TRELLCHEM®

Chemical Protective Suits
User information & Technical data package
HPS/VPS/VPS-FLASH

TRELLEBORG

This manual may only be removed from the suit by the end user.

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IMPORTANT!

This manual is valid only for Trellchem® HPS, VPS and VPS-Flash, totally encapsulating/Level A versions.

These suits may only be used by specially trained personnel who are familiar with the contents of this manual.

Failure to comply with any of the recommendations given herein may result in serious injury or death.

Check the website www.trellchem.com for available updates and the latest edition of this manual.

Pre-use information

Proper use

Proper use within the USA is consistent with NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program,* and 29 *CFR* 1910.132, *Personal Protective Equipment*.

Users in other countries are advised to consult national or other applicable personal protective equipment regulations.

Safety considerations

All personnel should be well acquainted with this manual before using the suits.

Chemical response

Responding to hazardous chemical emergencies can be a very complex task and may involve chemicals other than those listed in the NFPA 1991 standard or in this documentation. Besides the specific chemical(s) encountered, other aspects such as the concentration, temperature of the chemical, mixtures of chemicals, flammability, toxicity etc. have to be considered.

Identify the chemicals before entering into the hazardous area in the chemical protective suit. Minimize the exposure to chemicals during the mission. Avoid direct contact with the chemicals as far as possible.

Guidelines for use

Choosing the appropriate chemical protective suit, accessories and other necessary equipment to deal with a chemical emergency, has to be made by qualified safety professionals.

The Trellchem® chemical protective suits are designed to be worn together with breathing apparatus combined with full face positive pressure breathing mask.

The Trellchem® chemical protective suits are to be used with a protective safety helmet meeting the requirements for type 1, class G helmets of ANSI Z89.1.

The Trellchem® suit is available in different sizes for the wearer's safety and comfort.

Trellchem® HPS and VPS of sock design should be worn together with the Onguard Hazmax 87012 boot. Trellchem® VPS-Flash should be used with the Tingley Hazproof #82330 or #82331 boot.

The Perfect Fit KV18AJTC Kevlar glove shall be worn as the outer glove of the glove system.

Make sure that the suit has not passed its recommended shelf life (see "Shelf life") and that the suit is free from damage before it is taken back into service.

Make sure that someone is available to assist while donning, decontaminating and doffing. Also make sure that the suit is decontaminated, inspected and pressure tested before it is returned into service or storage. If the suit is damaged, take it out of service and repair or replace as required.

Temperatures

The suit may be used in temperature ranges from - 40°F/ - 40°C to 150°F/ 65°C. Never use the suit near open flames or intense heat.

Take every precaution when responding to accidents which involve condensed gases at low temperature. It might be necessary to use a cold protective outer cover as well as an insulating underwear to protect the wearer from frostbite on the skin.

Antistatic properties
The Trellchem® chemical protective suit is not considered an antistatic garment. All non-conductive materials, including chemical protective suits, may cause static electric discharges which are more likely to occur in low humidity environments. You can minimize static charges by spraying with water before and during use.

Note: Most performance properties of the vapor protective suit or individual element cannot be tested by the user in the field.

Limitations of use
The suit offers chemical protection. Any other use may result in serious injury or death. Consult the chemical and technical data appendix for information on the protection offered against specific chemicals. The suit may be used in temperature ranges from -40°F/-40°C to 150°F/65°C. Never use the suit near open flames or intense heat. Also see ”Safety considerations” above.

Marking
Marking on the suit can be made by a ”permanent marker” type of pen. Special labels/marking can be supplied upon request.

Visor, antifog agents and procedures
Antifog agents that temporarily prevent the visor from fogging up are available. Antifog gel, art no 069 000 710 should be used on the visor. Alternatively an antifog lens (VP1 art no 072 270 300; CV art no 072 270 400) may be fitted to the inside of the visor. The Trellchem® suits are equipped with a built-in ventilation system which allows ventilation of the suit as well as the visor.

Undergarments
The most suitable type of undergarments depends on weather conditions and type of mission as well as the tactics and preferences of the users. For very cold weather and/or where there is a risk of contact with chemicals at very low temperature undergarments, such as Trellchem® Insulating Underwear, that protect the user from frost bite should be used.

Shelf life
7 years for VPS (and its individual elements) and 10 years for HPS (and its individual elements) under recommended storage conditions (see ”Recommended storage practices”). Life expectancy may, from experience of Trellchem® suits, exceed the above mentioned shelf life.

Warranty information
In case of faults or defects, if any, in the protective suits, including gloves and other accessories, the following is applicable:

If a fault or defect appears in the protective suit as a result or in the course of any use, function or state of the protective suit, the purchaser is requested to contact the company from which the suit was purchased. The terms of sale agreed upon between the purchaser and the said company shall apply in this case. Trelleborg Protective Products AB shall have no liability to purchasers of the protective suits other than when the suit in question was purchased directly from Trelleborg Protective Products AB.

The liability of Trelleborg Protective Products AB for faults or defects of a protective suit shall be subject to the Standard Warranty set forth in its General Conditions of Dispatch for Industrial Rubber Products, unless otherwise stated in a separate agreement in writing between Trelleborg Protective Products AB and the purchaser. The General Conditions of Dispatch are available on request.

This manual does not in any way comprise a guarantee or warranty on the part of Trelleborg Protective Products AB, and Trelleborg Protective Products AB expressly excludes any implied warranty of merchantability or fitness. Trelleborg Protective Products AB is not in any way nor under any conditions liable for compensation to the purchaser or commercial user of a protective suit for injury to (including death of) any person or loss of or damage to property of any kind or for costs, loss of profits or other damage or loss of any nature whatsoever.

Preparations for use

Sizes

Available size range:

SUIT SIZE	HEIGHT (in/cm)	WEIGHT (lbs/kg)	SOCK SIZE
M	67-84/170-187	143-187/65-85	9
L	72-76/183-193	165-209/75-95	10
XL	74-78/189-199	187-231/85-105	11
XXL	77-81/195-205	209-253/95-115	11
NOTE: The data refers to a wearer without SCBA or any other equipment.			

No specific adjustment procedures are required. Follow the donning procedure described under ”Donning of suit”, below.

Recommended storage practices

The suit is to be stored hanging or folded in a cool dry place, away from direct sunlight. The suit should be stored in the plastic storage bag delivered with it or in another tight bag. To avoid the suits being damaged by being pressed together, they should not be stored on top of each other. When the suit has been stored folded, it should be unfolded and inspected annually, when not used. (Shelf life, see above)

Inspection frequency and details

The suit is to be inspected upon delivery, after each use and after repair or, if not used, at least annually.

The inspection shall consist of the following steps:

·Visual inspection of both inside and outside.
·Look for surface damages on material, seams, visor, inner and outer gloves.
·Look for changes in the material properties such as brittleness, stiffness, swelling, stickiness or other phenomena.
·Check function of zipper and zipper fitting. See “Zipper, handling and lubricants”.
·Check the function of inlet valve (if fitted), exhaust valves and passthrough (if fitted). Make certain that they are firmly mounted and not damaged.
·Pressure test, see ”Test of gastightness” below.

Note any remarks, found during the inspection, in the inspection log.

If any defect/malfunction is found, the suit must be taken out of service. Minor repairs may be done according to “Repair and maintenance”. Any repair or replacement of parts other than those described in “Repair and maintenance” below may only be performed by a certified Trellchem® dealer or by Trelleborg Protective Products AB. Chemical degradation is not possible to repair.

