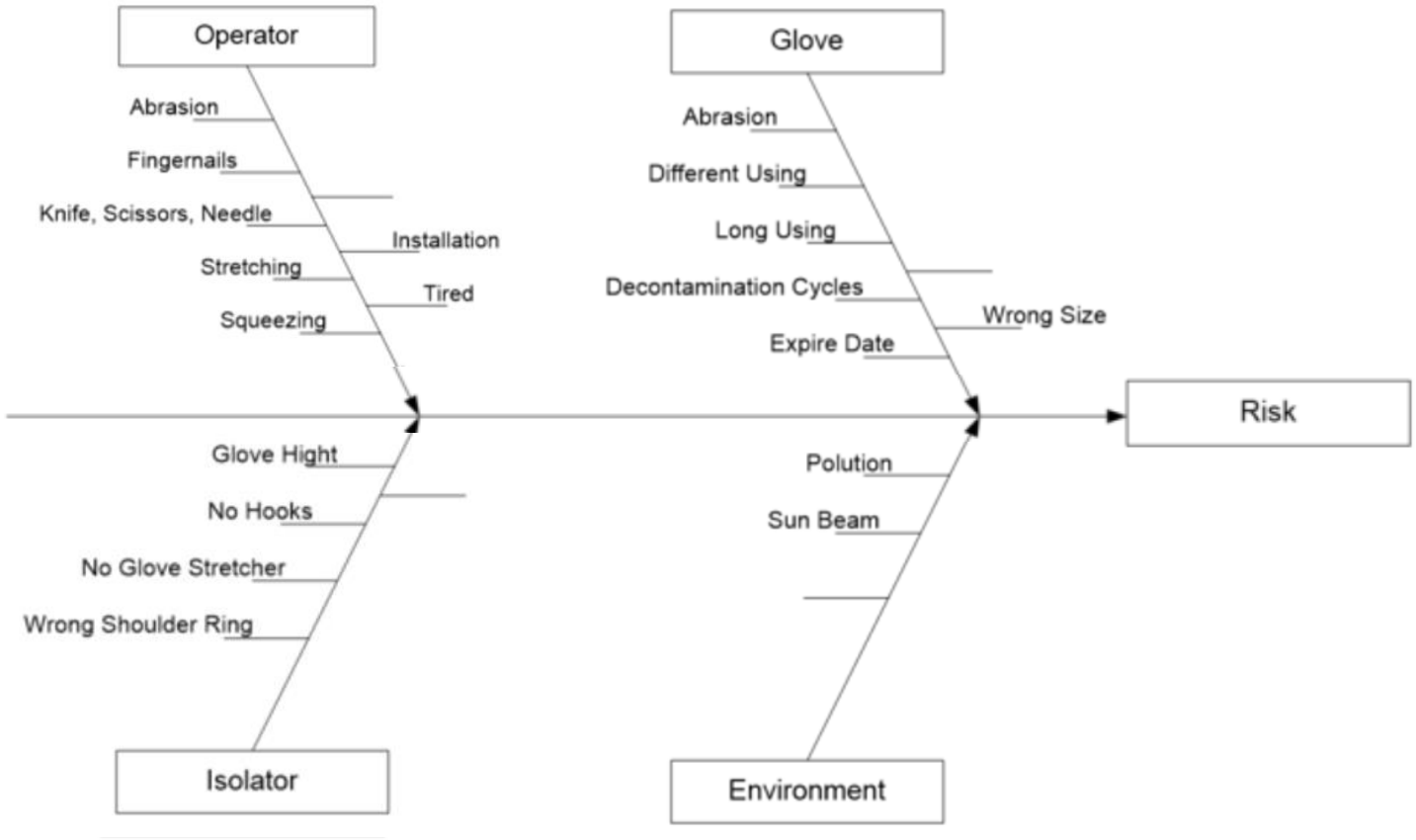
PIERCAN

- Repetition of the leak test
- Performance of the material persistence tests according to SKAN standard operating procedure
- Test for isolator suitability with regard to dimensions and design of the glove
- Determination of suitable SOP for physical glove test (SKAN – Parameter for WGT)
- Aeration cycle test
- Life cycle evaluation /analysis

Pictures :
https://www.google.com/search?q=Piercan+gloves+picture&rlz=1C1GCEA_enCH887CH887&source=lnms&tbm=isch&sa=X&ved=2ahUKEwjj1f75q8_2AhWTg_0HHeCUBRwQ_AUoAXoECAEQAw&biw=2276&bih=1122&dpr=1.13

Contamination Risk Management

Sources for glove contamination

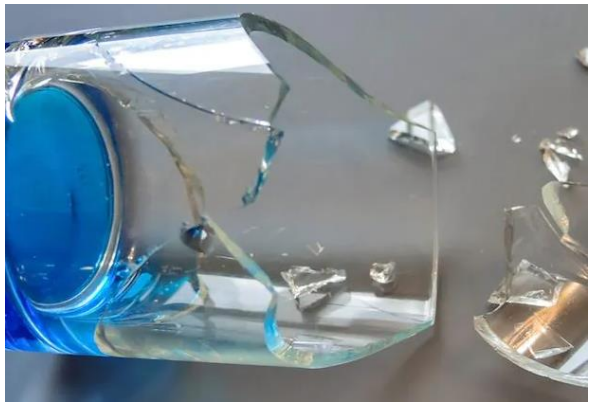


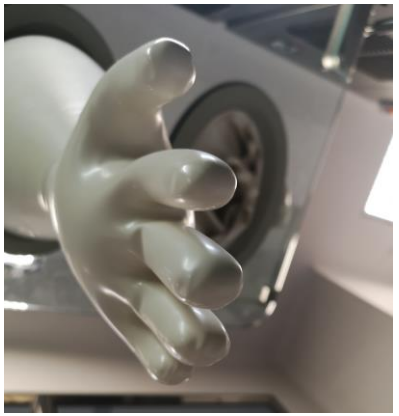
Glove ruptures & pinholes

Frequent occurring places & what are common patterns?

