CWA DETECTION TUBES

A line of 23 tubes covers all known important CWA. The most frequent manufactured and sold types:

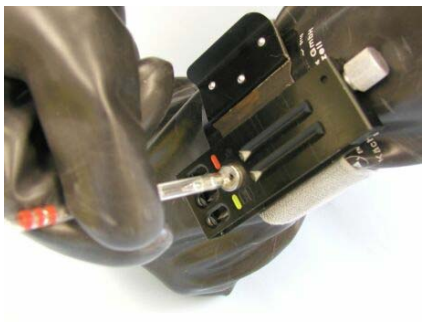
Code	Agent Detected	Sensitivity mg / m^3	Code	Agent Detected	Sensitivity mg / m^3
TT11	**G, V** (biochemical)	0,05	TT17	**AC, CK**	0,5 / 0,5
TT13	**H, HD, T, Q, HN**	1,0	TT18	**CG, DP**	1,0
TT15	**HD**	3,0	TT19	**CG, DP, H**	3 / 3
TT16	**HN**	1,0	TT20	**BZ**	1,0
TT14	**L**	1,0	TT21	**CN**	0,5
TT12	**CG, CK, AC, DP**	5,0	TT22	**CS**	1,0

The tubes are not intended for exact pump but can be used in any hand and/or electrical pumps designed for the detector tubes application. Designed with ∅ 6 mm, length 93÷105 mm, according to customer requirement.

Advantages:

- Wide choice of tubes. Shelf life 5 years for all tubes including the biochemical TT11.
- Environmental friendly – no Hg and Os used for detection methods.
- Possible to use in many known pumps (Czech UNIVER, Draeger, MSA AUER, Yugoslavian, etc.).
- Available simulants to train with tubes safely in a standard room.

Accessories, to open tubes and pump



Tube opening

Ampoule opening

Tube TT11 in a hand pump UNIVER

Electric pump CHP-71

New electric pump CHP-5

Manufactured by: **ORITEST Ltd**

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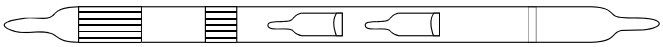
PRODUCT INFORMATION	
CWA DETECTION TUBE	TT 10

Application	**NERVE AGENTS GB, GD**
Code	**TT-10**
Marking	1 red stripe
Sensitivity	0.5 $mg.m^{-3}$ for sarin
Sucking	30 strokes per 100 ml, or 3 litres
Colour	Grey → yellow up to orange
Reaction	Aminoperoxide reaction
Description	The detection tube contains one layer and two ampoules with solutions. The layer contains silicagel impregnated with sodium phosphate. The upper ampoule contains the solution of hydrogen peroxide in a mixture of isopropyl alcohol and water; the bottom ampoule contains the solution of o-dianisidine in acetone.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and both ampoules are broken at once. Their content is shaken down into a layer. The layer colour is compared with the etalon.
Selectivity	Only nerve agents of the G type (tabun, sarin, soman, cyclosin) can be detected using the tube; of the other chemical warfare agents (CWA), only phosgene, diphosgene and chlorocyanide react with a similar mechanism; of TIC, for example, phosphorus trichloride.
Interferences	Strong oxidizing agents, for example, chlorine or nitrogen dioxide that react directly with o-dianisidine, give similar colour.
Temperature	0-40°C (below 15°C heating required).
Humidity	The function of the tube does not depend on air humidity, water is embedded in the analytical system.

Construction



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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 11**

Application **NERVE AGENTS GB, GD, VX, GA, GF, GP**

Code **TT-11**

Marking 3 red stripes

Sensitivity 0.05 $mg.m^{-3}$ for sarin, soman

Suction 10 strokes per 100 ml, or 1 litre

Colour White → yellow

Reaction Biochemical reaction based on the inhibition of acetylcholine esterase that catalyzes the hydrolysis of acetylthiocholine

Description The detection tube contains two layers and two ampoules with solutions. The indication layer contains white granulated cellulose with immobilized beef brain acetylcholine esterase (usually bovine or pork). The comparative layer contains yellow crushed glass impregnated with acetylthiocholine substrate and chromogen preparation (Ellman's reagent). Both ampoules are filled with a buffer solution with pH 8.