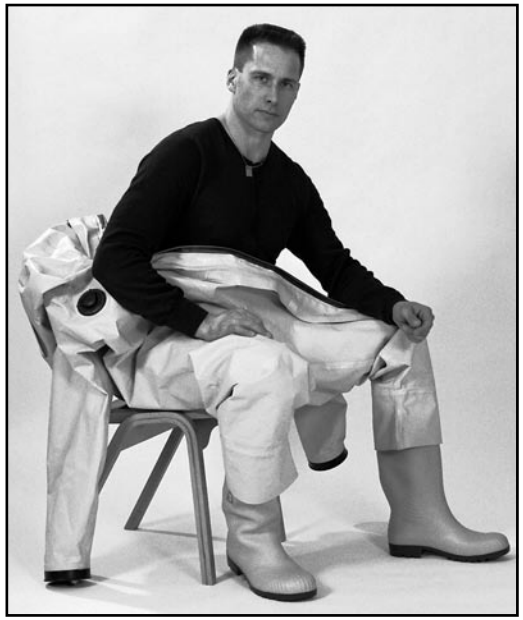
Donning of suit

The suit should be of an appropriate size, see ”Sizes” above. Make sure that the suit is visually inspected, air pressure tested and free from defects. Have someone assist you while dressing. If outside, try to find a clean area to stand.

Encapsulating 1a

1. Put both legs into the suit. Put on the oversocks (sock version).

2. Put on the boots (sock version).



3. Put on the breathing apparatus except the mask.

4. Put on the inner cotton comfort gloves,
art. no. 072 240 200.

5. Put right arm into the suit and hump over the breathing apparatus.

6. Insert your left arm into the left sleeve.

7. If the suit is fitted with ventilation, connect the ventilation hose to the regulating valve.

8. Put on the breathing mask and safety helmet.

9. Pull the hood over your head and close the zipper.

10. Put on the rubber gloves. See ”Trellchem® Bayonet glove ring system”, page 42.

Doffing of suit

After a response in hazardous environment the suit must be rinsed with water, preferrably containing detergent, before doffing. Make sure you have someone to assist you when doffing. Take off the suit in reverse order of that described above.

About the pressure test/test of gastightness

Testing according to NFPA 1991, NFPA 1994 and ASTM F 1052.

The suit should be tested with the gloves fitted.

The pressure test is conducted in two steps:

1. Inflate the suit with an airpistol to 5.0 inch/127 mm water gauge (1245 Pa/12.5 mbar) through the valve on the adapter. This is the pre-test expansion pressure. Maintain this pressure for at least 1 minute in order to fill out wrinkles and allow the material to settle. Extend the time if air temperatures inside and outside the suit are not equal.

2. Adjust the pressure to 4 inch/101 mm water gauge (996 Pa/9.96 mbar). This is the test pressure. Set and start the timer and wait for 4 minutes. Do not touch the suit during this period of time. Note the pressure after 4 minutes. If this pressure is 3.2 inch/81 mm water gauge (797 Pa/7.97 mbar) or more, the suit has passed the test. Note the final pressure in the suit log.

After the pressure test is completed disconnect the pressure gauge from the adapter, remove the adapter, reinstall the exhaust valve and remove the blind plug from the exhaust valves.

If the suit does not pass this test, the suit shall be removed from service. Inflate the suit and brush it with soapy water to find the leaks. Repair the leaks according to the instructions under “Repair and maintenance”. Retest according to “Test of gastightness”. Final pressure reading is to be filled in after completed repair and retest in the inspection log.

Test of gastightness - equipment

Trelltest pressure test kit

The TRELLTEST pressure test kit consists of:

1 pce adapter with connection nipple and valve
1 pce pressure gauge with PVC-hose and quick release coupling
1 pce digital stop watch/timer
3 pcs rubber blind plugs
2 pcs cuff clips (only for use with old glove attachment, not Bayonet)

Trellchem® automatic test equipment

The Trellchem® automatic test equipment consists of:
(1) Mains power adaptor
(2) On/Off switch
(3) Start button
(4) LCD display panel
(5) Power connection
(6) High-pressure regulator (for use with high-pressure air cylinders)
(7) Suit connections
(8) Air inlet connection
(9) USB connection
Hoses to connect suit tester to suit
Hose to connect high-pressure regulator to suit tester
Software and USB cable
The suit tester is mounted in a robust PELI case with a universal power transformer that allows it to be operated on a range of international power supplies.

Test of gastightness - procedure

HPS/VPS/VPS-Flash type 1a (with Trelltest)

1. Remove one of the exhaust valves and install the adapter.

2. Install the blind plugs in the other exhaust valves. For old suits with grey exhaust valves there is a small plug available - please contact your distributor.

3. Close the zipper and connect the pressure gauge to the adapter.

4. Inflate the suit through the valve on the adapter. Test the suit as described in ”About the pressure test”.

HPS/VPS/VPS-Flash type 1a
(with Trellchem® automatic test equipment)

The test is highly sensitive and should be conducted in a stable temperature environment free from drafts. During the test the suit should not be touched as this can easily affect the result.

1) If you intend to record the results using the suit check software, connect your laptop/PC to the suit tester using the USB connection cable. **Note**: Before attaching the suit tester to your laptop/PC for the first time, the supplied software should be fully installed.

2) Plug the mains power supply into the suit tester and switch the unit on.

3) Remove dust cap from air inlet connection and plug in a clean dry air supply. **Note**: Minimum inlet pressure is 3 bar and maximum inlet pressure to the tester is 10 bar.

4) Connect the suit tester to the external air supply - a high-pressure cylinder or a compressed air line - according to the instructions in the manual supplied with the suit tester.

5) Connect suit connection hoses to the gastight suit to be tested by using the following method:
a) From the inside of the suit carefully insert the two 6 mm clear plastic tubes (connected to the adaptor) through one of the suit valves. Make sure each 6 mm tube goes through an opposite quadrant of the valve.

b) Place the blind plug(s) in the remaining valve(s).

c) Gently pull the 6 mm tubes through the suit until the adaptor is in place.

d) Connect the 6 mm clear plastic tubes to the push fit connections...

e) ...and then connect to the suit connection couplings on the tester.

Note: There are alternative connection methods available. Please contact your Trelleborg representative for further information, if required.

6) You are now ready to begin testing your gastight suit. Press the Start button. The suit tester will now begin its test procedure by inflating the suit and then stabilising the pressure within it. Once this has been completed it will commence the decay test. The complete process is controlled automatically. You can monitor how the test is progressing on either the LCD display or on the suit check software.

7) The end of the test will be indicated on the LCD display and a notification window will be displayed on the software. If using the software, record and save the test results.

If you are completing further tests, disconnect the tested suit and replace with the next suit to be tested by reconnecting the airline supplies to the new suit. The unit and software can then be reset for the next test.

8) Once all tests have been completed, disconnect the last suit tested from the suit tester and switch the unit off. Unplug all the remaining hoses and cables and store in the pockets and bag provided.

Note 1: If you complete the test using a **high-pressure cylinder**, first turn the cylinder valve off. Disconnect the hose coupling at tester inlet and remove high-pressure regulator assembly from cylinder.

Note 2: If you complete the test using a **low-pressure airline supply**, first isolate this supply, then disconnect the hose.

Repair and maintenance

Repair of suit - general

Always use original Trellchem® parts when repairing. **WARNING**: Measures must be taken to avoid inhalation of the fumes from the solvent and the glue. Make sure that the working area where repairs are to be carried out is properly ventilated. The Trellchem® repair kit can be used for repair of punctures or minor damages. The outer gloves can easily be replaced as well as the inner gloves or rubber cuffs.

NOTE! After repairs the suit must be left for 24 hours to allow the glue to dry. Afterwards the suit must be inspected and pressure tested as described above.

To assure safe working order and to maintain the Trelleborg warranty, major repairs such as large tears, replacement of zipper, visor etc., shall be done by a Trelleborg certified repair centre or by Trelleborg Protective Products AB.