- Parts in direct contact with the product
- Critical points can be:
  - frequent contact areas
  - Fingertips
  - Finger interstices
  - Palm of the hand
- Weak points:
  - Sleeve and shoulder ring connection
  - Connection glove and sleeve
  - Seam (PVC sleeve)

  (places which are less easy to stretch)

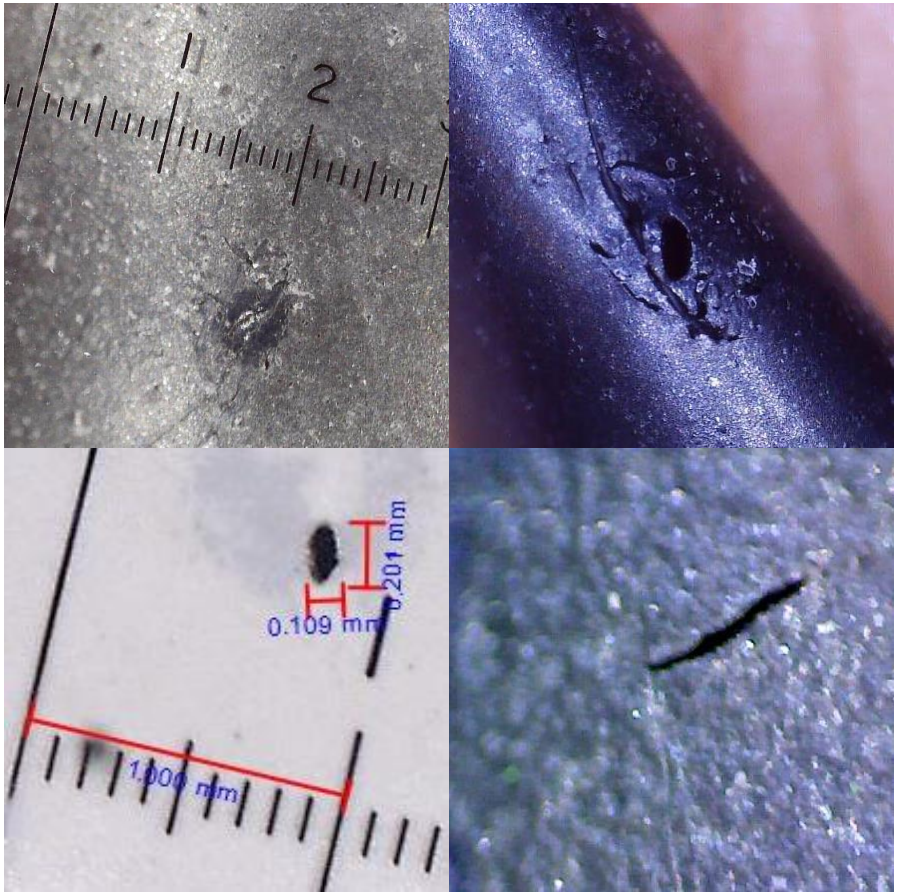




Pictures : google image search

Shapes of Holes

- Difficult holes to find:
  - Mostly clefts
  - Different orientations
  - Different locations
  - Different sizes
  - Elastic material of the glove
  - Color of the glove
  - Small holes can close again over time



Glove Risk Management

- To reduce the contamination risk, glove tests have been implemented:
  - Visual Inspection
    - Limited on hole size, operator and test conditions (e. g. light, glass door, etc.)
  - Physical (automated) glove leak test
    - Limited on hole size

Contamination Risk Management

Questions that arises:

- **What happens between each test?**
- **What about holes which cannot be detected?**
- **How can the risk of contamination through a glove in the isolator be minimized?**
- **What is the status of the isolator (on batch) if a pinhole is detected?**