Detection Procedure The ampoule is broken and its content is shaken down on the cellulose. Execute a prescribed number of strokes (equivalent air volume), wait the prescribed time, break the second ampoule and shake down its content through the crushed glass on the cellulose. The change of the colour of the indication layer is evaluated. If a yellow colour appears in the specified time, the atmosphere does not contain CWA; the layer remains unchanged in the opposite case or, as the case may be, the yellow colour appears only after a longer time.

Selectivity All the types of nerve-paralyzing agents (G, GV, V series) and other compounds that inhibit acetylcholine esterase (organophosphorus or carbamate pesticides) can be detected using the tube.

Interferences High concentrations of oxidation, reduction, acid or alkaline gases and vapours decrease the sensitivity of the tube.

Temperature 0-40^{0}C (below 15°C heating required).

Humidity Water is embedded in the analytical system.

Construction

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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 12.1**

Application **PHOSGENE, DIPHOSGENE, CYANOGEN CHLORIDE, HYDROGEN CYANIDE CG (DP), CK, AC**

Code **TT-12.1**

Marking 3 green stripes

Sensitivity

Phosgene (diphosgene)	5 $mg.m^{-3}$
Cyanogen chloride	5 $mg.m^{-3}$
Hydrogen cyanide	5 $mg.m^{-3}$

Sucking 30 strokes per 100 ml, or 3 litres

Colour

Phosgene (diphosgene):	yellowish → red
Cyanogen chloride:	yellowish → pink
Hydrogen cyanide:	yellowish → pink

Reaction Phosgene and diphosgene react with 4-(p-nitrobenzyl)pyridine, yielding a quaternary ammonium salt.
Cyanogen chloride is indicated by the modified reaction according to König. 4-benzylpyridine and dimedone are the basic components of this preparation.
Hydrogen cyanide is converted to cyanogen chloride.

Description The detection tube contains three layers and an ampoule with the detection solution. The upper layer contains crushed glass and is intended for intercepting the precipitation in the ampoule for phosgene. The central layer contains chloramine B and is intended for converting hydrogen cyanide to cyanogen chloride. The bottom indication layer contains 4-benzylpyridine and dimedone is intended for the detection of cyanogen chloride. The ampoule contains the detection solution for phosgene (diphosgene) and contains 4-(p-nitrobenzyl)pyridine a N-phenylbenzylamine.

Detection Procedure The ampoule is broken and its content is shaken down on the layer. A prescribed number of strokes are executed (equivalent air volume) and the colour of individual layers is compared with the etalon.

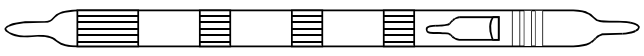
Selectivity The indication layer for phosgene and disphosgene is also sensitive to other acylation substances, for example, benzoyl chloride, chloromethyl formate…
The indication layer for cyanogen chloride is specific to halogenocyanides and phosgeneoxime.

Interferences High concentrations of hydrogen chloride and other strongly acid gases and vapours may interfere with the detection of phosgene and diphosgene. The layer becomes yellow under the effect nitrogen dioxide.
The layer for cyanogen chloride becomes pink by the action of nitrogen dioxide.

Temperature 0-50°C (below 15°C heating required).

Humidity The tube can be used in a broad range of air humidity (10-90%).