Repair of Trellchem® HPS/VPS/VPS-Flash

Trellchem® HPS (487 080 310) / VPS (487 080 400) /
VPS-Flash (487 080 420) repair kit:

1 can Trelleborg adhesive 6-0724, 125 ml for outside repair
1 bottle Trelleborg hardener 1-7869, 8 ml sufficient for 125 ml adhesive
1 bottle Trelleborg solvent 1-1197, 250 ml for cleaning
1 set Trelleborg repair patches, red for HPS outside / yellow for VPS outside / orange for VPS Flash outside
Transparent tape on release paper for inside repair
1 brush

Repair of inside:

1. Select a patch which is large enough to cover the damage with a margin of at least 15 mm around the damage.

2. Find and mark the proper position of the patch.

3. Clean the material on the inside with Trelleborg solvent 1-1197.

4. Remove the release paper from the transparent repair patch

5. and apply the patch over the damage starting from one end to avoid wrinkles.

6. Smooth with a hand roller or any other appropriate tool.

Repair of outside:
Clean suit material and outside patch with Trelleborg solvent 1-1197. Apply a thin layer of the two part adhesive 6-0724/1-7869 to the patch and around the damage. Let dry 5-10 minutes, until it is tacky. Apply a second layer of adhesive to patch and material. Let dry until it is tacky. Apply the patch over the damage. Smooth the patch starting from one end to avoid wrinkles. Smooth with a hand roller or any other appropriate tool.

1. Add the hardener to the glue. Mix thoroughly. This mixture must be used within two hours. The adhesive and the hardener have a limited storage life and are both marked with date of expiry. Do not use after this date.

2. Select a patch which is large enough to cover the damage with a margin of at least 15 mm around the damage. Position the patch accordingly and mark the position with a pen.

3. Clean the patch

4. and the suit material with Trelleborg solvent 1-1197.

5. Apply a thin layer of the adhesive/hardener mix around the damaged area and...

6. ...to the patch. Allow to dry 5-10 minutes, until it is tacky. **Important:** repeat the previous and this step, applying a second layer of glue. Let dry until tacky.

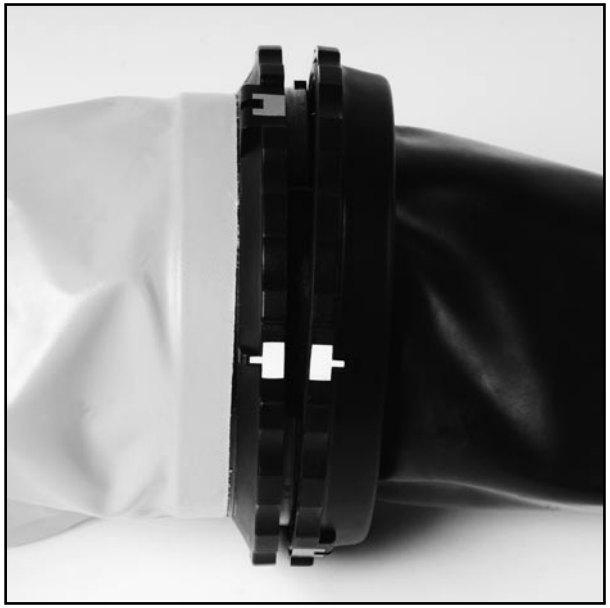
7. Apply the patch over the damage, starting from one end to avoid wrinkles.

8. Smooth with a hand roller or any other appropriate tool.

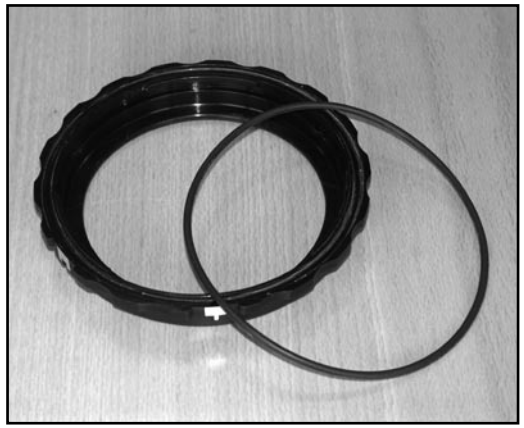
Trellchem® Bayonet glove ring system - general

Closed position
Green marks opposite white marks. To open the system and detach the glove assembly, remove the red locking pin, push the two rings together and twist counter clockwise until the white marks meet.

Open (detach/ attach) position
White marks opposite white marks. To attach the glove ring, match the white marks, push the two rings together and twist clockwise until the white marks meet the green marks. Insert the red locking pin.



O-rings
When assembling the Bayonet ring system for the first time, lubricate the groove and the O-ring with Molykote grease (069 095 005). A small paint-brush may be used to spread the grease evenly. Apply a thin layer. This lubrication may have to be repeated after cleaning. Put each O-ring into place.



072 000 611
O-ring for the glove ring.

072 000 606
O-ring for the sleeve ring.

Replacement of glove assembly (4H/Silver Shield inner glove plus outer rubber glove)

Parts required (per suit)
Glove ring 073 103 565 (plus O-ring), 2 pcs
4H/Silver Shield glove with grey inner ring 072 251 210, 2 pcs
HPS/VPS Chloroprene rubber glove 072 251 010, 1 pair

1. Only 4H inner gloves that are delivered on a ring can be used.

2. Remove the white protective film on each finger of the inner glove. This will uncover a sticky area that will hold the inner glove in place and keep it inside the outer glove when the hand is retracted.

3. Push the inner glove into the outer rubber glove. Make sure all fingers of the inner glove come into position all the way inside the fingers of the outer glove.

4. Press the fingers of the outer and inner gloves together so that they stick together.

5. Push the ring of the inner glove approximately 2 inches (5 cm) into the rubber glove.

6. Put one hand inside the gloves and curl a fist. At the same time, put a finger of the other hand between the ring and the outer glove to release air that is trapped between the gloves.

7. Push the glove through the glove ring and align the thumb of the glove with the green mark on the glove ring. Push it firmly into place using your thumbs. See “Trellchem® Bayonet glove ring system - general” for instructions on how to attach the glove ring/glove ring assembly onto the suit.

8. The gloves can be detached by going through the applicable steps above ”backwards”. The inner glove will stick to the outer glove but this can be overcome by using a little force. You may try one finger at a time and/or turning the outer glove inside-out if you have problems detaching the inner glove.

Maintenance instructions - Bayonet rings

The Trellchem® Bayonet ring system includes two Viton® O-rings and a safety locking pin. The Viton® O-rings should be replaced when broken or at least every 5 years. For optimal performance the O-rings must at all times be lubricated. If not, the Bayonet ring system will be difficult to close and there is a risk of damaging the O-rings. Therefore, it is recommended to lubricate O-rings with Molycote lubrication after every use.

The safety locking pin should be replaced when necessary. When functioning properly, the safety pin "snaps" in place when pushing it with a finger. The pin may after repeated use become too easy to push in place i.e. it gets worn out, and must then be replaced.

Maintenance instructions - Zipper (including lubricants)

The zipper must be lubricated every time the suit has been used and/or cleaned. Use the wax stick supplied with the suit. Little and often is better than neglecting and heavy applications of wax. See also separate instruction enclosed with the lubricant stick. After cleaning the sealing areas and metal elements have to be re-waxed, inside and outside, with the wax stick supplied with the suit.

During storage the zipper should be closed with approximately 10 cm/4 inches open.

IMPORTANT! Have someone help you close and open the zipper. Pull the slide using two fingers in the loop attached to the slide. The slide must always be pulled parallel and straight along the zipper. A pull sideways may seriously damage the zipper. When closing, make sure that neither suit material nor undergarment material is caught in the zipper. Excessive force will damage the zipper. If the slide gets jammed or is hard to pull, pull it back, trace the reason (e.g. dirt or clothing material caught in the chain) and solve the problem. Then *slowly* try to pull it again. Never try to overcome a problem by pulling harder as this will damage the zipper.

Maintenance instructions - Regulating valve and passthrough

The regulating valve and passthrough should be serviced every 5 years. Contact your local distributor for a *service-kit*, which includes:

- Suit sealing (1 pce)
- O-rings (2 pcs)
- Valve housing (the old valve housing shall be sent to service via the local distributor).