Glove Risk Management

Find out which pinholes you can detect

→ Quantifiable Pinholes

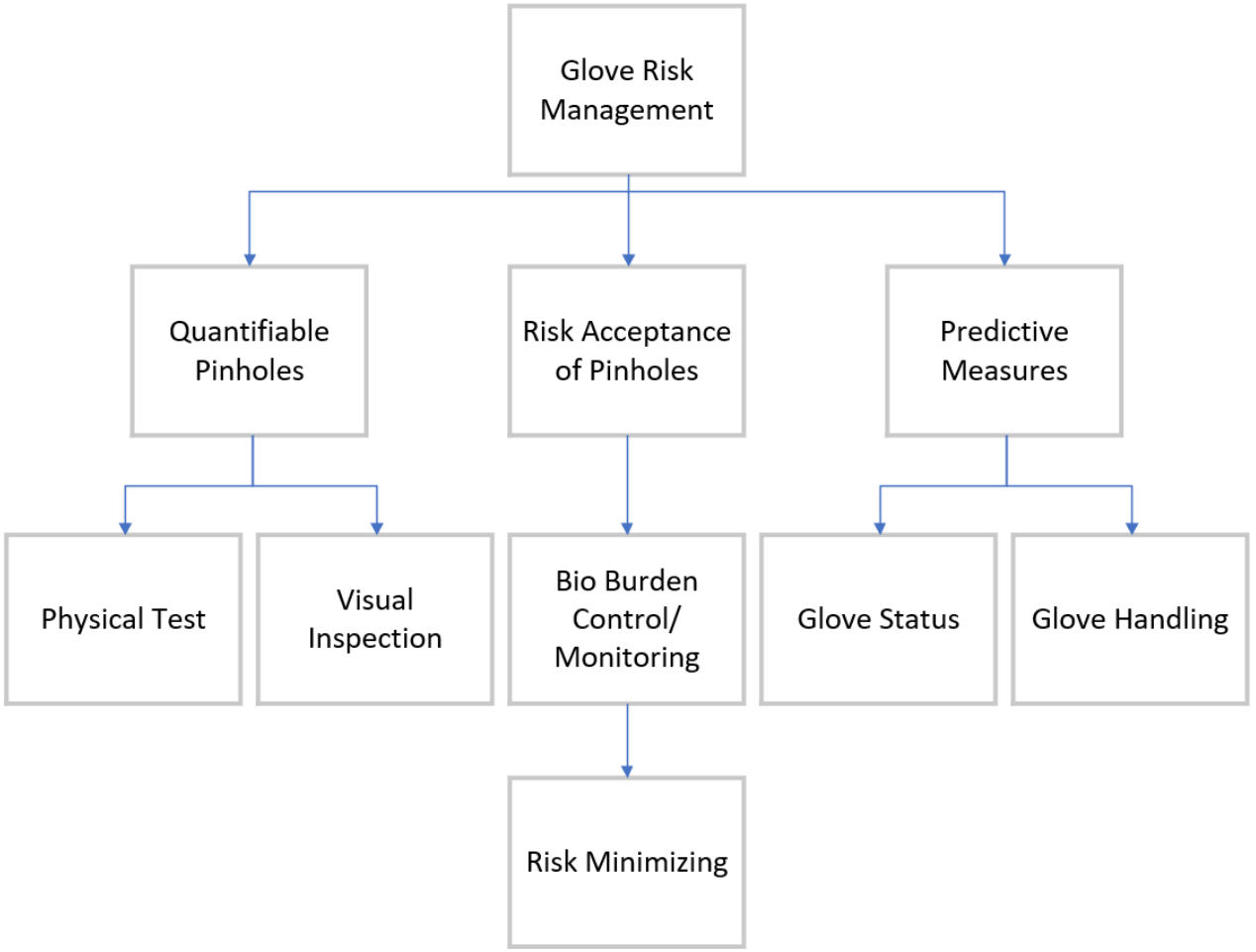
Define measures to accept not detectable pinholes

→ Risk acceptance of pinholes

Be prepared before a pinhole occurs

→ Predictive measures

Control measures



Predictive Measures

Predictive Measures

- General overview about the glove
- Each glove is separated in its task:
  - E.g. maintenance use only or process relevant or for unexpected interventions

- This category is devided in two control measures:
  - Glove status
  - Glove handling

Glove Status

- Recording all interventions on each glove
- Define the task of each glove
- Only users with necessary authorization have access to certain gloves (depending on glove task)
- Task of the glove
- installation date
- expiry date
- who installed the glove
- who uses the glove
- when was the glove used
- glove integrity tests (e. g. number of pinholes, pinhole locations)
- change intervals
- reason for change
- bio burden

Glove Handling

- Precautionary measures on the isolator and by the operator
  - Glove port size and location
  - Glove type & type of glove stretchers
  - Positioning of parts inside the isolator
  - Operator training
  - Do not wear rings, jewelries, watches
  - Wash hands, cut fingernails
  - Handling in general
  - Do not touch sharp edges (e. g broken glass) with the glove
  - Avoid over stretching
  - Correct assembling of the glove
  - Touch surfaces as little as possible
  - Defined working hours (tired)
  - Operator monitoring and adjust training courses
  - Report issues
  - Reducing stress

Predictive Measures

Benefits:

- Glove exchange frequency can be adjusted – different task, different exchange frequency
- Get info about which glove, or user is more related to issues on the glove
- Helps to improve the process on the glove
- Helpful after getting pinholes to make decisions about the isolator contamination status
- Operators a trained
- Operators helping to reduce pinholes in gloves
- Controls are present before pinholes are occur

Risk Acceptance of Pinhole

SKAN/Novartis Case Study

Based on «How Risky Are Pinholes in Gloves? A Rational Appeal for the Integrity of Gloves for Isolator» (A. Gessler et al, PDA, Inc. 2011):

- Less bio burden (outside)
- Small pinholes
- Less contamination risk

What we learned from the study

Control measure category should include:

- Bio burden monitoring on both sides of the glove
- Bio burden control by frequently cleaning of the glove
- Data recording and trend analysis