Construction



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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 12**

Application **PHOSGENE, DIPHOSGENE, CYANOGEN CHLORIDE, HYDROGEN CYANIDE CG (DP), CK, AC**

Code **TT-12**

Marking 2 green stripes

Sensitivity

Phosgene (diphosgene)	5 $mg.m^{-3}$
Cyanogen chloride	5 $mg.m^{-3}$
Hydrogen cyanide	5 $mg.m^{-3}$

Suction 30 strokes per 100 ml, or 3 litres

Colour

Phosgene (diphosgene)	yellowish → red
Cyanogen chloride:	yellowish → pink
Hydrogen cyanide:	yellow → orange up to brown

Reaction Phosgene and diphosgene react with 4-(p-nitrobenzyl)pyridine, yielding a quaternary ammonium salt. cyanogen chloride is indicated by the modified reaction according to König. 4-benzylpyridine and dimedone are the basic components of this preparation.
Hydrogen cyanide reduces sodium picrate yielding the sodium salt of isopurpuric acid.

Description The detection tube contains three indication layers formed by silicagel impregnated with chromogen preparations. The upper layer serves for the detection of phosgene (diphosgene), the central layer for the detection of cyanogen chloride and the bottom layer for the detection of hydrogen cyanide.

Detection Procedure A prescribed number of strokes are executed (equivalent air volume) and the colour of individual layers is compared with the etalon.

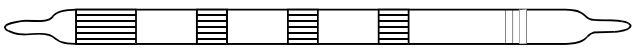
Selectivity The indication layer for phosgene and disphosgene is also sensitive to other acylation substances, for example, benzoyl chloride, chloromethyl formate, etc. The indication layer for cyanogen chloride responds to bromocyanide, but also to phosgeneoxime.
Other reducing agents may react similarly as hydrogen cyanide, unless they are intercepted by the preceding indication layer. For this reason, the detection of hydrogen cyanide is sufficiently selective.

Interferences High concentrations of hydrogen chloride and other strongly acid gases and vapours may interfere with the detection of phosgene and diphosgene. The layer becomes yellow by the effect nitrogen dioxide. The layer for cyanogen chloride becomes pink by the action of nitrogen dioxide.
The layer for hydrogen cyanide is coloured orange or brown by the action of higher concentrations of sulphur dioxide.

Temperature 0-50°C (below 15°C heating required). Under normal conditions, a higher sensitivity can be achieved, primarily for hydrogen cyanide, when heating the tube after sampling contaminated air.

Humidity The tube can be used in a broad range of air humidity (10-90%).

Construction



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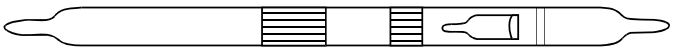
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 13**

Application	**MUSTARD, NITROGEN MUSTARD H, HD, HN**
Code	**TT-13**
Marking	1 yellow stripe
Sensitivity	1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 Litres
Colour	Yellowish → blue
Reaction	Reaction of mustards with 4-(p-nitrobenzyl)pyridine, a preparation for alkylation.
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by silicagel saturated with 4-(p-nitrobenzyl)-pyridine; the detection layer contains sodium perchlorate and sodium hydroxide.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	All types of sulphur mustards can be detected using the tube (technical H, distilled HD, sesqui Q, oxygen T) and nitrogen mustards (HN-1, HN-2, HN-3), similarly as other chlorinated alkyl sulfides or amines. The agents of the G series react at higher concentrations. In all these cases, blue colouring arises. With phosgene and diphosgene, red colouring arises, orange colouring with chloroacetophenone.
Interferences	The influence of other compounds: Dimethylsulphate gives a blue product, benzoylchloride an orange one, benzoylchloride a violet reaction product.
Temperature	0-50^{0}C (below 15°C heating required). When heating the tube after sampling contaminated air and before breaking the tube, a higher sensitivity can be achieved.
Humidity	Water is embedded in the analytical system.