Maintenance instructions - Overpressure valve

The overpressure valve should be replaced every 5 years.

Spare part list

COMPONENT	ARTICLE NUMBER
Viton® O-rings, for sleeve ring (10 pcs)	072 000 606
Viton® O-rings, for glove ring (10 pcs)	072 000 611
Molycote lubrication	069 095 005
Safety locking pin	073 103 585
Zipper maintenance kit	070 000 410
Service kit, for regulating valve and passthrough	072 141 100
Overpressure valve	072 131 200

Cleaning

Hand wash in warm water (40 °C). Use a mild detergent and a piece of soft rag or a smooth brush. Care should be taken not to scratch or damage the material. Let the suit airdry or use a fan (alternatively a cleaning system such as the TopTrock® may be used). Stains of oil or other substances may be washed off carefully with white spirit, after which the suit should be rinsed with lukewarm water with a mild detergent followed by water. The suit material will withstand most commercial disinfectants. Your Trellchem® dealer or Trelleborg Protective Products AB may be contacted for advice. Do not use garments that are not thoroughly cleaned and dried.

Decontamination guidelines

Due to the vast number of chemicals and their different properties, no general decontamination procedure exists. The best way to decontaminate must be decided for the specific chemical encountered. This decision may only be taken by people educated for this task and with a good knowledge of chemistry. Trelleborg Protective Products AB may be contacted for advice.

As a first rule a pre-decontamination must always be performed before doffing the suit - the safety of the wearer is the most important! This pre-decontamination should include rinsing with large amounts of water, if possible containing a detergent.

After this initial procedure the real decontamination can take place and since all chemicals can be divided into groups, depending on chemical and/or physical properties, the following three groups are the most relevant when it comes to decontamination:

- volatile
- water soluble or reacts with water
- water insoluble

Depending on which group a chemical falls into, the decontamination procedure will be different, see the following descriptions. A special group of chemicals are the chemical warfare agents, for which we recommend a special decontamination procedure, see below.

Volatile chemicals

Chemicals that have lower boiling temperature than 80 °C are regarded as volatile. These are typically solvents like ethyl acetate, heptane, benzene, chloroform, acetone and many others.

To decontaminate a suit which has been in contact with a volatile compound you air the suit outdoors or in a well-ventilated area, if possible at a slightly elevated temperature (30-40 °C). Hang the suit with the zipper fully open and

enough space around it, so that the air can flow freely around the suit. The required time for ventilating the chemicals depends on the temperature and airflow rate around the suit. After having aired the suit check for odour/smell of the chemicals and/or test the air for residual chemicals by using simple gas detecting tubes.

Water soluble chemicals

Chemicals that have higher solubility than 60 g/l water are regarded as water-soluble. Also, the solubility is dependent on the temperature; an increase in temperature increases the solubility. Examples of water-soluble chemicals are: phenol, ethylene glycol, sodium, all acids and alkali (see further below).

When decontaminating a suit which has been in contact with a water-soluble compound you rinse the suit thoroughly with water, preferably with some added detergent. To further enhance the solubility you can use warm water (40 °C).

Acids and alkali

Examples: sulphuric acid, hydrochloric acid, sodium hydroxide, ammonium hydroxide.

Since both acids and alkali are soluble in water, a suit which has been in contact with either one of them should be rinsed with water. Residual acid may first be neutralised with a dilute solution of alkali and vice versa for residual alkali. Afterwards, rinse thoroughly with water with some added detergent. The pH should be checked during the decontamination, when the pH is neutral the decontamination is finished. pH can easily be checked with a pH-stick.

Water insoluble chemicals

Chemicals that are not water-soluble are soluble in some type of solvent, for example alcohol or white spirit. Chemicals that have lower solubility than 60 g/l water are regarded as water insoluble. Examples are: styrene, pyridine, nitrobenzene, diesel and crude oil.

If the suit has been in contact with a water insoluble compound you wipe the suit thoroughly with a cloth soaked in alcohol or white spirit (depending on what solvent will solve the chemical). Afterwards, rinse thoroughly with water with some added detergent.

There are chemicals that are so sticky that it is more or less impossible to get the suit completely clean. If this occurs the suit must be scrapped.

Chemical warfare agents

To decontaminate chemical warfare agents we recommend using a 30% water slurry of calcium hypochlorite (also known as chloride of lime or HTH). The suit is washed with the slurry and the slurry is allowed to react with the agents for about 15 minutes before it is washed off with water. After this procedure the suit is washed thoroughly with lots of water, preferably with some added detergent.

Biological decontamination

The optimal method for biological decontamination depends on the type of biological contamination. The recommended procedure is using hydrogen peroxide.

Rinse the suit in lukewarm water. Apply alkaline detergent (pH 10-11) to all surfaces of the suit using a sponge in order to dissolve proteins. Allow the detergent to work for 4-5 minutes. Then rinse the detergent away with lukewarm water. The suit can be disinfected using 3% hydrogen peroxide solution. First rinse the suit, then coat all surfaces on the suit with 3% hydrogen peroxide solution. Let the solution work 5 minutes at a temperature of 25°C. Rinse thoroughly to remove all hydrogen peroxide.

Retirement and disposal

The suit has to be replaced when worn out, damaged beyond repair or after being exposed to undecontaminable chemicals. If changes in the rubber material properties (brittleness, stiffness, swelling, stickiness or other phenomena) are found, the suit should be taken out of service immediately and replaced. In doubtful cases contact your supplier or Trelleborg Protective Products AB.

NOTE: Trelleborg cannot guarantee the performance and safety of suits beyond 15 years of age.

Worn out suits should be disposed of according to local regulations for rubber/plastic waste. Incineration is recommended. Suits that are not completely decontaminated must be disposed of in a safe manner, taking local regulations for the specific chemical into account.

Suit material and component description

Garment material

The suit material of Trellchem® HPS is a combination of a red Viton®/ butyl rubber coated fabric on the outside and a polymer barrier laminate on the inside, proprietary to Trelleborg Protective Products AB. (Viton® is a registered trademark of DuPont.)

The suit material of Trellchem® VPS is a combination of a yellow chloroprene rubber coated fabric on the outside and a polymer barrier laminate on the inside, proprietary to Trelleborg Protective Products AB.

The suit material of Trellchem® VPS-Flash is a combination of an orange chloroprene rubber coated aramide fabric on the outside and a polymer barrier laminate on the inside, proprietary to Trelleborg Protective Products AB.

Visor material

The visor is 2 mm high impact resistant PVC, protected during delivery by outside and inside plastic films that are to be removed before use. As an accessory, an antifog lens may be fitted to the inside of the visor, to prevent it from fogging up.

Glove material and assembly

The glove assembly providing chemical protection consists of two layers. An inner glove (North 4H/Silver Shield®, size 13, art.no. 072 251 210) made of silver colored polymer barrier laminate. The outer glove (Guardian Manufacturing, IN-35A, chloroprene rubber, size 12, art.no. 072 251 010) is made of special chloroprene rubber.

The Perfect Fit KV18AJTC Kevlar® glove providing mechanical protection is to be worn over the other gloves. This is a large unisize overglove, which will stretch to fit on top of the available gloves above.

Each suit delivery also includes one separate pair of thin inner comfort gloves made of cotton. The gloves are available in a standard size.

Footwear material

The garment is made with an integrated bootie in the primary suit material. The user must wear separate outer safety boots to cover the bootie. Boots to be used with Trellchem® HPS and VPS are Onguard Hazmax 87012. Available sizes: US 6-15. Boots to be used with Trellchem® VPS-Flash are Tingley Hazproof #82330 or #82331. The suit is delivered with a pair of silicone coated oversocks to ease the donning of the safety boots.