Risk Acceptance of Pinholes

Benefits:

- Bio burden data of all gloves
- Bio burden control adjustments
- Defined “cleaning status”
- Arguments for decisions “after a pinhole occurs”

Quantifiable Pinholes

Quantifiable Pinholes

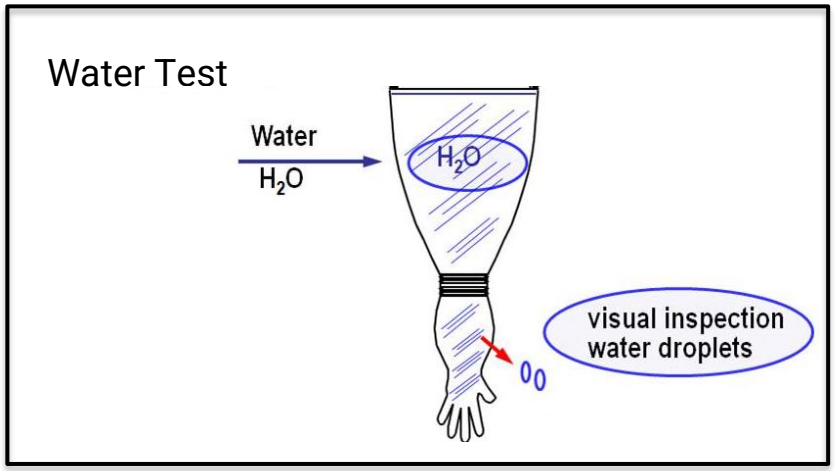
The verification of pinholes of a certain size in isolator gloves. This evidence is given momentary (while a test is actual performed) or over a period (between two tests).

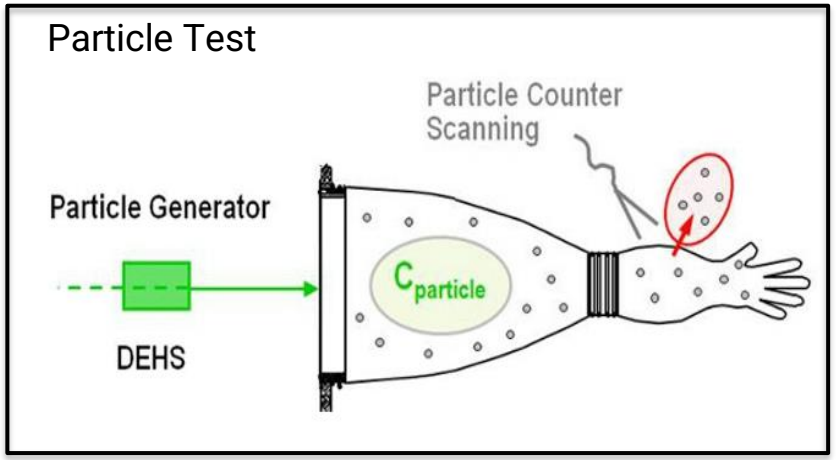
It contains:

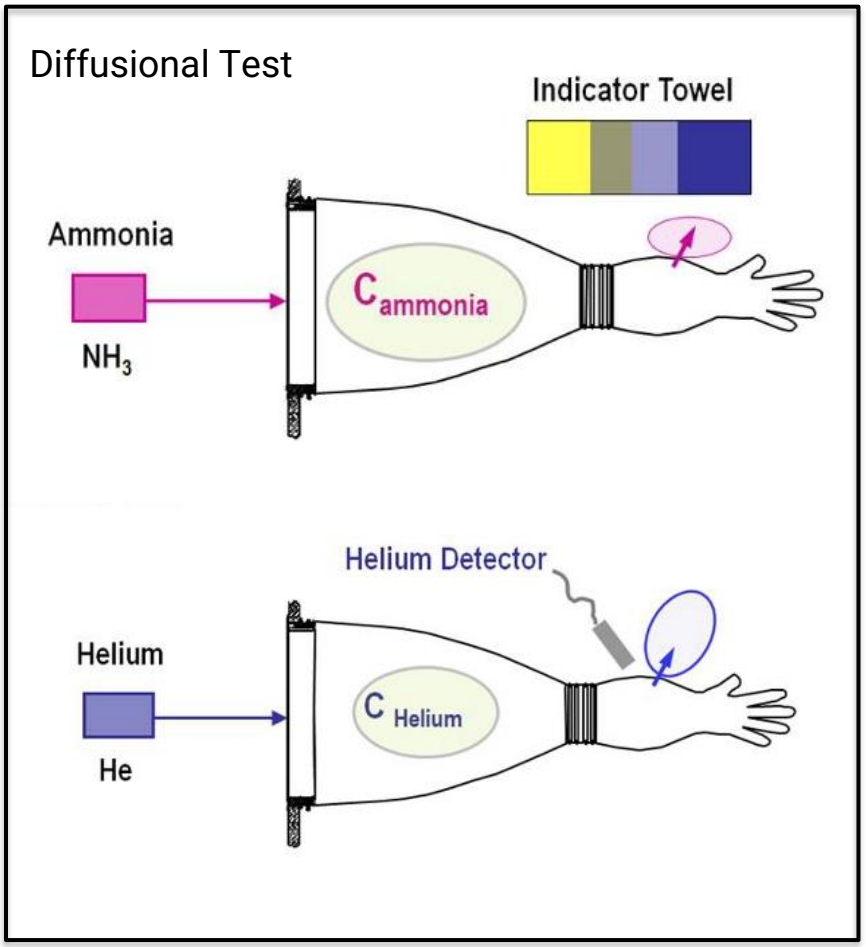
- Physical/automatic glove leak test
- Visual inspection