Construction



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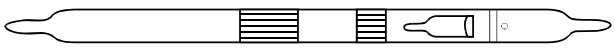
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 14.1**

Application	**LEWISIT L**
Code	**TT-14.1**
Marking	1 yellow stripe, 1 yellow dot
Sensitivity	1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White → pink Blue colouring may arise during a negative result.
Reaction	Liberation of acetylene and its reaction with Llosvay preparation
Description	The detection tube contains an indication layer and an ampoule with the detection solution. The indication layer contains silicagel impregnated with the modified Llosvay preparation; 20% sodium hydroxide forms the detection solution.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	The tube is selective for lewisit, its analogues L-2 and L-3 do not give this reaction, neither other CWA on the basis of arsenic.
Interferences	Hydrogen sulphide may interfere, because it yields brownish colouring, similarly as high concentrations of carbon disulphide.
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Water is embedded in the analytical system.

Construction



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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 14.2**

Application	**WARFARE ARSINES SA, L, DA, DC**
Code	**TT-14.2**
Marking	1 yellow stripe, 1 blue stripe
Sensitivity	1 $mg.m^{-3}$ lewisite
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellowish → pink
Reaction	Hydrogen arsenide released by the reaction with hydrogen is indicated by the reaction with silver diethyldithiocarbamate with the formation of a colour complex.
Description	The detection tube contains an indication layer, a retention layer (silicagel), a layer of granulated zinc and an ampoule with the detection solution. The indication layer contains silicagel impregnated with silver diethyldithiocarbamate in 4-benzylpyridine; the ampoule contains diluted hydrochloric acid and copper chloride.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the retention layer (the zinc layer must be wetted). Another number of strokes is then executed and the colour of the layer is compared with the etalon.
Selectivity	The tube makes it possible to detect hydrogen arsenide (before the ampoule is broken), lewisite, diphenylchloro arsine, diphenylcyano arsine and some other warfare arsines. Adamsite does not give a positive result.
Interferences	Hydrogen sulphide may interfere, because it yields yellow up to grey colouring (AgS).
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Water is embedded in the analytical system.
Notes	It is not permissible to expose the detection tube to the effect of direct sunlight.
Construction	

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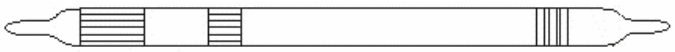
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 14.3**

Application	**HYDROGEN ARSENIDE SA**
Code	**TT-14.3**
Marking	1 yellow stripe, 2 blue stripes
Sensitivity	0.5 $mg.m^{-3}$
Strokes	30 strokes per 100 ml, or 3 litres
Colour	Yellowish → pink
Reaction	Hydrogen arsenide released by the reaction with hydrogen is indicated by the reaction with silver diethyldithiocarbamate with the formation of a colour complex.
Description	The detection tube contains one indication layer, silicagel impregnated with silver diethyldithiocarbamate in 4-benzylpyridine.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of the layer is compared with the etalon.
Selectivity	Other CWA do not react.
Interferences	Hydrogen sulphide may interfere, because it gives a yellow up to grey colouring (formation of AgS).
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	The detection tube is resistant to changes of air humidity.
Notes	It is not permissible to expose the detection tube to the effect of direct sunlight for a long time.

Construction



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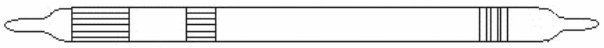
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 15**

Application	**SULPHUR MUSTARD H, HD**
Code	**TT-15**
Marking	2 yellow stripes
Sensitivity	3 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellow → orange (up to red)
Reaction	Probably an addition complex of mustard with 4,4'-bis(diethylamino)benzophenone and magnesium perchlorate
Description	The detection tube contains one indication layer, silicagel impregnated with chromogen preparations (ethyl Michler's ketone, magnesium perchlorate).
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of the layer is compared with the etalon.
Selectivity	All types of sulphur mustards can be detected using the detection tube (technical H, distilled HD, sesqui Q, oxygen T), similarly as other chlorinated alkylsulphides. In all these cases, an orange colouring arises. In the presence of phosgene (diphosgene) and other acylation preparations (acetyl chloride, benzoyl chloride) at concentrations above 20 mg/m^3, a green colouring arises.
Interferences	High concentrations of hydrogen chloride and ammonia (similarly acid and alkaline gases) cause discolouration of the indication layer.
Temperature	15-50^{0}C (below 15°C heating required). Under normal conditions, a significantly higher sensitivity can be achieved when heating the tube after sampling contaminated air.
Humidity	The declared sensitivity of the detection tube is not lowered even at relative air humidity above 90%.