Zipper/closure - type and material

The zipper is a gastight 1350 mm long zipper installed for front entry. The chain is made of an alloy (white copper). The slide is made of bronze (copper/tin alloy). The tape is made of a chloroprene rubber coated polyester fabric. The outside of the zipper is protected by a flyfront made of the suit material. The free edge is held in place by Velcro® tape.

Material seam types and composition

Garment material/garment material seam

The seam is made as a double reinforced butt seam construction. The sewing thread is aramide. The inner tape is made of a barrier laminate which is heat welded over the seam. On Trellchem® HPS, the outer tape is a Viton® strip, which is glued over the seam with a proprietary Viton® adhesive. On Trellchem® VPS and VPS-Flash, the outer tape is a chloroprene strip which is glued with a chloroprene adhesive.

Garment material/visor seam

The visor is glued to the inside of the garment material with a two part adhesive. A strip of garment material is welded to the inside of the garment. To this strip another strip (garment material) is glued, which also is glued to the visor, covering its edge.

Garment material/glove seam

The gloves are attached with an impact resistant plastic bayonet glove ring system, where the male part of the ring system is glued to the inside of the sleeve. The glove is mounted on the inner ring, which is inserted in the female part of the ring system. The male and the female parts are locked together with a bayonet fitting. Two Viton® o-rings ensure the gastightness of the system.

Garment material/suit closure seam

The seam is sewn and glued with a two part adhesive. On Trellchem® HPS, the outside is covered with a Viton® tape glued with a proprietary Viton® adhesive. On Trellchem® VPS and VPS-Flash, the outside is covered with a chloroprene tape glued with a chloroprene adhesive. The inside is covered with a rubber coated polyamide fabric glued by a two part adhesive.

Exhaust valve type and materials

The suit is equipped with exhaust valves which are manufactured of impact resistant plastic. The valve membrane is made of rubber. The valves are attached by a mechanical screw compression seal. The valves are covered with splash guards made of the primary suit material.

External fitting types and materials

Following pass-throughs are compatible with Trellchem® HPS, VPS and VPS-Flash and can be installed upon request:

Interspiro, Survivair, Scott, ISI, Dräger and MSA.

Outer glove and boot materials

See ”Glove material and assembly”, and ”Footwear material” above.

Head protection accomodated

The Trellchem® chemical protective suits are to be used with a protective safety helmet meeting the requirements for type 1, class G helmets of ANSI Z89.1.

Respirator

The Trellchem® chemical protective suits are designed to be worn together with a self-contained breathing apparatus. The suits will accomodate the major brands of SCBA’s, such as Interspiro, Survivair, Scott, ISI, Dräger and MSA.

Chemical and technical data appendix

NFPA approvals

Cert. Mod. (NFPA 1991, 2005 edition)

Trellchem® HPS, VPS and VPS-Flash totally encapsulating/Level A versions comply with the NFPA 1991 standard on vapor-protective ensembles for hazardous materials emergencies. This includes the VP1 and CV designs and versions including ventilation as well as versions without ventilation. The NFPA 1991 approval includes chemical and biological terrorism protection requirements. Trellchem® VPS-Flash also fulfils the optional flash-over requirement. Trellchem® HPS, VPS and VPS-Flash are certified by SEI (Safety Equipment Institute, USA).

European EC Type approval

CE 0402

Trellchem® HPS and VPS (not VPS-Flash) have been tested and approved by notified body no 0200; FORCE Dantest-CERT, Park Allé 345, DK-2605 Bröndby, Denmark. The suits are CE-marked and have EC type approval under the European Council Directive 89/686/EEC on personal protective equipment and the European standard EN 943 part 1 and part 2 (ET versions).

About the permeation data

The data being presented was derived from permeation tests performed by Texas Research Institute Inc. and Intertek Testing Services, USA, in accordance with ASTM F739 with a minimum detectable permeation rate of less than or equal to 0.1 µg/cm^2*min.

It should be noted that the testing was performed on swatches of suit material under laboratory conditions, not under actual workplace environments. The user must determine the applicability of the results obtained under laboratory conditions to the actual conditions of use. Information presented is subject to change without notice. Duration of test 8 hours. NFPA 1991 requires the primary suit materials not to exhibit breakthrough in less than 1 hour for pristine material as well as after the material is conditioned (flexed and abraded).

Chemical permeation data

Comments on the list below:
All tests are performed in accordance with ASTM F 739 (0.1 µg/cm^2 *min), except chemicals marked (1), which are tested in accordance with EN 374-3 (1.0 µg/cm^2 *min) and the chemical warfare agents (HD, GA, GB, GD, L, VX), which are tested in accordance with FINABEL Conv. 0.7.C.

The 21 test chemicals marked with an asterisk (*) are stipulated (minimum requirement) in the American standard NFPA 1991. All chemicals are tested at 99-100% concentration, unless otherwise stated.

BT Time = Breakthrough time

CHEMICAL	HPS BT TIME (MIN)	VPS BT TIME (MIN)
Acetic anhydride	> 480	> 480
*Acetone	> 480 [1)]	> 480 [1)]
*Acetonitrile	> 480 [1)]	> 480 [1)]
Acetyl chloride	> 480	> 480
Acrylamide 40%	> 480	> 480
Acrylic acid	> 480	> 480
*Anhydrous ammonia	> 480 [1)]	> 480 [1)]
Aniline	> 480	> 480
Arsine (AS)	> 480	> 480
Benzene	> 480	> 480
Bromine	360	300
*1,3-Butadiene	> 480	> 480
Butylamine	316	> 480
*Carbon disulfide 95%	> 480	> 480
*Chlorine	> 480 [1)]	> 480 [1)]
Chloroform	> 480	> 480
Chlorosulfonic acid	> 480	270
Cyanogen chloride (CK)	> 60	> 60

CHEMICAL	HPS BT TIME (MIN)	VPS BT TIME (MIN)
*Dichloromethane	> 480 [1)]	> 480 [1)]
*Diethyl amine	> 480 [1)]	> 480 [1)]
Diethyl ether	352	> 480
*Dimethyl formamide	> 480	> 480
Dimethyl hydrazine 98%	> 480	> 480
Dimethylsulfoxide	> 480	> 480
Epichlorohydrine	> 480	> 480
*Ethyl acetate	> 480 [1)]	> 480 [1)]
Ethylene glycol	> 480	> 480
*Ethylene oxide	> 480	> 480
Formaldehyde 37%	> 480	> 480
Formic acid 96%	> 480	> 480
Furfual	> 480	> 480
Heptane	> 480	> 480
*Hexane	> 480 [1)]	> 480 [1)]
Hydrazine	> 480	> 480
Hydrochloric acid 37%	> 480	> 480
Hydrofluoric acid 48%	> 480	> 480
*Hydrogen chloride	> 480	> 480
Hydrogen fluoride, gas	> 480	No data
Hydrogen fluoride, liquefied	270	No data
Hydrogen peroxide 50%	> 480	> 480
Isoprene	> 480	> 480
JP-4	> 480	> 480
Lewisite (L)	> 1440	> 1440
*Methanol	> 480 [1)]	> 480 [1)]
*Methyl chloride	> 480	> 480
Methyl ethyl ketone	> 480	> 480
Methyl isocyanate	> 480	> 480
Methyl metacrylate	> 480	> 480
Methyl tert-butyl ether	> 480	> 480
Monochlorobenzene	> 480	> 480
Mustard gas (HD)	> 1440	> 1440