Glove Integrity Test Methods

Glove Integrity Test Methods



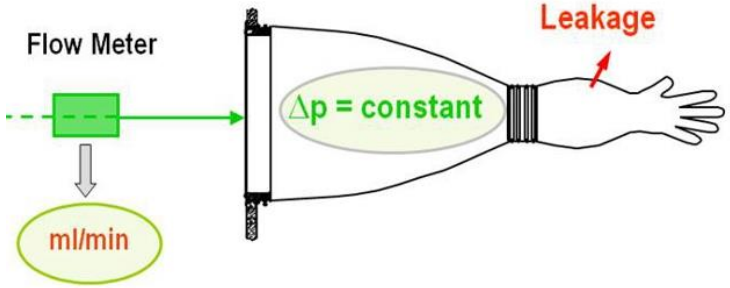




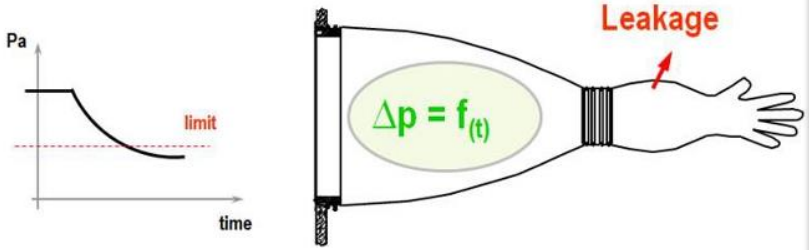
Source: A. Gessler. How Risky are pinholes in gloves? A rationa appeal for the integrity of gloves for isolators. Vol. 65, No 3, May – June 2011, Page 227 – 241, PDA, Inc. 2011

Glove Integrity Test Methods

Flow Test

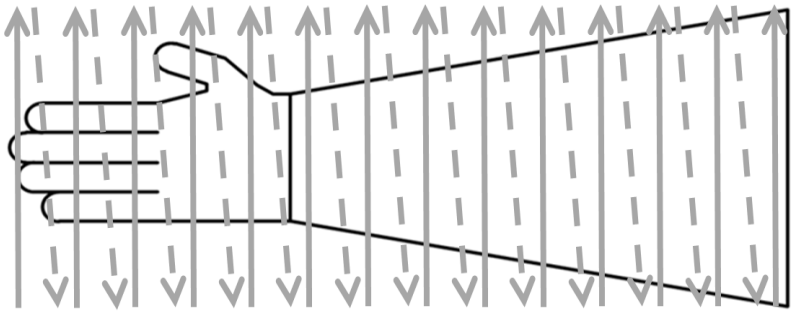


Pressure Drop Test



Visual inspection

- Trained operator
  - Very high detection rate
- Not trained operator
  - Very low detection rate



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Risk Minimizing

Example

Risk Minimizing - Example

- Risk matrix
- Risk description/analysis
- Risk rating
- Risk reduction with controls

Glove Risk Management

- Different gloves
- Different tasks of each glove
- Different operators
- Different risks

Glove Risk Management

Glove Risk Management

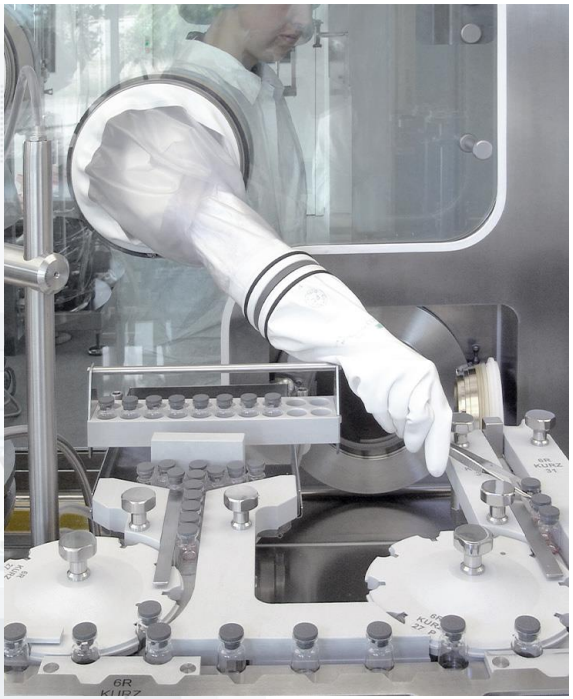
Individual Glove Tasks

- **Glove Port 1 → Transfer Material**
- **Glove Port 2 → Move materials, Work with scissors or stitching tools**
- **Glove Port 3 → Move Materials, Work with scissors or stitching tools**
- **Glove Port 4 → Spare/Maintenance activities only**