Construction



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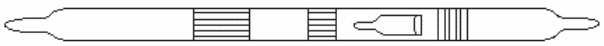
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 16**

Application	**NITROGEN MUSTARD HN**
Code	**TT-16**
Marking	3 yellow stripes
Sensitivity	1 $mg.m^{-3}$ for HN-3
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellow → orange
Reaction	Reaction with the Dragendorff's reagent
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by activated silicagel; the detection solution contains the Dragendorff's reagent.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	All types of nitrogen mustards (HN-1, HN-2, HN-3) can be detected by using the tube. Of the other CWA, the followings agents react similarly: BZ, phencyklidin, CR, VX.
Interferences	The presence of other substances that do not have the character of CWA and also give a colour response (alkaloids, amines, pyridines, etc.), can be considered as an interfering effect.
Temperature	0-40^{0}C (below 15°C heating required).
Humidity	Water is embedded in the analytical system.

Construction



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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 17.1**

Application **HYDROGEN CYANIDE AC**

Code **TT-17.1**

Marking 1 blue stripe, 1 blue dot

Sensitivity 0.5 $mg.m^{-3}$

Suction 30 strokes per 100 ml, or 3 litres

Colour Grey → red-violet

Reaction Hydrogen cyanide reacts with 4-nitrobenzaldehyde in the presence of pyridine, giving rise to coloured benzoin.

Description The detection tube contains one layer and an ampoule with the detection solution. The layer contains silicagel impregnated with sodium carbonate; the detection solution contains 4-nitrobenzaldehyde in pyridine.

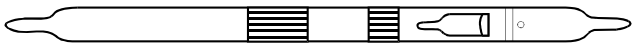
Detection Procedure The ampoule is broken and its content is shaken down into the layer. A prescribed number of strokes are executed (equivalent air volume) and the colour of the layer is compared with the etalon.

Selectivity Apart from hydrogen cyanide, tabun, which easily releases hydrogen cyanide, can also be detected (GA sensitivity about 1 $mg.m^{-3}$).

Temperature 0-50^{0}C (below 15°C heating required).

Humidity Optimum 10-95% of the relative humidity of air.

Construction



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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 17.2**

Application	**HYDROGEN CYANIDE AC, CYANOGEN CHLORIDE CK**
Code	**TT-17.2**
Marking	1 blue stripe
Sensitivity	3 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	AC: grey › red-violet CK: yellowish → red-violet
Reaction	Hydrogen cyanide reacts with 4-nitrobenzaldehyde in the presence of pyridine giving rise to coloured benzoin. According to König, cyanogen chloride reacts with pyridine and dimedone giving rise to a polymethine dye.
Description	The detection tube contains two layers and an ampoule with the detection solution. The upper layer contains silicagel impregnated with sodium carbonate; the bottom layer contains silicagel impregnated with dimedone; the detection solution contains 4-nitrobenzaldehyde in pyridine.
Detection Procedure	The ampoule is broken and its content is shaken down into the layer. A prescribed number of strokes are executed (equivalent air volume) and the colour of the bottom layer is compared with the etalon.
Selectivity	Apart from hydrogen cyanide, tabun, which easily releases hydrogen cyanide, can also be detected. Bromocyanide and phosgeneoxime reacts similarly as cyanogen chloride.
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Optimum 10-95% of the relative humidity of air.