CHEMICAL	HPS BT TIME (MIN)	VPS BT TIME (MIN)
Nitric acid 65%	> 480	> 480
Nitric acid, fuming	135 [1]	No data
*Nitrobenzene	> 480	> 480
Nitromethane	> 480	> 480
Oleum 30%	> 480	360
Phenol 85%	> 480	> 480
Phosgene (CG)	> 480	> 480
Phosphoric acid 85%	> 480	> 480
Phosphorous trichloride	> 480	> 480
Pyridine	> 480	> 480
Sarin (GB)	> 1440	> 1440
*Sodium hydroxide 40%	> 480 [1]	> 480
Soman (GD)	> 1440	> 1440
Styrene	> 480	> 480
*Sulphuric acid 98%	> 480 [1]	> 480
Tabun (GA)	> 1440	> 1440
*Tetrachloroethylene	> 480	> 480
*Tetrahydrofuran	> 480 [1]	> 480 [1]
Thionyl chloride 97%	> 480	No data
*Toluene	> 480 [1]	> 480 [1]
Toluene di-isocyanate (TDI) 96%	> 480	> 480
Tribromophenol	> 480	> 480
Trichloroacetic acid	> 480	> 480
Trichloroethylene	> 480	> 480
Triethylamine	> 480	> 480
Triethylenetetramine	> 480	> 480
Vinyl acetate	> 480	> 480
Vinyl chloride	> 480	> 480
VX	> 1440	> 1440

NFPA 1991 Approval data

PRODUCT NAME: TRELLCHEM HPS/VPS/VPS-FLASH			
VAPOR PROTECTIVE SUIT PERFORMANCE			
PROPERTY	HPS	VPS	VPS-Flash
7.1.1 Liquid-Tight Integrity	PASS	PASS	PASS
7.1.2 Overall Ensemble Function and Integrity	PASS	PASS	PASS
Ending Suit Pressure	99 mm H_2O	98 mm H_2O	89 mm H_2O
7.1.3 Maximum Suit Ventilation Rate	37 mm H_2O	36 mm H_2O	36 mm H_2O
Ending Suit Pressure	99 mm H_2O	98 mm H_2O	91 mm H_2O
7.1.4 Gastight Integrity	99 mm H_2O	97 mm H_2O	95 mm H_2O
7.1.5 Exhaust Valve Mounting Strength	1996 N	1996 N	1572 N
7.1.6 Fitting Pull Out Strength			
Dräger Passthrough	2098 N	2098 N	2995 N
Interspiro Passthrough	1929 N	1929 N	2697 N
ISI Passthrough	2294 N	2294 N	2458 N
MSA Passthrough	1892 N	1892 N	3125 N
Scott Passthrough	1888 N	1888 N	3037 N
Survivair Passthrough	2016 N	2016 N	2638 N
Type T Ventilation Valve	1717 N	1717 N	5480 N
Type TE Ventilation Valve	1549 N	1549 N	3874 N
7.1.7 Exhaust Valve Inward Leakage	16 ml/min.	16 ml/min.	16 ml/min.
7.8.2 Overall Ensemble Flash Test			
Ending Suit Pressure			99 mm H_2O
Afterflame			0 sec.
Visual Acuity			20/100

GARMENT MATERIAL PERFORMANCE				
BASE MATERIAL: TRELLCHEM HPS/VPS/VPS-FLASH				
PROPERTY	RESULT			
7.2.1 Chemical Permeation Resistance, flexed and abraded	Avarage Permeation Rate (µg/cm²*min.)			Avarage Breakthrough Time (min.)
	HPS	VPS	VPS-Flash	
Acetone	< 0.01	< 0.05	< 0.05	> 180
Acetonitrile	< 0.01	< 0.01	< 0.01	> 180
Anhydrous ammonia (gas)	< 0.01	< 0.01	< 0.01	> 180
1,3-Butadiene (gas)	< 0.02	< 0.03	< 0.03	> 180
Carbon disulfide	< 0.09	< 0.08	< 0.01	> 180
Chlorine (gas)	< 0.01	< 0.01	< 0.01	> 180
Dichloromethane	0.10	0.02	< 0.08	> 180
Diethylamine	< 0.01	< 0.01	< 0.01	> 180
Dimethylformamide	< 0.01	< 0.01	< 0.01	> 180
Ethyl acetate	< 0.05	< 0.08	< 0.08	> 180
Ethylene oxide (gas)	< 0.01	< 0.01	< 0.01	> 180
Hexane	< 0.01	< 0.06	< 0.06	> 180
Hydrogen chloride (gas)	< 0.01	< 0.01	< 0.01	> 180
Methanol	< 0.01	< 0.01	< 0.01	> 180
Methyl chloride (gas)	< 0.05	< 0.01	< 0.01	> 180
Nitrobenzene	< 0.01	< 0.01	< 0.01	> 180
Sodium hydroxide	< 0.01	< 0.01	< 0.01	> 180
Sulfuric acid	< 0.01	< 0.01	< 0.01	> 180
Tetrachloroethylene	< 0.01	< 0.01	< 0.01	> 180
Tetrahydrofuran	< 0.15	< 0.05	< 0.04	> 180
Toluene	< 0.04	< 0.04	< 0.04	> 180

PROPERTY	RESULT		
7.2.2 Flammability Resistance	HPS	VPS	VPS-Flash
• Afterflame	M 5.24 sec. XM 6.38 sec.	M 7.8 sec. XM 8.09 sec.	M 0 sec. XM 0 sec.
• Burn Distance	M 0.95 inch XM 1.00 inch	M 1.00 inch XM 1.00 inch	M 0.57 inch XM 0.47 inch
• Burning Behaviour	PASS	PASS	PASS
7.2.3 Burst Strength	1230 N	1340 N	1242 N
7.2.4 Puncture Propagation Tear Resistance	M 56 N XM 76 N	M 78 N XM 67 N	M 77 N XM 75 N
7.2.5 Cold Weather Temperature Performance	M 0.0065 Nm XM 0.0109 Nm	M 0.0034 Nm XM 0.0020 Nm	M 0.010 Nm XM 0.007 Nm
7.8.3 Thermal Protective Performance			
TPP Rating			22.8 cal/cm²
M = Machine Direction XM = Cross Machine Direction			

GARMENT SEAM PERFORMANCE				
BASE MATERIAL: TRELLCHEM HPS/VPS/VPS-FLASH				
PROPERTY	RESULT			
7.2.6 Chemical Permeation Resistance	Avarage Permeation Rate (μg/cm²*min.)			Avarage Breakthrough Time (min.)
	HPS	VPS	VPS-Flash	
Acetone	< 0.01	< 0.05	< 0.05	> 180
Acetonitrile	< 0.01	< 0.01	< 0.01	> 180
Anhydrous ammonia (gas)	< 0.01	< 0.01	< 0.01	> 180
1,3-Butadiene (gas)	< 0.02	< 0.04	< 0.04	> 180
Carbon disulfide	< 0.09	< 0.05	< 0.01	> 180
Chlorine (gas)	< 0.01	< 0.01	< 0.01	> 180
Dichloromethane	< 0.10	< 0.10	< 0.09	> 180
Diethylamine	< 0.01	< 0.01	< 0.01	> 180
Dimethylformamide	< 0.01	< 0.03	< 0.03	> 180
Ethyl acetate	< 0.05	< 0.01	< 0.01	> 180
Ethylene oxide (gas)	< 0.01	< 0.01	< 0.01	> 180
Hexane	< 0.02	< 0.03	< 0.03	> 180
Hydrogen chloride (gas)	< 0.01	< 0.01	< 0.01	> 180
Methanol	< 0.01	< 0.01	< 0.01	> 180
Methyl chloride (gas)	< 0.05	< 0.02	< 0.02	> 180
Nitrobenzene	< 0.01	< 0.01	< 0.01	> 180
Sodium hydroxide	< 0.01	< 0.01	< 0.01	> 180
Sulfuric acid	< 0.01	< 0.01	< 0.01	> 180
Tetrachloroethylene	< 0.01	< 0.01	< 0.01	> 180
Tetrahydrofuran	< 0.01	< 0.04	< 0.03	> 180
Toluene	< 0.04	< 0.03	< 0.03	> 180

GARMENT SEAM PERFORMANCE			
BASE MATERIAL: TRELLCHEM HPS/VPS/VPS-FLASH			
PROPERTY	RESULT		
7.2.7 Seam Breaking Strength	HPS	VPS	VPS-Flash
	20.8 kN/m	20.2 kN/m	19.1 kN/m