Glove Risk Management

Individual Glove Risks

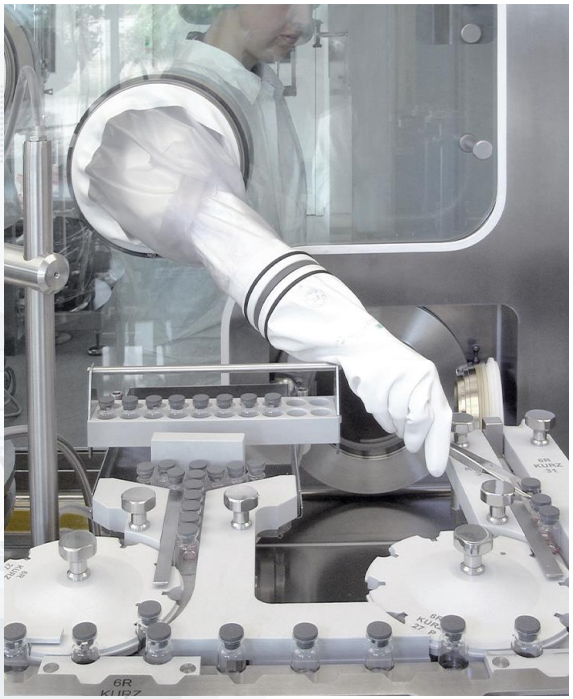
- Glove Port 1 → Squeezing on transfer door
- Glove Port 2 → Stitching, Cutting when positioning
- Glove Port 3 → Stitching, Cutting when positioning
- Glove Port 4 → Not used



Glove Risk Management

Individual Glove Measures

- Glove Port 1 → Training, handle position
- Glove Port 2 → Stitching, Cutting when positioning
- Glove Port 3 → Stitching, Cutting when positioning
- Glove Port 4 → Not used – no individual risks



Risk Minimizing - Example

Risk Matrix

Probability of occurence \ Extend of loss		pinhole < detectable and bioload controlled	pinhole (< detectable)	Risk of contamination
		1	2	3
often	3	B	C	C
possible	2	B	C	C
Impossible	1	A	B	C

group of risk	risk	procedure for minimizing
A	small	can be present
B	middle	should be present
C	big	must be present

Glove Risk Management

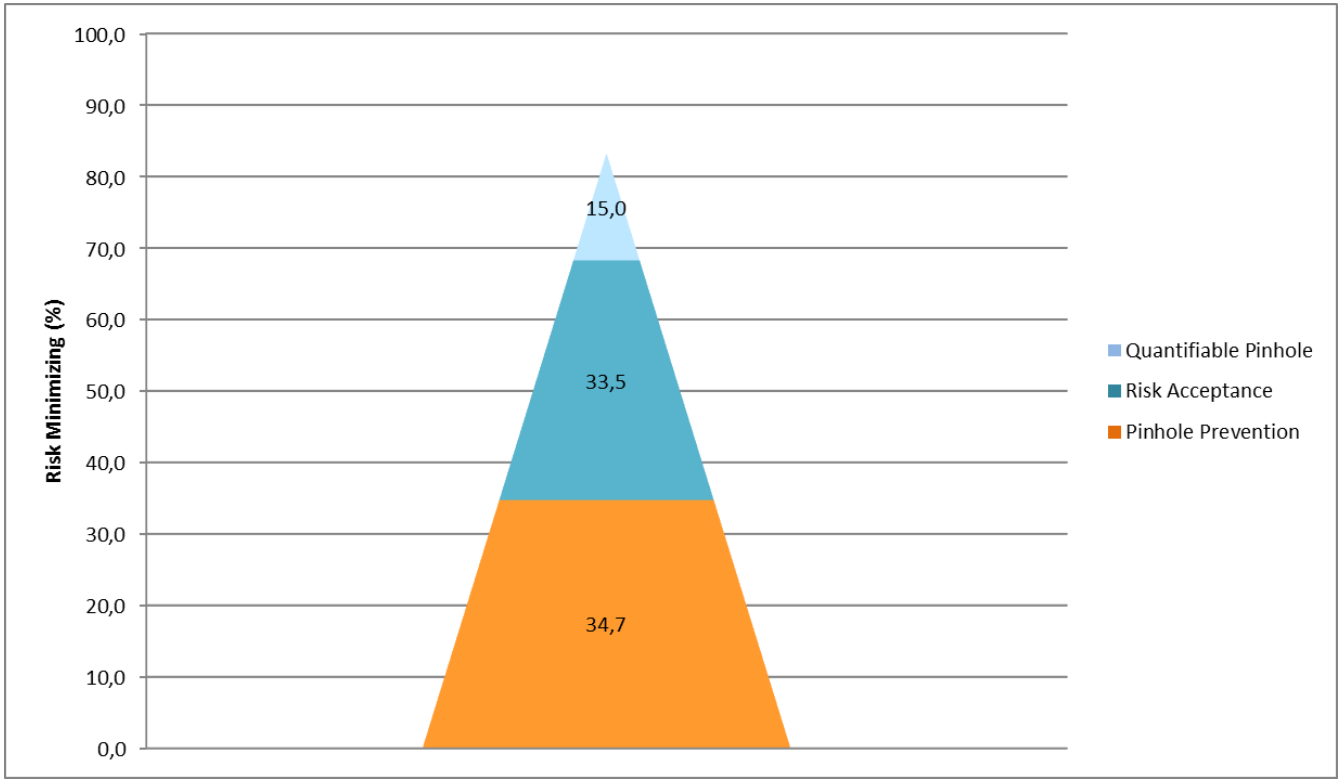
Source	number	hazard	scenario	probability of occurrence	extent of loss	risk
Example	1,01	cutting in the glove (breakage of glas, sharp edge, scissors, knife, needle, etc.)	after cutting in the glove there will be a leakage	3	3	9
	1,02	the glove is overstreched by user	the glove will be destroyed, maybe a leakage	2	3	6
	1,03	abrasion through false handling	the glove lost their properties, it is easier to get a leakage or dirt can be accumulated	2	2	4
	1,04	user has long fingernails	the glove will be scratched	3	3	9
	1,05	user has dirty hands	glove will be polluted, after getting a leakage the isolator can be contaminated	3	2	6
	1,06	tired	if the operator is tired, they will do more failures in the glove handling	2	2	4
	1,07	stressed	handling to rude because production must be running	2	2	4
	1,08	glove is wrong installed	the glove dont fit to the assembly = leakage	2	2	4
	1,09	squeezed	there will be a leakage	2	2	4