Construction

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PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 17**

Application	**HYDROGEN CYANIDE AC, CYANOGEN CHLORIDE CK**
Code	**TT-17**
Marking	1 blue stripe
Sensitivity	0.5 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellow → red-violet
Reaction	According to König, cyanogen chloride reacts with 4-benzylpyridine and dimedone giving rise to a polymethine dye. Hydrogen cyanide is converted to cyanogen chloride by means of a chlorination preparation.
Description	The detection tube contains two layers. The upper layer (auxiliary) contains silicagel impregnated with chloramine B, the bottom layer (indication) contains silicagel impregnated with 4-benzylpyridine and dimedone.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of the bottom layer is compared with the etalon.
Selectivity	Cyanogen bromide and phosgeneoxim (CX) react in the same manner, nitrogen dioxide gives the same pink colour.
Temperature	0-50^0C (below 15°C heating required).
Humidity	Optimum 10-95% of the relative humidity of air.

Construction

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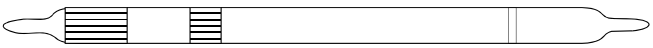
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 18**

Application	**PHOSGENE CG, DIPHOSGENE DP**
Code	**TT- 18**
Marking	1 green stripe
Sensitivity	1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellowish → red
Reaction	Phosgene and diphosgene react with 4-(p-nitrobenzyl)pyridine yielding a quaternary ammonium salt.
Description	The detection tube contains one indication layer that contains silicagel impregnated with sodium carbonate, 4-(p-nitrobenzyl)pyridine, N-phenylbenzylamine and stabilizers.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of the layer is compared with the etalon.
Selectivity	Acetyl chloride, benzoyl chloride and other acylation substances give the same colours as phosgene and diphosgene.
Interferences	High concentrations of hydrogen chloride and other acid gases and vapours decrease the sensitivity to phosgene.
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Optimum 10-95% of the relative humidity of air.

Construction



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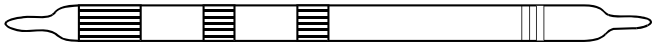
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 19**

Application	**SULPHUR MUSTARD HD, PHOSGEN (DIPHOSGENE)**
Code	**TT-19**
Marking	1 yellow stripe, 1 green stripe
Sensitivity	3 $mg.m^{-3}$ HD, CG (DP)
Suction	30 strokes per 100 ml, or 3 litres
Colour	HD: yellow → orange (up to red) CG: yellowish → red
Reaction	HD: Probably an addition complex of mustard gas with 4,4'-bis(diethylamino)benzophenone and magnesium perchlorate CG: Reaction with 4-(p-nitrobenzyl)pyridine yielding a quaternary ammonium salt
Description	The detection tube contains two indication layers. The upper indication layer contains silicagel impregnated with the ethyl analogue of Michler's ketone and magnesium perchlorate; the bottom indication layer contains silicagel impregnated with 4-(p-nitrobenzyl)pyridine and N-phenylbenzylamine.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of both layers is compared with the etalon.
Selectivity	All types of sulphur mustards can be detected using the detection tube (technical H, distilled HD, sesqui Q, oxygen T), similarly as other chlorinated alkylsulphides. In all these cases, an orange colouring arises. In the presence of phosgene (diphosgene) at concentrations above 20 mg/m^3, a green colouring arises. Diphosgene, acetyl chloride, benzoyl chloride and other acylation substances give the same colouring as phosgene at the bottom indication layer.
Interferences	High concentrations of hydrogen chloride and ammonia (similarly acid and alkaline gases) cause discolouration of the indication layer. High concentrations of hydrogen chloride and other acid gases and vapours decrease the sensitivity to phosgene.
Temperature	$15\text{-}50^0$C (below 15°C heating required). Under normal conditions, a significantly higher sensitivity can be achieved when heating the tube after sampling contaminated air.
Humidity	Optimum 10-90% of the relative humidity of air.

Construction



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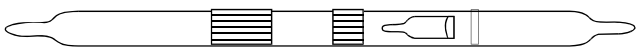
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 20**

Application	**AGENT BZ**
Code	**TT-20**
Marking	1 white stripe
Sensitivity	1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White → green-blue
Reaction	Reaction with the Marquis reagent (sulphuric acid and formaldehyde)
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by crushed glass, above which a layer of glass wool is placed. The detection solution contains the Marquis reagent.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	Of the known CWA, only substance BZ gives a green-blue colour; however, other psychoactive substances may also give a colour change, for example, opiates may cause red up to violet colouring. Other aromatic CWA that act in form of aerosol may cause a colouring of different shade: CS yellow, CR yellow, adamsite red-brown.
Interferences	The presence of sooth during burning of an organic material may be considered as an interfering effect, because sooth blackens the indication layer. Highly volatile aromatic substances, such as benzene, toluene or xylene, do not interfere.
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Optimum 10-90% of the relative humidity of air.

Construction



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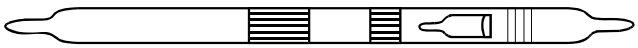
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 21**

Application	**AGENT CN**
Code	**TT-21**
Marking	2 white stripes
Sensitivity	0.5 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White → raspberry red
Reaction	Reaction with m-dinitrobenzene (Zimmermann's reaction).
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer contains silicagel impregnated with m-dinitrobenzene. The detection solution contains 20% sodium hydroxide.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	Of the CWA, agent CS also gives raspberry red colour (minimum sensitivity 1 $mg.m^{-3}$) or bromobenzylcyanide; at higher concentrations, acetone, bromoacetone and other substances giving the Zimmermannn's reaction react similarly.
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Water is embedded in the analytical system.

Construction



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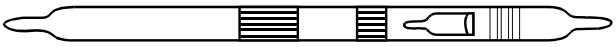
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 22**

Application	**AGENT CS**
Code	**TT-22**
Marking	3 white stripes
Sensitivity	1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White › green-blue
Reaction	Reaction with chloranil.
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by activated silicagel impregnated with chloranil. The detection solution contains a mixture of ammonium hydroxide with ethanol.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	The reaction is relatively selective, nitrogen mustard HN-3 may give a similar colour, other HN a red up to a violet colour.
Temperature	0-50^{0}C (below 15°C heating required)
Humidity	Water is embedded in the analytical system.

Construction



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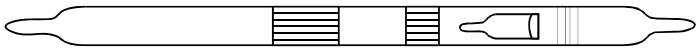
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 23**

Application	**CYANOGEN CHLORIDE CK**
Code	**TT-23**
Marking	2 blue stripes
Sensitivity	0.5 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellowish → red-violet
Reaction	According to König, cyanogen chloride reacts with 4-benzylpyridine and dimedone to a polymethine dye.
Description	The detection tube contains one layer and an ampoule with the detection solution. The layer contains silicagel impregnated with dimedone; the detection solution contains 4-benzylpyridine in ethanol.
Detection Procedure	The ampoule is broken and its content is shaken down on the layer. A prescribed number of strokes are executed (equivalent volume of air) and the layer colour is compared with the etalone.
Selectivity	Apart from cyanogen chloride, cyanogen bromide and phosgeneoxime can also be detected.
Interferences	Nitrogen dioxide may cause a colour effect.
Temperature	0-50^{0}C (below 15°C heating required)
Humidity	Optimum 10-95% of the relative humidity of air.

Construction



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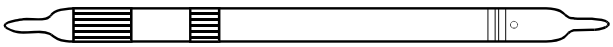
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 24**

Application	**HYDROGEN CYANIDE AC**
Code	**TT-24**
Marking	2 blue stripes, 1 blue dot
Sensitivity	10 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	Yellow → orange-brown
Reaction	Hydrogen cyanide reacts with sodium picrate yielding the sodium salt of isopurpuric acid.
Description	The detection tube contains one indication layer that contains silicagel impregnated with sodium carbonate, picric acid and dimethyl sulfoxide.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume) and the colour of the layer is compared with the etalon.
Selectivity	Sulphur dioxide, hydrogen sulfide and other reducing substances give a similar colour.
Interferences	High concentrations of acid gases and vapours decrease the detection sensitivity.
Temperature	10-50^{0}C (below 15°C heating required).
Humidity	Optimum 10-70% of the relative humidity of air.

Construction



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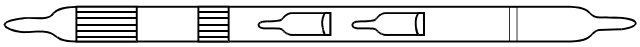
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 25**

Application	**CHLOROPICRIN PS**
Code	**TT- 25**
Marking	1 green stripe, 1 white stripe
Sensitivity	10 $mg.m^{-3}$
Strokes	30 strokes per 100 ml, or 3 litres
Colour	Yellowish → pink up to red
Reaction	Chloropicrin reacts with N,N-dimethylaniline with the formation of a colour product.
Description	The detection tube contains a layer with silicagel and two ampoules. One ampoule contains 10% N,N-dimethylaniline in toluene, the other one 30% hydrogen peroxide.
Detection Procedure	A prescribed number of strokes are executed (equivalent air volume), both ampoules are broken and their content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	Chlorine or nitrogen dioxide may give the same colour as chloropicrin.
Temperature	$0\text{-}50^{0}C$ (below 15°C heating required).
Humidity	Optimum 10-95% of the relative humidity of air.

Construction



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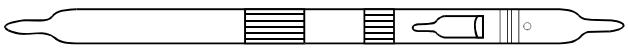
PRODUCT INFORMATION	
CWA DETECTION TUBE	**TT 26**

Application	**ADAMSITE**
Code	**TT-26**
Marking	2 white stripes, 1 dot
Sensitivity	3 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White → green
Reaction	Several reactions proceed simultaneously: a) Reaction of adamsite with sulphuric acid; mechanism is not known; b) In the environment of sulphuric acid, mercury nitrate gives nitric acid that nitrates the adamsite molecule. c) The effect of mercury nitrate (mechanism is not known).
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by unimpregnated silicagel; the detection solution contains mercury nitrate in concentrated sulphuric acid.
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	Green colouring is specific for adamsite; chloroacetophenone may give a similar colour of a different shade (red), bromobenzylcyanide or vapours of petrol or kerosine (yellow up to yellow-brown).
Temperature	0-50^{0}C (below 15°C heating required).
Humidity	Optimum 10-90% of the relative humidity of air.

Construction



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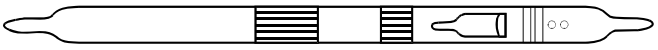
PRODUCT INFORMATION	
CWA DETECTION TUBE	TT 27

Application	**AGENT CR**
Code	**TT-27**
Marking	2 white stripes, 2 dots
Sensitivity	0.1 $mg.m^{-3}$
Suction	30 strokes per 100 ml, or 3 litres
Colour	White (yellowish) → red-violet
Reaction	Diazo-coupling reaction Agent CR acts as a diazotation reagent The arising diazonium salt couples with the Bratton-Marshall reagent to a characteristic azo dye.
Description	The detection tube contains an indication layer and ampoule with the detection solution. The indication layer is formed by activated silicagel impregnated with sodium nitrite. The detection solution contains N-(1-naphthyl)-ethylendiamine hydrochloride in the mixture of pyridine with 20% hydrochloric acid (1:1).
Detection Procedure	A prescribed number of strokes are executed (equivalent volume of air), the ampoule is broken and its content is shaken down on the layer. The layer colour is compared with the etalon.
Selectivity	The reaction is specific for agent CR.
Temperature	5-50^{0}C (below 15°C heating required).
Humidity	Water is embedded in the analytical system.

Construction



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