CLOSURE (ZIPPER) PERFORMANCE	
PROPERTY	RESULT
7.2.8 Chemical Penetration Resistance	BT ≥ 1 hr.
Acetone	BT ≥ 1 hr.
Acetonitrile	BT ≥ 1 hr.
Anhydrous ammonia (gas)	BT ≥ 1 hr.
1,3-Butadiene (gas)	BT ≥ 1 hr.
Carbon disulfide	BT ≥ 1 hr.
Chlorine (gas)	BT ≥ 1 hr.
Dichlorometane	BT ≥ 1 hr.
Diethylamine	BT ≥ 1 hr.
Dimethylformamide	BT ≥ 1 hr.
Ethylacetate	BT ≥ 1 hr.
Hexane	BT ≥ 1 hr.
Hydrogen chloride (gas)	BT ≥ 1 hr.
Methanol	BT ≥ 1 hr.
Methyl chloride (gas)	BT ≥ 1 hr.
Nitrobenzene	BT ≥ 1 hr.
Sodium hydroxide	BT ≥ 1 hr.
Sulfuric acid	BT ≥ 1 hr.
Tetrachloroethylene	BT ≥ 1 hr.
Tetrahydrofuran	BT ≥ 1 hr.
Toluene	BT ≥ 1 hr.
7.2.9 Closure Breaking Strength	HPS 8.90 kN/m VPS 8.61 kN/m VPS-Flash 9.63 kN/m

VISOR MATERIAL PERFORMANCE			
Visor material: 2 mm High Impact PVC			
PROPERTY	REQUIREMENT	RESULT	
7.3.1 Chemical Permeation	BT ≥ 1 hr.	Avarage Permeation Rate ($\mu g/cm^2$*min.)	Avarage Breakthrough Time (min.)
Acetone	BT ≥ 1 hr.	< 0.02	> 180
Acetonitrile	BT ≥ 1 hr.	< 0.01	> 180
Anhydrous ammonia (gas)	BT ≥ 1 hr.	< 0.01	> 180
1,3-Butadiene (gas)	BT ≥ 1 hr.	< 0.03	> 180
Carbon disulfide	BT ≥ 1 hr.	< 0.08	> 180
Chlorine (gas)	BT ≥ 1 hr.	< 0.01	> 180
Dichloromethane	BT ≥ 1 hr.	< 0.02	> 180
Diethylamine	BT ≥ 1 hr.	< 0.01	> 180
Dimethylformamide	BT ≥ 1 hr.	< 0.01	> 180
Ethyl acetate	BT ≥ 1 hr.	< 0.05	> 180
Ethylene oxide (gas)	BT ≥ 1 hr.	< 0.01	> 180
Hexane	BT ≥ 1 hr.	< 0.02	> 180
Hydrogen chloride (gas)	BT ≥ 1 hr.	< 0.01	> 180
Methanol	BT ≥ 1 hr.	< 0.01	> 180
Methyl chloride (gas)	BT ≥ 1 hr.	< 0.01	> 180
Nitrobenzene	BT ≥ 1 hr.	< 0.01	> 180
Sodium hydroxide	BT ≥ 1 hr.	< 0.01	> 180
Sulfuric acid	BT ≥ 1 hr.	< 0.01	> 180
Tetrachloroethylene	BT ≥ 1 hr.	< 0.01	> 180
Tetrahydrofuran	BT ≥ 1 hr.	< 0.04	> 180
Toluene	BT ≥ 1 hr.	< 0.04	> 180

PROPERTY	REQUIREMENT	RESULT
7.3.2 Flammability Resistance		
• Afterflame	≤ 10 sec.	M 0 sec. XM 0.41 sec.
• Burn Distance	≤ 4 inch	M 0.65 inch XM 0.75 inch
• Burning Behaviour	No melting/ dripping	PASS
7.3.3 Burst Strength	≥ 200 N	4430 N
7.3.4 Puncture Propagation Tear Resistance	≥ 49 N	923.5 N
7.3.5 Cold Weather Temperature Performance	No damage	PASS
M = Machine Direction XM = Cross Machine Direction		

VISOR SEAM PERFORMANCE

PROPERTY	RESULT			
7.3.6 Chemical Permeation Resistance	Avarage Permeation Rate (μg/cm²*min.)			Avarage Break-through Time (min.)
	HPS	VPS	VPS-Flash	
Acetone	< 0.01	< 0.01	< 0.01	> 180
Acetonitrile	< 0.01	< 0.01	< 0.01	> 180
Anhydrous ammonia (gas)	< 0.01	< 0.01	< 0.01	> 180
1,3-Butadiene (gas)	< 0.03	< 0.04	< 0.04	> 180
Carbon disulfide	< 0.08	< 0.05	< 0.01	> 180
Chlorine (gas)	< 0.01	< 0.01	< 0.01	> 180
Dichloromethane	< 0.02	< 0.10	< 0.09	> 180
Diethylamine	< 0.01	< 0.01	< 0.03	> 180
Dimethylformamide	< 0.01	< 0.03	< 0.03	> 180
Ethyl acetate	< 0.08	< 0.07	< 0.07	> 180
Ethylene oxide (gas)	< 0.01	< 0.01	< 0.01	> 180
Hexane	< 0.01	< 0.03	< 0.03	> 180
Hydrogen chloride (gas)	< 0.01	< 0.01	< 0.01	> 180
Methanol	< 0.01	< 0.01	< 0.01	> 180
Methyl chloride (gas)	< 0.03	< 0.02	< 0.02	> 180
Nitrobenzene	< 0.01	< 0.01	< 0.01	> 180
Sodium hydroxide	< 0.01	< 0.01	< 0.01	> 180
Sulfuric acid	< 0.01	< 0.01	< 0.01	> 180
Tetrachloroethylene	< 0.01	< 0.01	< 0.01	> 180
Tetrahydrofuran	< 0.09	< 0.07	< 0.04	> 180
Toluene	< 0.04	< 0.05	< 0.05	> 180
7.3.7 Seam Breaking Strength	HPS 29.5 kN/m VPS 27.8 kN/m VPS-Flash 21.8 kN/m			

GLOVE MATERIAL PERFORMANCE			
Glove combination: Perfect Fit KV18AJTC Kevlar® over glove Guardian Mfg. In-35A Chloroprene rubber outer glove North 4H/Silver Shield® inner glove			
PROPERTY	REQUIREMENT	RESULT	
7.4.1 Chemical Permeation, flexed and abraded	BT ≥ 1 hr.	Avarage Permeation Rate (μg/cm²*min.)	Avarage Breakthrough Time (min.)
Acetone	BT ≥ 1 hr.	< 0.02	> 180
Acetonitrile	BT ≥ 1 hr.	< 0.01	> 180
Anhydrous ammonia (gas)	BT ≥ 1 hr.	< 0.01	> 180
1,3-Butadiene (gas)	BT ≥ 1 hr.	< 0.03	> 180
Carbon disulfide	BT ≥ 1 hr.	< 0.09	> 180
Chlorine (gas)	BT ≥ 1 hr.	< 0.01	> 180
Dichloromethane	BT ≥ 1 hr.	< 0.10	> 180
Diethylamine	BT ≥ 1 hr.	< 0.01	> 180
Dimethylformamide	BT ≥ 1 hr.	< 0.01	> 180
Ethyl acetate	BT ≥ 1 hr.	< 0.03	> 180
Ethylene oxide (gas)	BT ≥ 1 hr.	< 0.01	> 180
Hexane	BT ≥ 1 hr.	< 0.01	> 180
Hydrogen chloride (gas)	BT ≥ 1 hr.	< 0.01	> 180
Methanol	BT ≥ 1 hr.	< 0.01	> 180
Methyl chloride (gas)	BT ≥ 1 hr.	< 0.01	> 180
Nitrobenzene	BT ≥ 1 hr.	< 0.01	> 180
Sodium hydroxide	BT ≥ 1 hr.	< 0.01	> 180
Sulfuric acid	BT ≥ 1 hr.	< 0.01	> 180
Tetrachloroethylene	BT ≥ 1 hr.	< 0.93	> 180
Tetrahydrofuran	BT ≥ 1 hr.	< 0.04	> 180
Toluene	BT ≥ 1 hr.	< 0.04	> 180

PROPERTY	REQUIREMENT	RESULT
7.4.2 Flammability Resistance		
• Afterflame	≤ 10 sec.	0 sec.
• Burn Distance	≤ 4 inch	0.25 inch
• Burning Behaviour	No melting/ dripping	PASS
7.4.3 Cut Resistance	> 25 mm	> 49 mm
7.4.4 Puncture Resistance	≥ 22 N	55 N
7.4.5 Cold Temperature Performance	≤ 0.057 Nm	0.0019 Nm
7.4.6 Glove Hand Function	< 600%	283%

NFPA 1991 Approval data, Chemical and Biological Terrorism Protection Requirements

PRODUCT NAME: TRELLCHEM HPS/VPS/VPS-FLASH		
VAPOR PROTECTIVE SUIT PERFORMANCE		
PROPERTY	REQUIREMENT	RESULT
7.6.4 Ensemble Inward Leakage	≤ 0.02%	HPS < 0.008% VPS < 0.007% VPS-Flash < 0.007%

GARMENT MATERIAL PERFORMANCE TRELLCHEM HPS/VPS/VPS-FLASH					
PROPERTY	REQUIREMENT	PERMEATION RATE (μg/cm²*min.)		RESULT	
7.6.1 Permeation Resistance, CK/ Cyanogen chloride	BT ≥ 1 hr.	None detected		> 1 hr.	
CG/Carbonyl chloride	BT ≥ 1 hr.	None detected		> 1 hr.	
DMA/Dimethyl sulfate	BT ≥ 1 hr.	< 0.10		> 3 hrs.	
AC (HCN)/ Hydrogen cyanide	BT ≥ 1 hr.	HPS 0.0140 0.0140 0.0135	VPS 0.0081 0.0062 0.0065	> 1 hr.	
7.6.2 Permeation Resistance, GB/ Sarin	60 min cumulative permeation ≤ 1.25 μg/cm²			HPS 0.00629 0.00616 0.00810 μg/cm²	VPS/VPS-Flash 0.00840 0.00864 0.01137 μg/cm²
HD/Sulfur mustard, distilled	60 min cumulative permeation ≤ 4 μg/cm²			HPS 0.02964 0.02447 0.01319 μg/cm²	VPS/VPS-Flash 0.03498 0.01828 0.02225 μg/cm²

GARMENT SEAM PERFORMANCE TRELLCHEM HPS/VPS/VPS-FLASH					
PROPERTY	REQUIREMENT	PERMEATION RATE (μg/cm²*min.)		RESULT	
7.6.1 Permeation Resistance, CK/ Cyanogen chloride	BT ≥ 1 hr.	None detected		> 1 hr.	
CG/Carbonyl chloride	BT ≥ 1 hr.	None detected		> 1 hr.	
DMA/Dimethyl sulfate	BT ≥ 1 hr.	< 0.10		> 3 hrs.	
AC (HCN)/ Hydrogen cyanide	BT ≥ 1 hr.	HPS 0.0070 0.0070 0.0073	VPS 0.0096 0.0091 0.0122	> 1 hr.	
7.6.2 Permeation Resistance, GB/ Sarin	60 min cumulative permeation ≤ 1.25 μg/cm²			HPS 0.01063 0.01043 0.01451 μg/cm²	VPS/VPS-Flash 0.04221 0.03859 0.05638 μg/cm²
HD/Sulfur mustard, distilled	60 min cumulative permeation ≤ 4 μg/cm²			HPS 0.02821 0.01888 0.02062 μg/cm²	VPS/VPS-Flash 0.01643 0.01824 0.02081 μg/cm²

VISOR MATERIAL PERFORMANCE			
PROPERTY	REQUIREMENT	PERMEATION RATE ($\mu g/cm^2$*min.)	RESULT
7.6.1 Permeation Resistance, CK/ Cyanogen chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
CG/Carbonyl chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
DMA/Dimethyl sulfate	BT $\geq$ 1 hr.	$<$ 0.10	$>$ 3 hrs.
AC (HCN)/ Hydrogen cyanide	BT $\geq$ 1 hr.	0.0073 0.0062 0.0073	$>$ 1 hr.
7.6.2 Permeation Resistance, GB/ Sarin	60 min cumulative permeation $\leq$ 1.25 $\mu g/cm^2$		0.11015 0.11174 0.13749 $\mu g/cm^2$
HD/Sulfur mustard, distilled	60 min cumulative permeation $\leq$ 4 $\mu g/cm^2$		0.03297 0.02135 0.02617 $\mu g/cm^2$

VISOR SEAM PERFORMANCE			
PROPERTY	REQUIREMENT	PERMEATION RATE ($\mu g/cm^2$*min.)	RESULT
7.6.1 Permeation Resistance, CK/ Cyanogen chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
CG/Carbonyl chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
DMA/Dimethyl sulfate	BT $\geq$ 1 hr.	$<$ 0.10	$>$ 3 hrs.
AC (HCN)/ Hydrogen cyanide	BT $\geq$ 1 hr.	0.0060 0.0081 0.0099	$>$ 1 hr.
7.6.2 Permeation Resistance, GB/ Sarin	60 min cumulative permeation $\leq$ 1.25 $\mu g/cm^2$		0.30522 0.32881 0.21922 $\mu g/cm^2$
HD/Sulfur mustard, distilled	60 min cumulative permeation $\leq$ 4 $\mu g/cm^2$		0.02133 0.03739 0.02996 $\mu g/cm^2$

GLOVE PERFORMANCE			
Glove combination: Perfect Fit KV18AJTC Kevlar® over glove Guardian Mfg. In-35A Chloroprene rubber outer glove North 4H/Silver Shield® inner glove			
PROPERTY	REQUIREMENT	PERMEATION RATE ($\mu g/cm^2$*min.)	RESULT
7.6.1 Permeation Resistance, CK/ Cyanogen chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
CG/Carbonyl chloride	BT $\geq$ 1 hr.	None detected	$>$ 1 hr.
DMA/Dimethyl sulfate	BT $\geq$ 1 hr.	$<$ 0.10	$>$ 3 hrs.
AC (HCN)/ Hydrogen cyanide	BT $\geq$ 1 hr.	0.0052 0.0070 0.0068	$>$ 1 hr.
7.6.2 Permeation Resistance, GB/ Sarin	60 min cumulative permeation $\leq$ 1.25 $\mu g/cm^2$		0.01259 0.01596 0.01344 $\mu g/cm^2$
HD/Sulfur mustard, distilled	60 min cumulative permeation $\leq$ 4 $\mu g/cm^2$		0.01555 0.01901 0.01832 $\mu g/cm^2$

Trellchem HPS ☐	Trellchem VPS ☐	Trellchem VPS-Flash ☐	Type T ☐	Type TE ☐	Production No:	
RESPONSE LOG				INSPECTION LOG		
Date	Chemical(s) to which the suit was exposed	Duration of exposure	Name of the wearer	Final air pressure reading	Suit inspected on (date) by (name)	Remarks
Trelleborg Protective Products AB, Johan Kocksgatan 10, SE-231 81 Trelleborg. Tel: +46 (0)410-51000, Fax: +46 (0)410-51850						

Trellchem HPS ☐	Trellchem VPS ☐	Trellchem VPS-Flash ☐	Type T ☐	Type TE ☐	Production No:	
RESPONSE LOG				INSPECTION LOG		
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