Glove Risk Management

number	Measure	probability of occurrence	extent of loss	risk
1,01	Prediction: Protection caps	2	3	6
	Prediction: Operator Training	1	3	3
1,02	Prediction: Choose correct glove size	2	1	2
	Prediction: Operator Training	1	1	1
1,03	Prediction: Operator Training	1	2	2
1,04	Prediction: Operator Training	1	2	2
1,05	Prediction: where second glove	2	1	2
	Prediction: Cleaning hands	1	1	1
1,06	Prediction: Defined working hours	1	2	2
1,07	Prediction: Defined working hours	1	2	2
1,08	Prediction: Maintenance Training	1	2	2
1,09	Prediction: Operator Training	1	2	2

Risk Minimizing - Example

Risk Rating



Conclusion on risk management

- Analyze all interventions on the isolator
- Set control measures to reduce the contamination risk
- Verify and track the control measures
- Rate the control measures – efficiency
- Adjustments on control measures over life cycle

→ This should help to reduce the contamination risk through gloves

Summary

- Glove Requirements
- Glove Types
- Selecting appropriate glove
- Glove Substitution
- Glove contamination Risks
  - Sources
  - Holes (critical places & shapes)
  - Control Measures
    - Quantifiable Pinholes
    - Risk acceptance
    - Pinhole prediction
  - Risk Management

Thank You!

Questions?

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Afternoon Program

Workshop:

- Physical glove testing using WirelessGT
- How is the location of gloves defined in an isolator (Mock-up)
- Visual inspection
- Hands-on experience with different gloves catalogue
- Glove installation & use of glove stretcher

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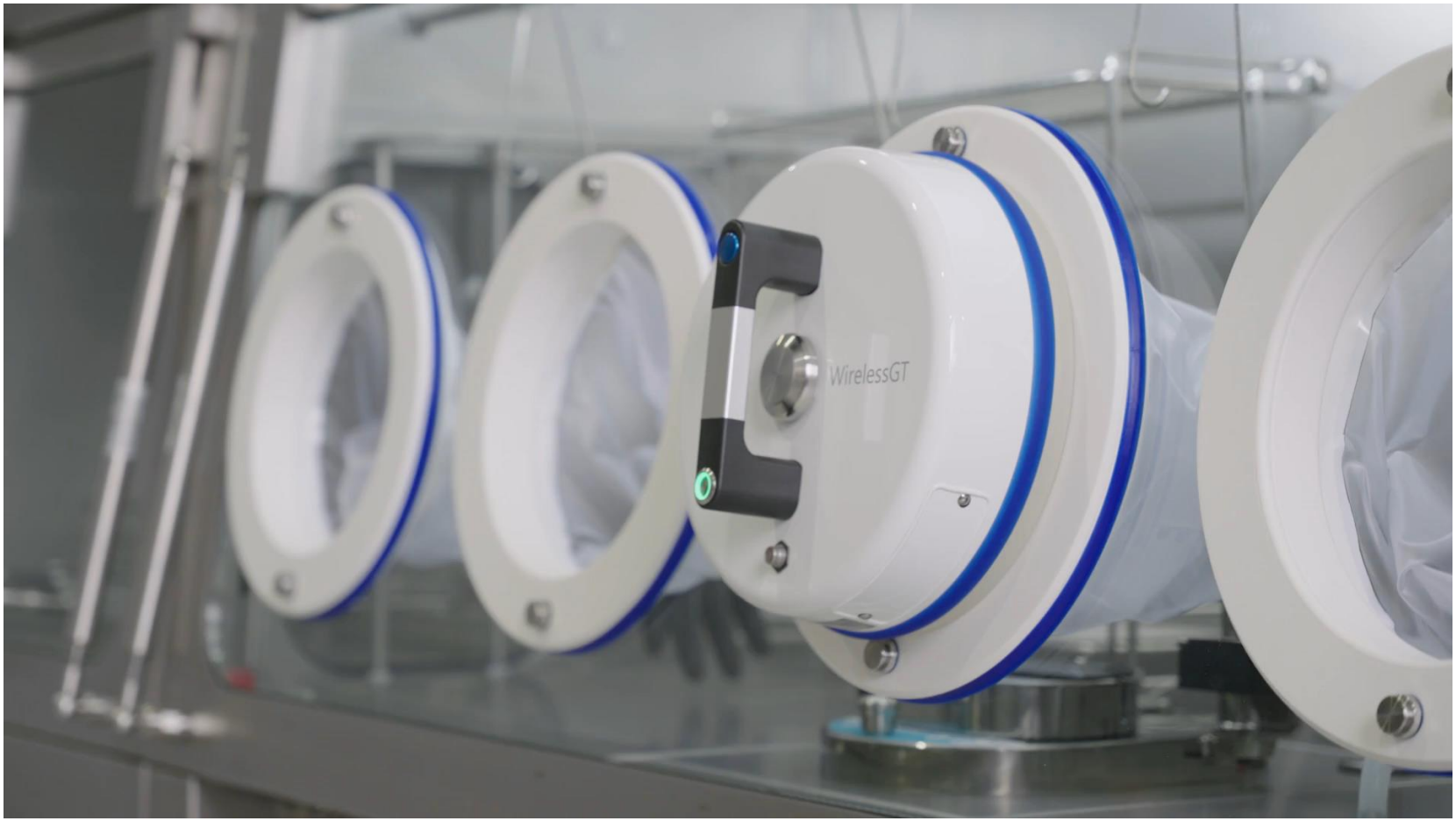
Pressure drop test with WirelessGT

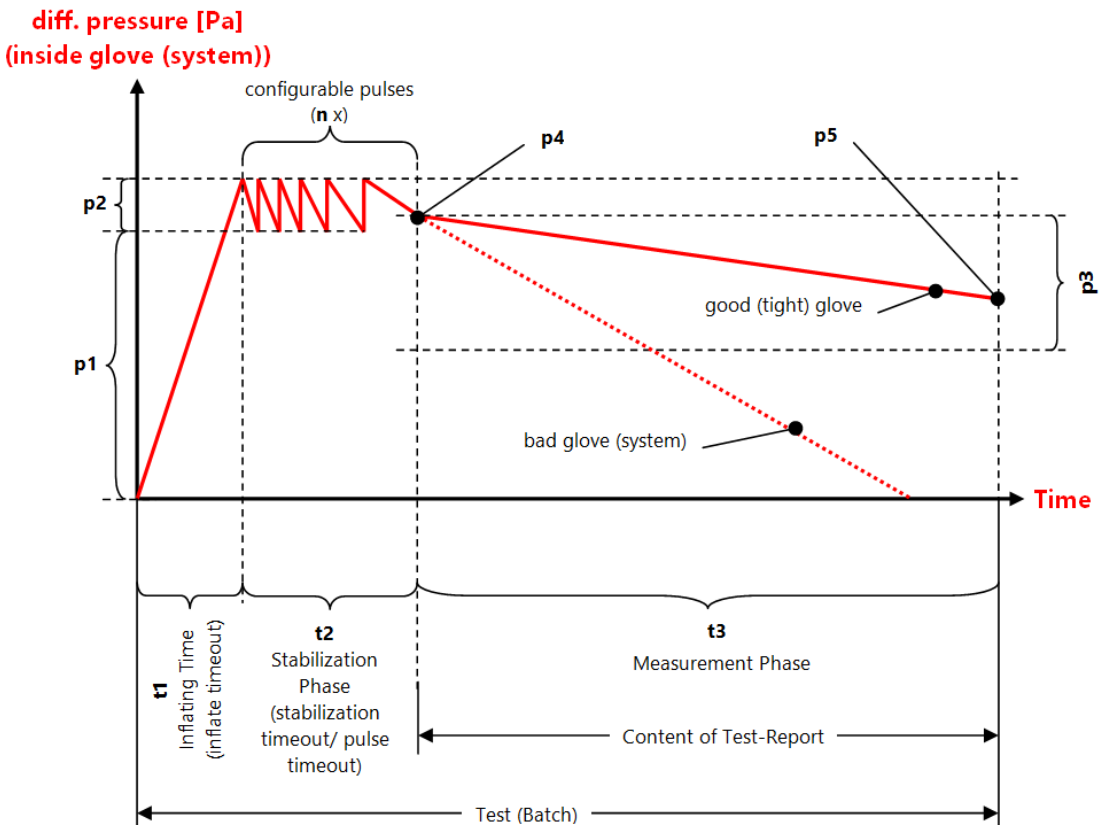
Wireless glove tester (WGT)

- cGAMP – specification for pressure drop measurements
- Li-Ion battery operation
- no additional hoses
- monitoring pressure drop for defined time
- Integrity testing on Isolator/RABS Systems
- suitable for use in cleanrooms class B,C and D
- Validated according to GAMP 5 category 3
- 21 CFR Part 11 compliant
- IP54 certified (water and dust tightness)

Pressure drop test with WGT



Pressure drop test with WGT



Pressure drop test with WGT

- How to define parameters?
  - size of the hole is specified by customer
  - depends on glove material, size and type
  - depends on pinhole size, location, direction and form
  - service from SKAN: parameter development for each glove type
  - service from SKAN: parameter qualification for each parameter set

Exercise: Piercan labelling

Characteristics	
Material:	
Length:	
Diameter:	
Glove Size:	
Thickness:	
Expiry date: