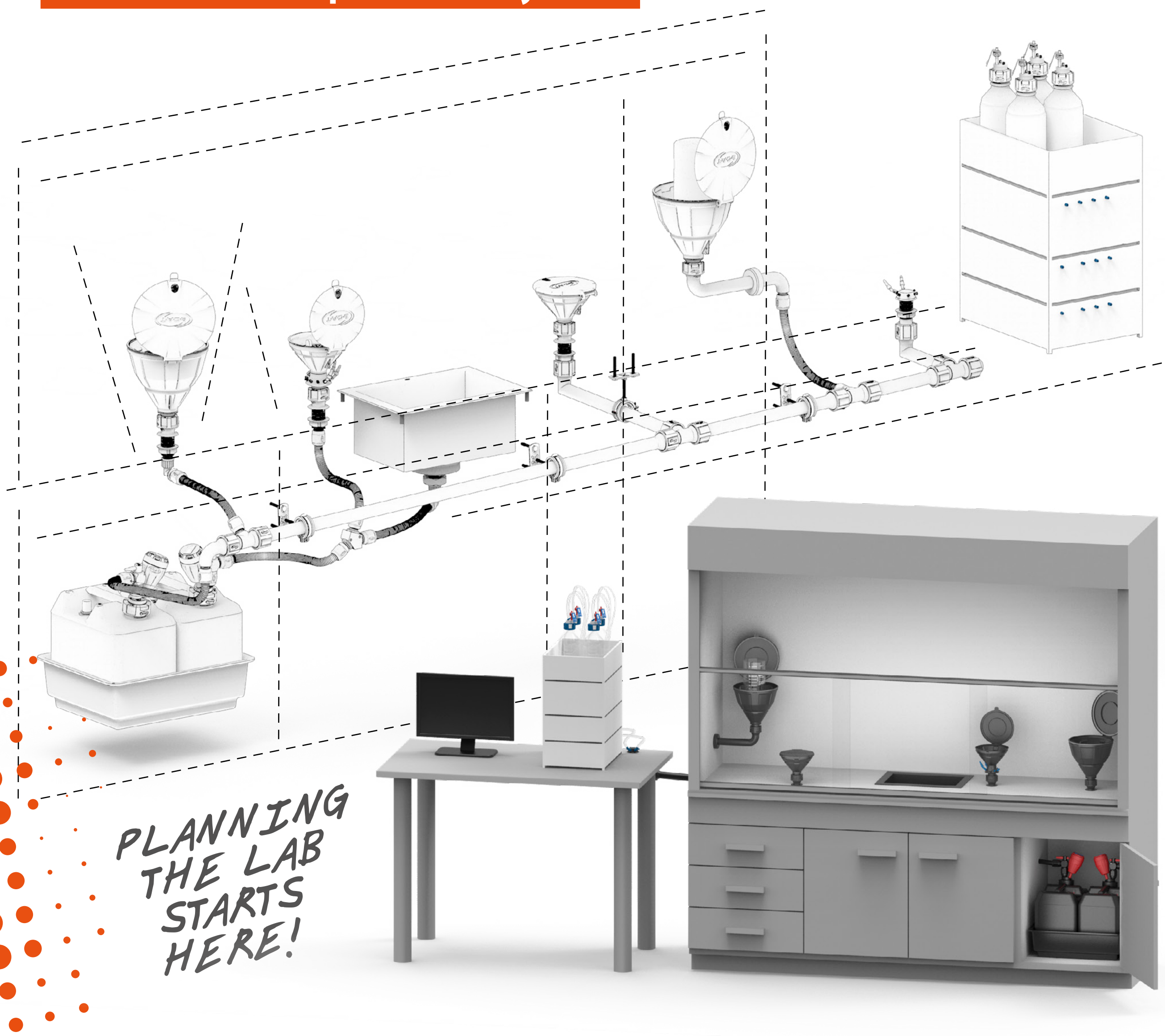
SymLine®
Chemical Waste Systems

SymLine - Intro

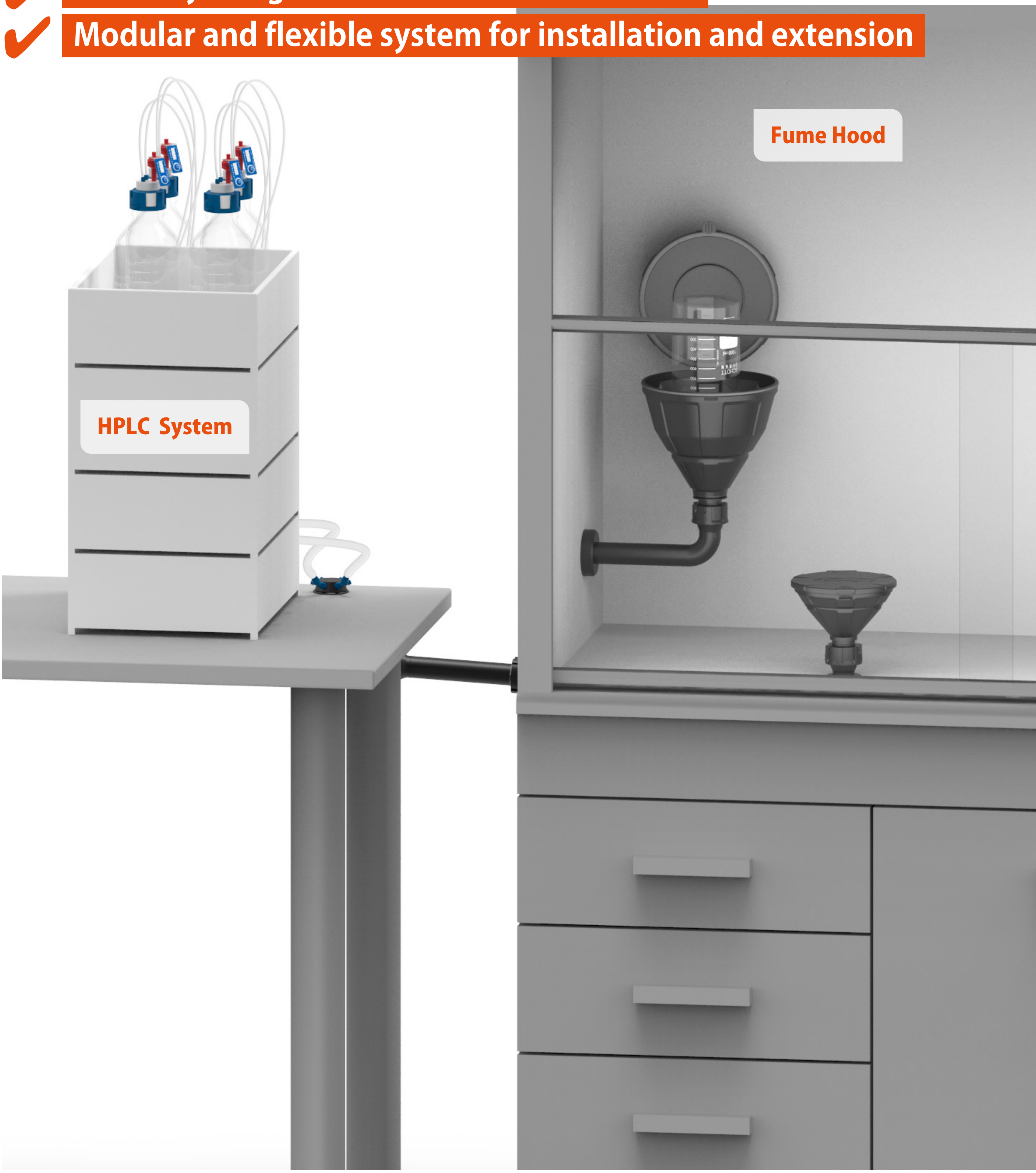
The right Strategy for Liquid Waste.

- ✔ **Environment and health safety**
- ✔ **Sustainable waste management**
- ✔ **Modular and expandable system**



a brand of S·C·A·T®

✔ Safe waste management for solvents
✔ Perfectly integratad in / at the lab furniture
✔ Modular and flexible system for installation and extension



Sample view for an HPLC connection and a SymLine integration in a fume hood.

Safety and maximum comfort in the disposal of liquid waste

This is what the SymLine® principle stands for. Environmental protection, more free space, fewer hazards at the workplace - the SymLine® system is integrated directly into your laboratory equipment. The waste containers are stored outside the work area for more safety, comfort and sustainable environmental protection.

The rear view of a laboratory fume hood.

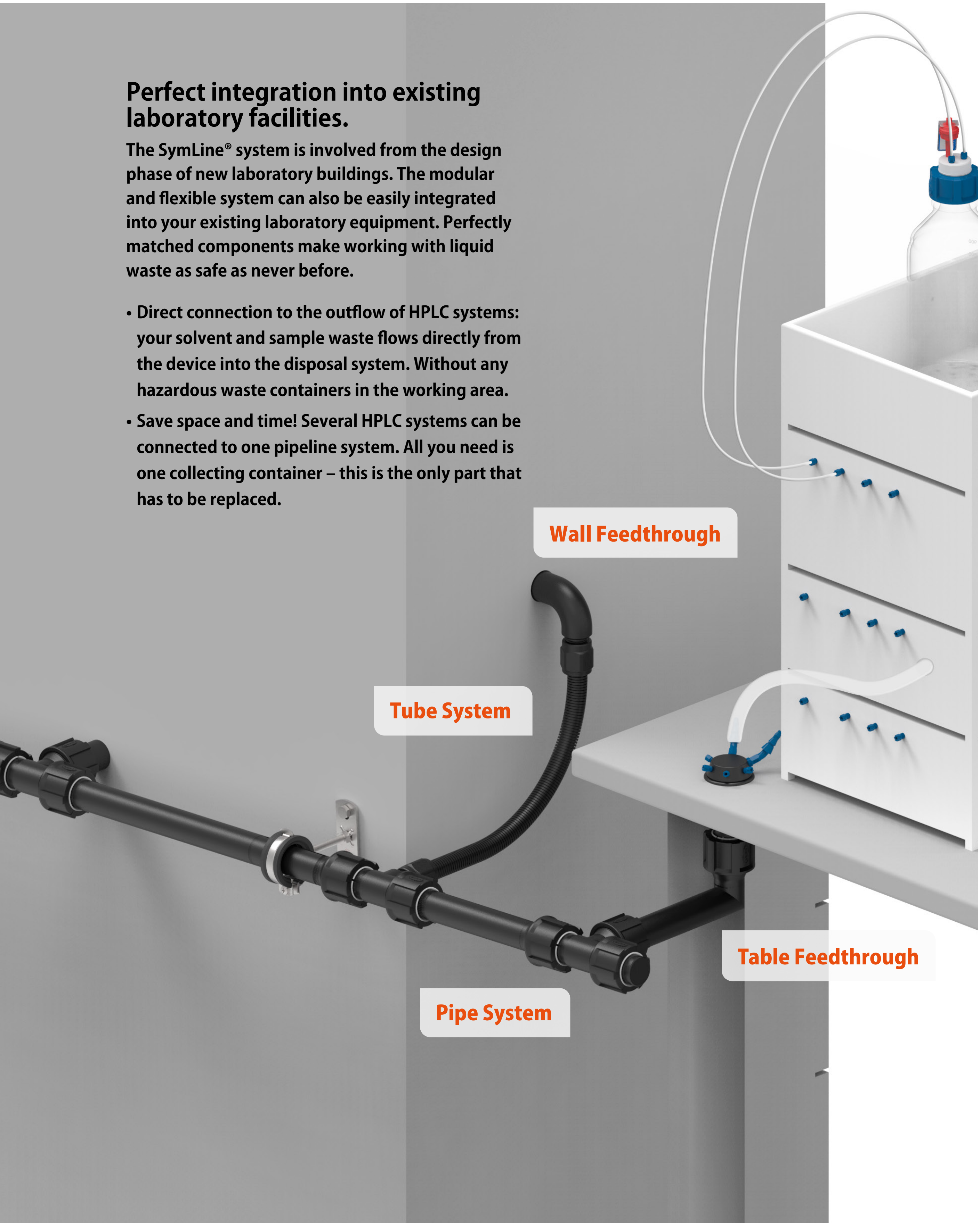
- ✔ **Perfectly integrated & modularly expandable**
- ✔ **Several workstations, one disposal system**
- ✔ **One central collection point**

The representation serves to illustrate possible installations and does not correspond to the real laboratory. Pipe system and attachment are installed in the service shaft of the fume hood.

Perfect integration into existing laboratory facilities.

The SymLine® system is involved from the design phase of new laboratory buildings. The modular and flexible system can also be easily integrated into your existing laboratory equipment. Perfectly matched components make working with liquid waste as safe as never before.

- **Direct connection to the outflow of HPLC systems: your solvent and sample waste flows directly from the device into the disposal system. Without any hazardous waste containers in the working area.**
- **Save space and time! Several HPLC systems can be connected to one pipeline system. All you need is one collecting container – this is the only part that has to be replaced.**



✔ **Compliant with TRGS & BGRCI**

✔ **Active disposal & storage**

✔ **Modular / individual configuration**

Extraction TRGS 727:

4.5.1 Conductive or dissipative containers
(1) During the filling and emptying of the container, all conductive or dissipative parts of the system must be electrically connected and grounded.

1 HPLC Connection

Connection of waste tubes directly to the disposal system!

2 Safety Funnels

Disposal is done directly in the fume hood - no long walks to the waste bins.

3 Sinks

For cleaning and rinsing laboratory glasses and instruments. The useful cover increases the work surface when not in use.

4 Pipe and Tube System

Numerous connection options for optimal integration. Individual tube lengths and adapters ensure maximum flexibility.

5 Grounding & Antistatic

Dissipative plastics ensure optimal protection against static charging and sparking!

6 Safety Waste Caps

Gases and vapours do not get into the laboratory air. Exhaust filters and vent lines eliminate health and environmental hazards effectively.

7 Containers

Collection containers for liquid waste.

8 Safety Cabinets

Explosion and fire protection according to the latest standards.

Filling Units

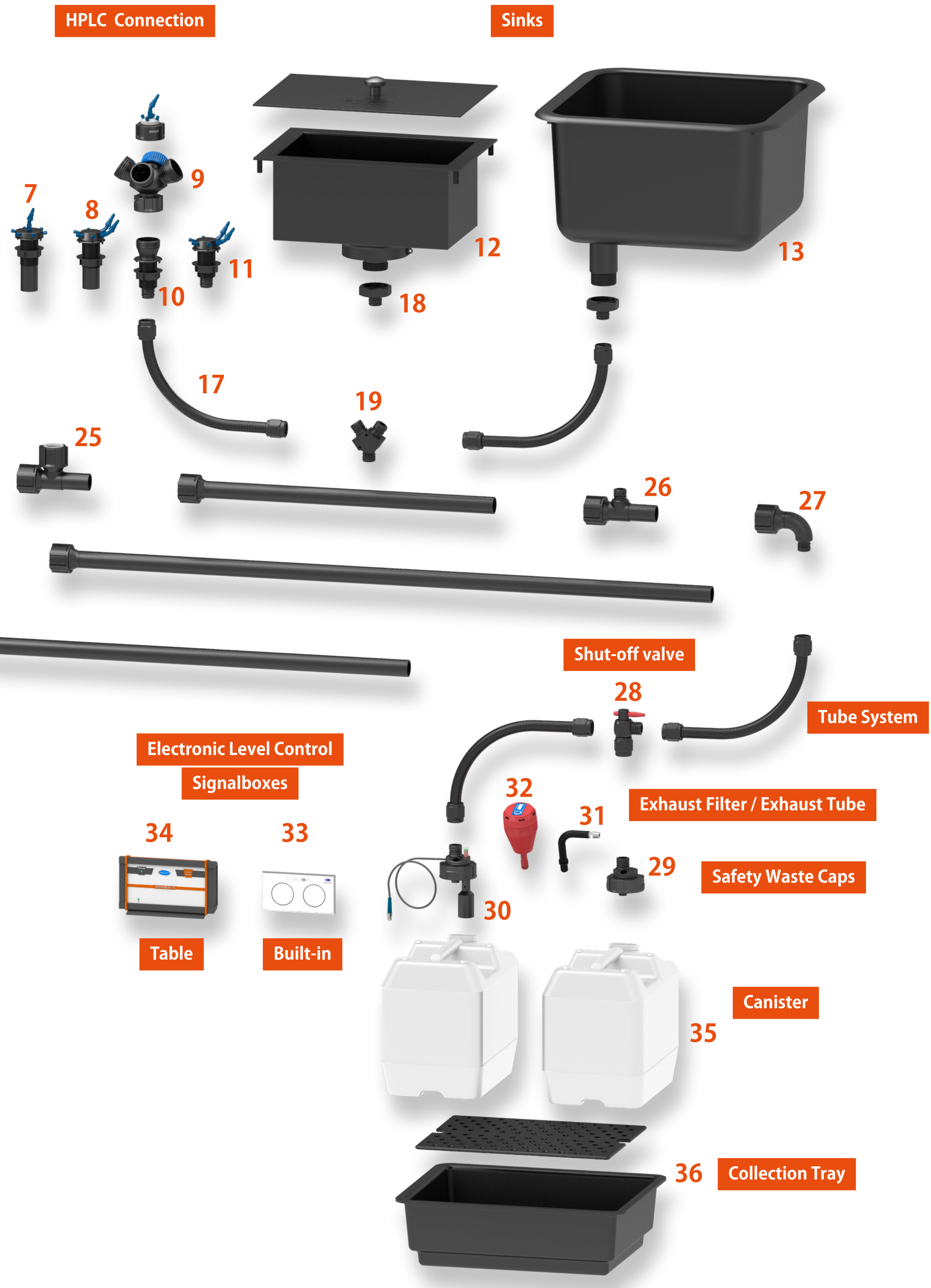
Feedthroughs

Pipe System

- One system, many possibilities
- Freely combinable
- Expandable

SymLine system components

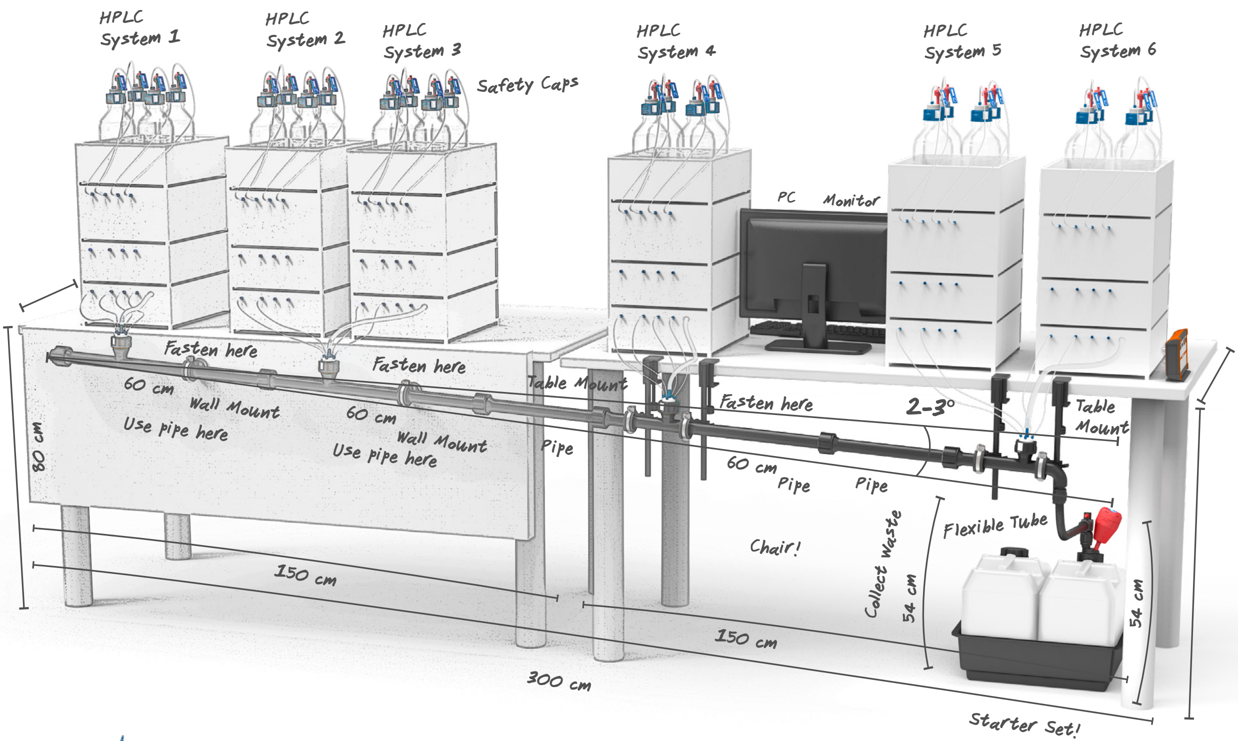
1 317 633 Funnel ARNOLD with sieve
2 317 638 Funnel ARNOLD with ball valve
3 318 962 Funnel MARCO
4 450 120 Funnel LISA-Extension
5 450 045 Safety Waste Cap LISA
6 306 498 Safety Waste Cap
7 106 412 HPLC Table feedthrough pipe
8 106 669 HPLC Table feedthrough flat pipe
9 306 509 4-in-1 Collector NICOLE
10 106 455 Table feedthrough tube connection
11 106 616 HPLC Table feedthrough flat tube
12 117 989 Sink with cover
13 118 003 Sink
14 106 450 Table feedthrough with pipe connection
15 106 601 Rear wall feedthrough for ARNOLD
16 106 612 Rear wall feedthrough for MARCO
17 106 569 SymLine FlexTube / 106 575 FlexTube Pro
18 106 584 Thread adapter sink/tube
19 106 476 Tube connector Y-Distributor
20 106 430 Connection pipe, angled 150 mm
21 106 438 Connection pipe, angled 200 mm
22 106 440 Connection pipe, angled 500 mm
23 106 690 Connection pipe, straight 600 mm
24 106 700 Connection pipe, straight 1200 mm
25 106 712 T-Piece for pipes
26 106 711 T-Piece for pipes with tube connection
27 106 456 Curved element pipe to tube
28 106 475 Shut-off valve
29 306 482 Safety Waste Cap
30 106 480 Safety Waste Cap electr. level control
31 106 490 Exhaust tube
32 410 535 Exhaust filter
33 106 548 Built-in Signalbox[2]
34 108 088 Table Signalbox
35 700 003 Canister
36 117 985 Collection tray with removable base insert


HPLC Connection
Sinks
7
8
9
10
11
12
13
18
17
19
25
26
27
Shut-off valve
28
Tube System
Electronic Level Control
Signalboxes
34
33
32
31
Exhaust Filter / Exhaust Tube
29
Safety Waste Caps
30
Table
Built-in
Canister
35
36
Collection Tray

- Consulting & planning
- Integrated installation
- Space-saving assembly

To the SymLine ″Classic“ system,
chapter "Filling Units", starting from page 32.

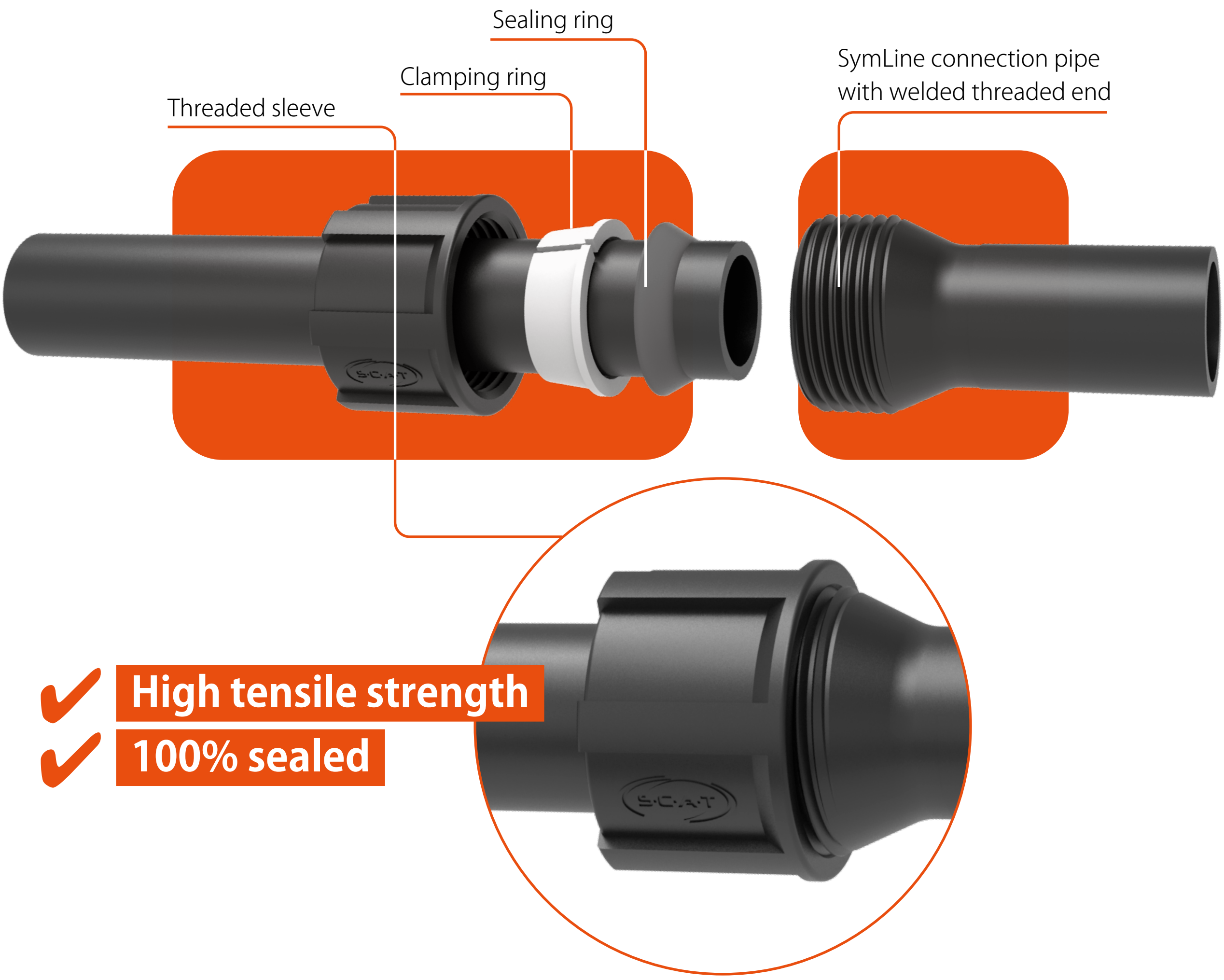
✔ Consulting & planning
✔ Do-it-yourself built-on
✔ Flexible conversion



To the SymLine FLEX system,
chapter ″FLEX“, starting from page 90.

The tubular system: safe attachment, optimum flow direction

The SymLine FLEX tube extensions have a funnel-shaped threaded sleeve at one end and a smooth tube opening at the other. In order to tightly interconnect the tubular system, the threaded sleeve, clamping ring and sealing ring are simply pushed over the smooth end of one tube, and this is then firmly screwed on to the threaded part of the following extension piece (i.e. on the other tube). When done properly (tightening torque 10 - 15 Nm), the resulting connection will withstand a tensile force of **400 N**. The system allows for optimum flow of waste liquids and prevents leakage.

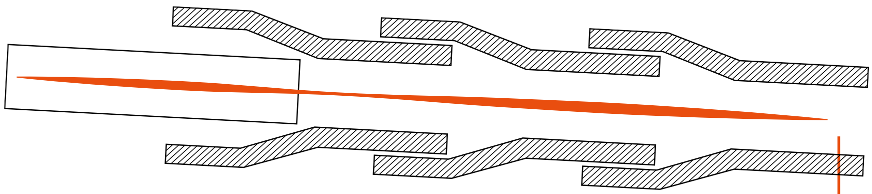


✔ **High tensile strength**
✔ **100% sealed**

Pipe system

The principle "smooth tube end runs in funnel-shaped threaded socket" optimally leads waste liquids and prevents leaks. This SymLine design is the global standard for all types of waste disposal cycles and their installations. Trust SymLine - the market leader - for safe disposal.

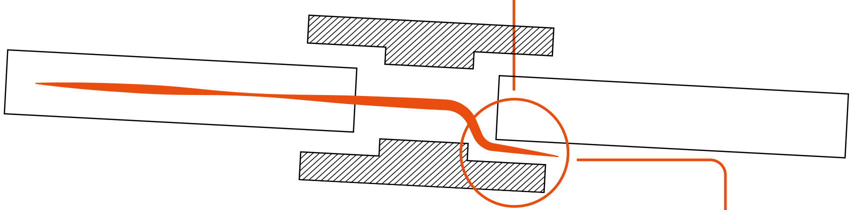
SymLine construction method - optimal for waste transport



SymLine construction, with optimum liquid flow. Liquids flow continually downwards, from the smooth pipe end, into the interconnected threaded one.

Typical construction principle - prone to leaking!

Place of possible problem



Smooth pipe ends are interconnected, using connecting sleeves. This results in increased danger of leakage.

Proactive protection against risks of ignition.

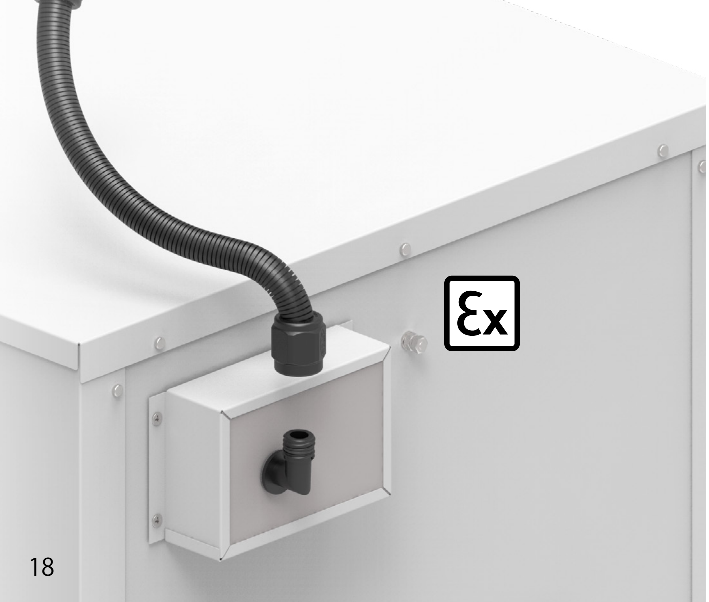
Why is grounding necessary?

Special care is required when collecting flammable liquids. Static charging may occur during drainage which is the cause of static sparking and increased fire risk. SymLine® built-in solutions made of electrostatic conductive plastics prevent static charging and can be secured by means of additional grounding connections.

There are a number of directives and regulations that define how to assess and avoid risks of ignition and which proactive measures to take. Of special importance are the German Trade Association Rules for Safety and Health at Work (BGR) issued by the German Federation of Institutions for Statutory Accident Insurance and Prevention, HVBG): BGR 132 - Directive 'Static Electricity'. In terms of contents this corresponds mainly to the international norm CENELEC 50404 and the latest Technical Regulations for Hazardous Substances (TRGS) TRGS 727 (formerly TRBS 2153) - Avoiding ignition risks caused by electrostatic charging. Electrostatic conductive synthetic materials which have a volume resistance $> 10^4\ \Omega$ & $< 10^9\ \Omega$ can be used in protective systems which are subject to the ATEX directive provided they are sufficiently grounded.

ATEX compliant!

SymLine® uses high-performance synthetic materials, provides an ideal link to safety cabinets and observes the ATEX directives.



By adding carbon, the plastic turns black and becomes electrostatic conductive.

SymLine material properties

All components made of electrostatic conductive plastic an be earthed and are suitable for voltage equalization, as per TRGS 727. Electrically conductive PE-HD EC displays a discharge resistance against earth of < 10^9 Ω, as per DIN EN 61340-5-1, and is suitable for Zones 0, 1 and 2, as per the German Hazardous Substances Ordinance (GefStoffV), EN 1127-1, DIN EN 60079-10-1 and DIN EN 60079-10-2. It is resistant to chemicals, as defined in SEFA 3 and SEFA 8.

- TRGS 727
- DIN EN 61340-5-1
- ATEX zone 0, 1 and 2
- EN 1127-1
- DIN EN 60079-10-1
- DIN EN 60079-10-2
- SEFA 3
- SEFA 8

The alternative to heavy stainless steel!

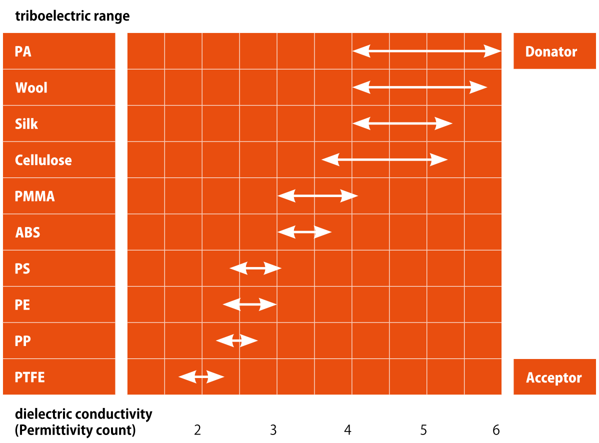
Organic solvents, acids, alkalis or other aggressive substances can be collected safely using the SymLine® system. There will be no problems of corrosion as they are exist with stainless steel. Heavy stainless steel canisters are very difficult to transport when full.
As a result of its light weight, electrostatic conductive plastic is the ideal material for use in the lab. This is why here SymLine® products have a considerable advantage.

When handling flammable liquids: risks of electrostatic ignition in the laboratory?

Author: Kurt Moritz
Kurt Moritz is the expert for electrostatics and mechanical explosion protection in the Technical Plant Safety department of **Merck KGaA, Darmstadt.**

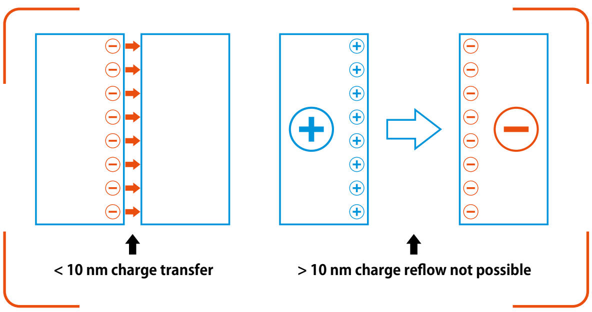
Electrostatics, commonly known as static electricity, is not produced through friction of two surfaces as per popular belief. It is generated by separating surfaces which have previously been in intensive contact. In this context, intensive contact refers to a surface having a dwell time, even if short, and a maximum distance of 10 mm to the other contact surface.

Depending on the conductivity and position in the triboelectric series, materials tend to pick up charged particles on their surfaces or transmit charged particles to the adjacent surface. In this case, conductive materials serve as electron suppliers (donator), while insulating materials absorb charged particles (acceptor).



Materials with higher permittivity serve as electron suppliers (donors). Those with lower permittivity tend to accept charged particles (acceptors).

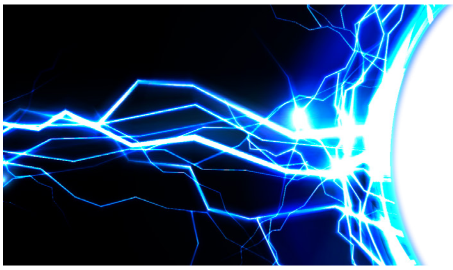
If the surfaces are separated quickly after such a charge transfer, and if at least one of these materials is a poor conductor of electricity, the electrical charge can no longer be transferred back to its origin. Consequently, this inability for charged particles to be transferred back results in an excess charge on one surface, while a charge deficiency is created on the other surface. During separation a voltage is generated, reaching up to the magnitude of kV.

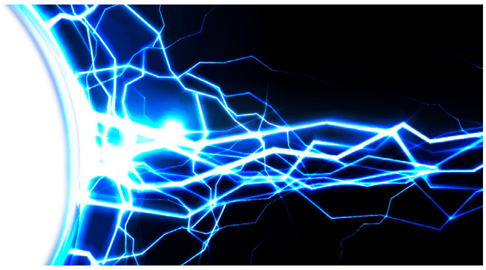


Charge transfer upon contact, charge separation by surface separation.

Therefore, electrostatics is always a surface effect and occurs on the surface on a molecular or atomic level.

When working with solids, it is easy to recognize separation processes that may lead to chargers, as these are generally visible movements. In general, visible movements are always present. Removing film layers, decanting material from a container or removing a synthetic piece of clothing from the body (fleece, polyester) are all examples that can lead to noticeable and sometimes visible static charge transfers.





As previously explained, for charge separation to occur at least one of the materials involved requires to be a poor conductor. Poor conductors (or „insulators“) include most plastics like PE, PVC, PVDF, PTFE, etc. However, solids are not measured in units of conductivity (unit: S/m) but in terms of their resistance (unit: Ωm). Siemens/ meter being the reciprocal of ohmmeter, the values are directly comparable, i.e. low conductivity corresponds to high resistance.

Liquids are also to be distinguished from an electrostatic point of view. Some substances also demonstrate a high resistance, meaning a poor ability to conduct electric charge.

These include, for example, aliphatic/aromatic hydrocarbons, such as ethers, as well as widely used solvents such as toluene, n-heptane, n-hexane, xylenes, etc.

Some nitriles (such as acetonitrile) and some esters are special in that they lead to unexpectedly high supercharges despite having relatively good conductivity - so far an unknown and hardly investigated effect. This means that electrostatic protection is especially important for such substances.

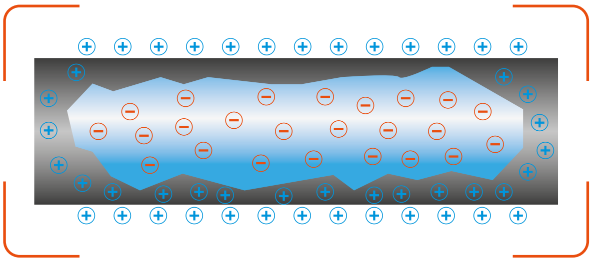
However, unlike to solids, the process of surface separation of liquids is not always recognizable as such.

It is difficult to visually distinguish between flowing and stagnant conditions of a liquid-filled glass pipe or semi-transparent HPLC tube.

Even if so: the liquid always remains in contact with the inside surface of the tube/pipe. **However, no surfaces are separated in this process, are they?**

This is common misconception. Unlike solids, a so-called electrochemical double layer (also called a Helmholz double layer) at the container or pipe wall with different electrically charged layers. While the liquid flows along the pipe, the charge layer primarily located in the liquid is carried along.

Surface roughness, flow-inhibiting installations and cross-sectional changes favour these effects, increasing the charge of the system.



Charge separation on a molecular basis during transfer.

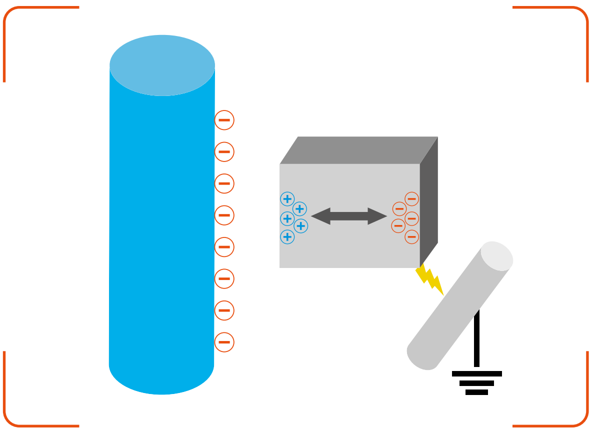
Of course, a certain volume of liquid as well as flow velocities are required in order to generate a charge.

In a closed system a flow velocity of typically <1 m/s is regarded as uncritical, as up to this point an equilibrium of charge transfer and charge reflow exists. However, this limit does not apply to pipe-exit conditions or decanting, since here different volume/ surface ratios are given. Furthermore, stopping the liquid flow will not allow for a charge reflow.

For the given reasons, filling a test tube from a laboratory wash bottle does not meet the criteria that lead to critical electrostatic charges, even though the wash bottle is also made of insulating material (generally LDPE or HDPE).

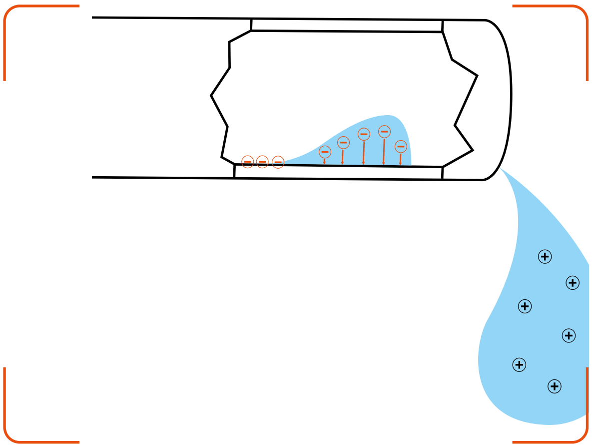
However, charges quantity is transferred at increasing velocities. **This situation may occur in capillaries and tubes of HPLC systems,** particularly when multiple tubes are combined, thus increasing the flow of waste solvents through a single tube. The associated separation or charging processes can be sufficiently strong to result in an electrostatic field being formed around the transfer tubes. If there are components inside the affected charge area which are conductive (such as metal parts) as well as non-grounded, they will become subject to a charge polarisation. This means that the opposing polarity increases towards the field; the same polarity is repelled. This polarisation effect of charged particles in non-grounded, conductive components can be so strong that a discharge of the excess charge or - depending on polarity - an equalisation of the charge deficit to the next grounded point takes place. Both generally manifest themselves in form of sparks.

A typical example of building up a charge through induction are metallic components such as couplings or brackets connected to a transfer tube made from insulating material.



Polarisation of conductive, non-grounded parts through "induction". This may lead to a charge equalisation in form of a spark.

Even when pouring liquids flowing over surfaces and are, subsequently, collected in containers (e.g. waste solvents that are poured through a funnel into a collection container), charges may accumulate. Initially, the funnel may take on one polarity due to the separation process between liquid and funnel. The oppositely charged liquid collects in the container and transmits its charge to the container. If the funnel and container are not electrically/electrostatically connected to each other, a different electric potential forms on both components, i.e. a charge that can be discharged in the form of sparks. This creates an ignition risk.



Charge separation when pouring a liquid with high conductivity (such as methanol, THF, acetonitrile) and a body of insulating material (such as PE/PTFE/etc.). Charges can also accumulate with reversed properties (conductive body and insulating liquid).

Incidents with damaging effects due to electrostatic charges and discharges when transferring liquids and waste solvents are well-known and documented.

How do you avoid electrostatic ignition risks when handling solvents in laboratories?

There are three different types of electrostatic discharge that apply to laboratory conditions. A risk assessment taking into account the three types is used to evaluate the risk as well as to specify safeguards, and by this mitigates electrostatic hazards.

The most common type is the discharge by spark which always occurs when conductive materials are charged by separating their surfaces from insulating materials or by "induction".

These charged, conductive objects may include

- **packaging materials such as canisters, alloy bottles, metal containers**
- **persons**
- **tools such as funnels, pipe components, sieves and filters**
- **as well as flammable solvents with high conductivity (alcohols, ketones)**

if their charges cannot be discharged.

The charge accumulates in the same way as in a capacitor. If the potential is high enough, the charge is equalized with another conductive object to another potential (generally to the grounded point).

The use of conductive or dissipative earthing materials prevents spark discharges.

The charge is equalised via the ground connection and a possible charge is harmlessly discharged. At the same time, conductive, grounded containers are capable of grounding the conductive liquids they hold.

The safe grounding of conductive components prevents spark discharges. Dissipative materials must also be grounded.

The second relevant type of discharge is the brush discharge.

This occurs on surfaces made of insulating material which have been charged by separating operations such as rubbing, wiping, the removal of protective films, etc., or by spraying.

Insulating solid surfaces can only be charged by such surface processes. Charging via induction does not occur in insulating materials, as the poor conductivity does not allow the charged particles in the material to be moved/polarised.

If a charged insulating surface is given a grounded conductor, such as by the approach of a metal object or a person, the electrostatic field concentrates towards this grounding point and develops into a spark manifesting on the surface - the brush discharge.

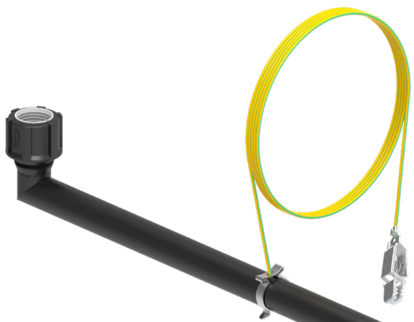
Brush discharges are lower in energy than spark discharges and cannot ignite flammable dust-air mixtures with a minimum ignition energy of > 1 mJ. However, the energy of the brush discharge is sufficient to ignite flammable solvent vapours or combustible gases.

Depending on the combustible material (e.g. belonging to the explosion group IIC) and how likely ignitable solvent vapour-air mixtures are (e.g. "occasional" (zone 1), an insulating material surfaces > 20 cm^2 made of insulating material may be evaluated as critical.

In certain conditions, containers such as canisters, bottles etc or tools made of insulating material are supplied with a manufacturer release for use with flammable solvents. However, the operator must observe the manufacturer specifications and conditions of use (such as "Dry wiping prohibited", "...only for designated use", etc.).

To protect against brush discharges, surfaces made of insulating material must not be charged by rubbing, wiping, or similar operations in the simultaneous presence of flammable vapours.

Alternatively, the use of conductive or dissipative materials is recommended, as they discharge safely when grounded. In this way the prerequisite for brush discharge, namely charged insulation surfaces, is not given.



Using conductive or dissipative grounding materials avoids insulation surfaces being present. This means that the prerequisite for brush discharges is no longer given.

The third type of discharge observed in laboratories is the propagating bush discharge.

This mainly occurs inside plants and on surfaces made of insulating material if so-called „strong charge-generating processes" take place simultaneously. For example, these conditions are present in insulating tubes through which aerosols or solid particles are transferred at high velocities.

A tube exposed to the conditions of propagating brush discharge is generally recongisable by a dark mark, with a length of several centimetres. At the centre of the mark preforation of the wall due the discharge can be seen. A propagating brush discharge contains enough energy to ignite fuel-air mixtures of any kind. However, as several conditions are required for the generation of this type of discharge, the probability of occurrence is relatively low. If in doubt, seek an expert opinion.

Since propagating brush discharges only occur on surfaces made of insulating material, the use of conductive or dissipative transport or conveyor systems is also an adequate safeguard in this situation.

Electrostatics and its ignition risks is a very complex issue. The requirements for components and parts used in so-called hazardous areas, i.e. zones in which flammable atmospheres occur frequently and to a great extent, are effectively regulated.

But even in areas with high air exchange and lower solvent volumes which are not defined as hazardous zones, care must be taken to avoid creating electrostatic ignition sources near emission points or in areas of handling solvents. An electrostatic discharge occurring in this area would inevitably cause the mixture to ignite and, in a worst-case scenario, would cause the container to explode.

Instead, this emission should initially be avoided by using suitable filtration systems. If this is not possible, care must be taken to ensure that no electrostatic hazards can be created near solvent emission points or in areas where these substances are handled (i.e. waste solvent collection points).

In order to do so, it must be ensured that not only the previously specified safeguards for solvent systems are applied, but also additional mitigations such as grounding of operators through dissipating floor mats and appropriate footwear are considered. Electrostatic requirements for the hazardous areas listed above are regulated differently depending on national regulations.

In Germany, the "Technische Regel für Gefahrstoffe" ("Technical Regulations for Hazardous Substances"), or TRGS 727 (formerly TRBS 2153), stipulates electrostatic requirements in hazardous areas under the title „Prevention of ignition hazards due to electrostatic charge".

At European level, CENELEC (EUROPEAN COMMITTEE FOR ELECTROTECHNICAL STANDARDIZATION) CLC/TR 50404:2003 superseded by CLC/TR 60079-32-1:2015 Electrostatics - Code of practice for the avoidance of hazards due to static electricity, is applied.

These regulations describe hazards and specify safety measures. Therefore, this source can also be used as reference or for specific questions.

Kurt Moritz
Kurt Moritz is the expert for electrostatics and mechanical explosion protection in the Technical Plant Safety department of **Merck KGaA, Darmstadt.**

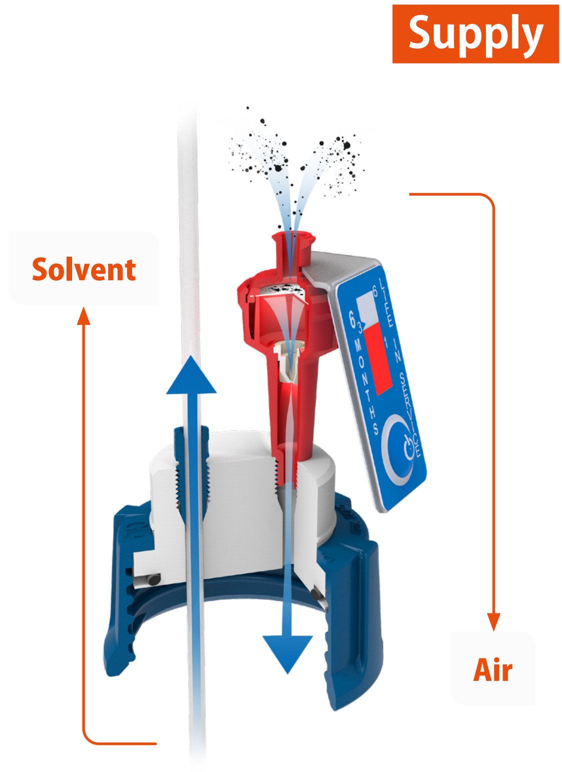
You are in the planning phase? We are ready to assist you!

Ask your lab furniture manufacturer, lab planner or the SymLine planning team.

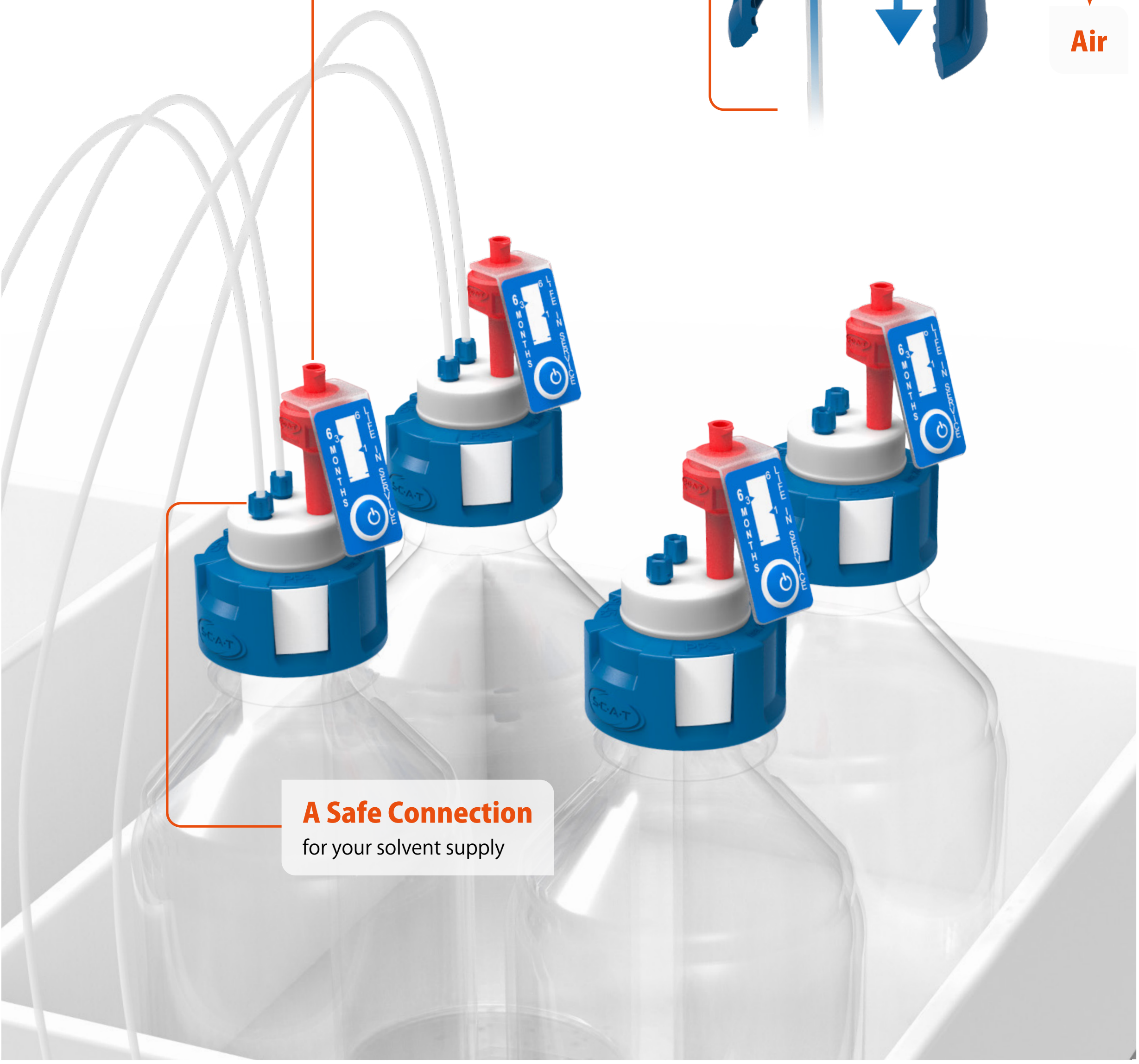
Safety Cap

Proven SCAT safety technology provides for optimum protection, both during the supply, and during the disposal, of solvents. Solvent vapors are blocked and filtered out. The system is therefore independent of other extraction systems within the laboratory.

SCAT Safety Caps ensure that your solvents are kept clean and remain stable. They protect users and the environment from the effects of solvent vapors, and enable a continual smooth operation of the HPLC facility.



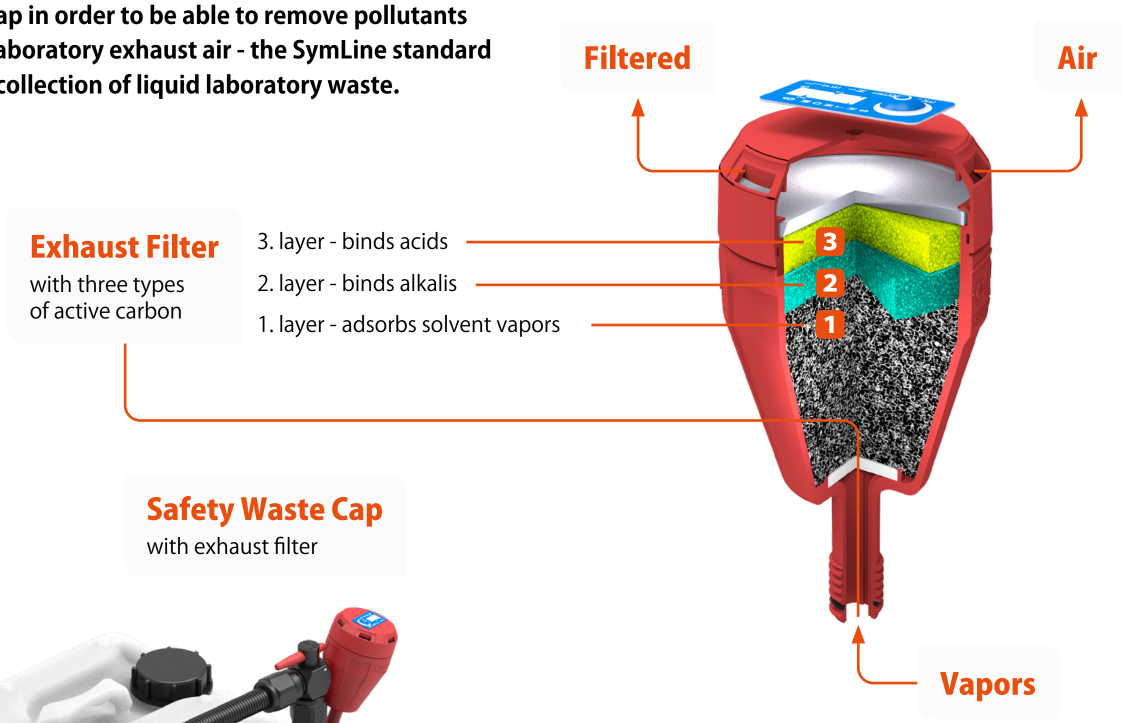
Safety Caps
with air ventilation valve



Disposal

Safety Waste Cap

Liquid laboratory waste can consist of a wide variety of substances and tends to produce toxic fumes. Users often do not know which mixtures are stored in their containers. The closed SymLine disposal system provides reliable protection against these toxic fumes. The Safety Waste Cap provides a safe connection to the waste containers. The freely rotatable core made of electrically conductive plastic ensures an ergonomic and secure closure and is suitable for use in potentially explosive areas and is ATEX-compliant! **Exhaust systems can be connected directly to our Safety Waste Cap in order to be able to remove pollutants via the laboratory exhaust air - the SymLine standard for safe collection of liquid laboratory waste.**



Exhaust Filter

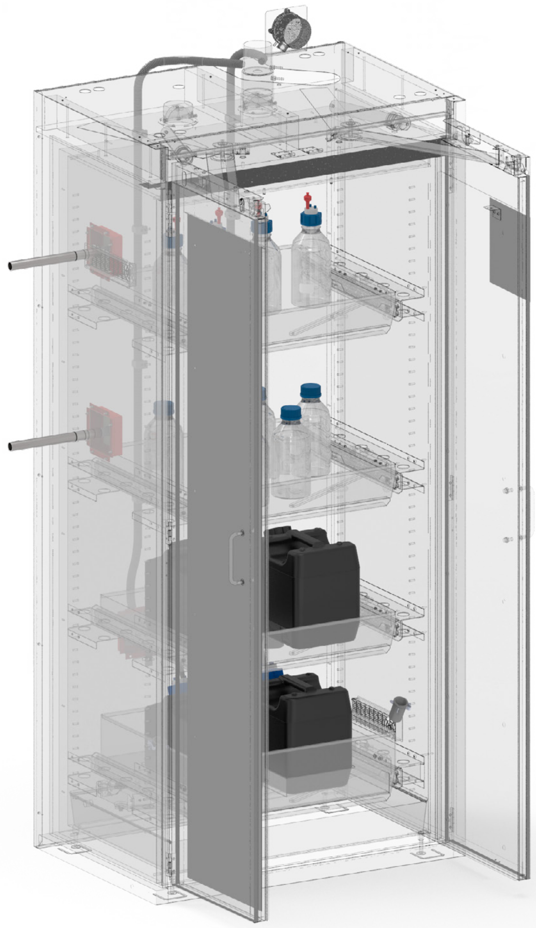
The SCAT exhaust filters offer optimal protection against the toxic laboratory waste vapors that are produced when there is no laboratory exhaust air. Thanks to the bevelled core of the Safety Waste Cap, exhaust filters can be connected without offset adapters. Due to the composition of 3 layers of active carbon, SCAT exhaust filters are suitable for adsorbing solvent vapours and binding acids and alkalis.

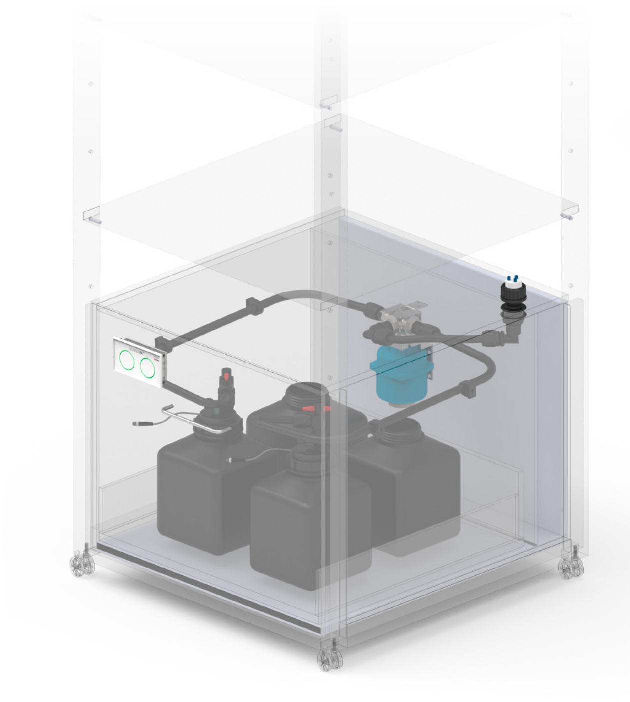
SymLine custom-made products

With the large number of different applications, it can happen that a system of standard components does not meet the demand perfectly. Therefore, we offer customized solutions meeting the customers' individual requirements. This gives the system an unique flexibility and individuality, whereby the highest quality standard is given at all times!

Mobile HPLC rack

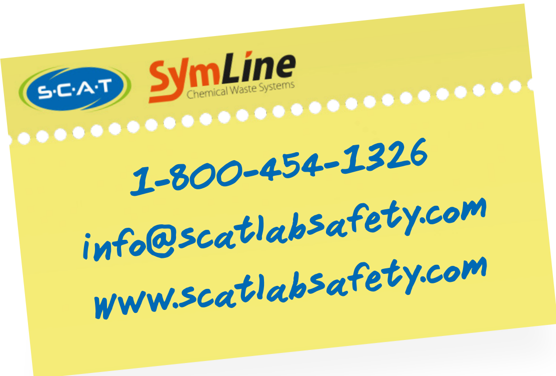
Can be used flexibly thanks to castors. Safety Waste Cap with table feedthrough. Waste disposal with level control and automatic switching via 3-way ball valve.





Safety cabinet with HPLC connection for supply and disposal

Tall safety cabinet with steel tube feedthrough for HPLC tubes and capillaries. Through attachments the fire protection is maintained. HPLC supply and disposal without any contact with solvents.



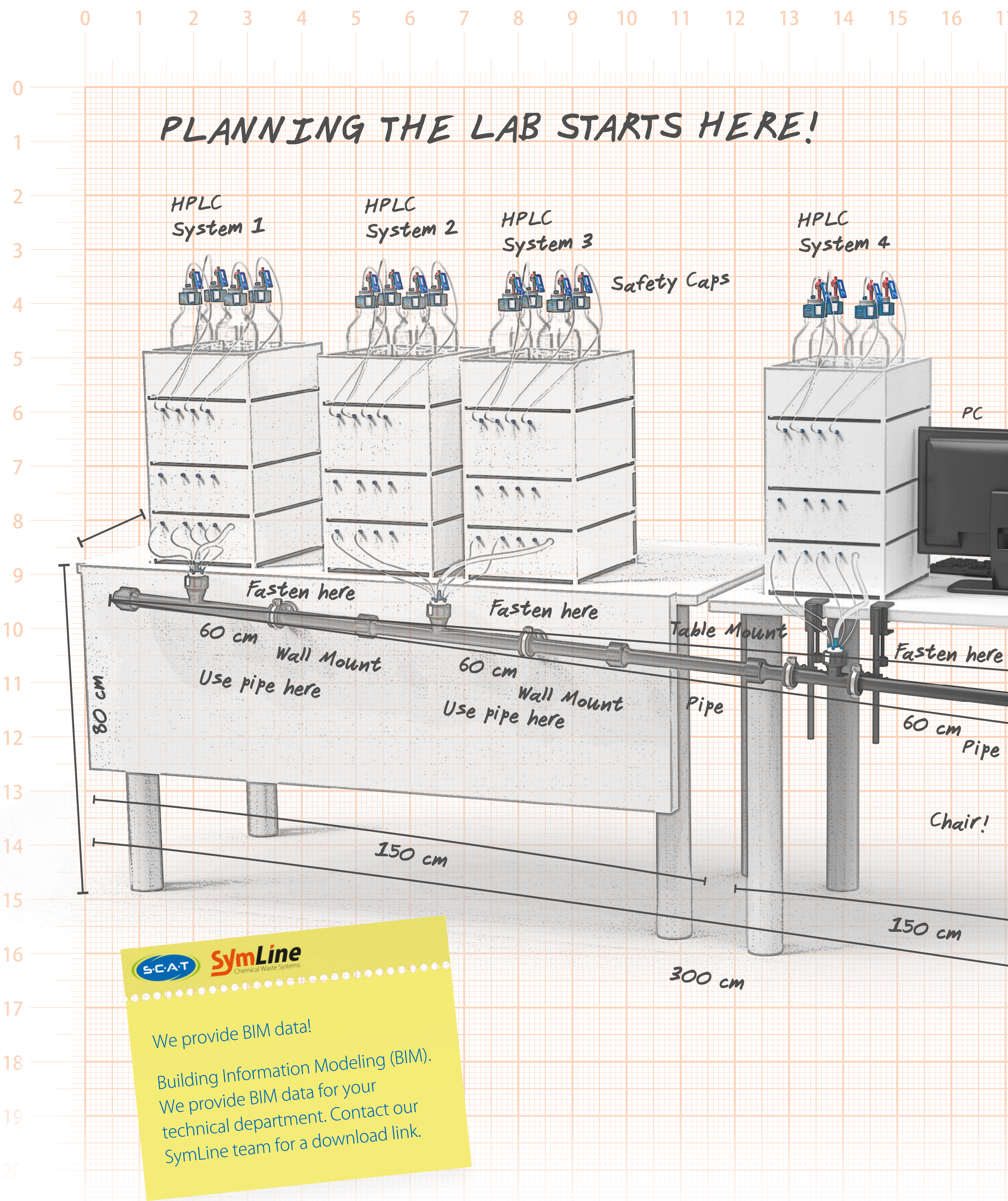
Our Partners

You can find an overview of our partners at:
scatlabsafety.com/CONTACT/Contact-Partners/

Or follow the **QR code** for more information

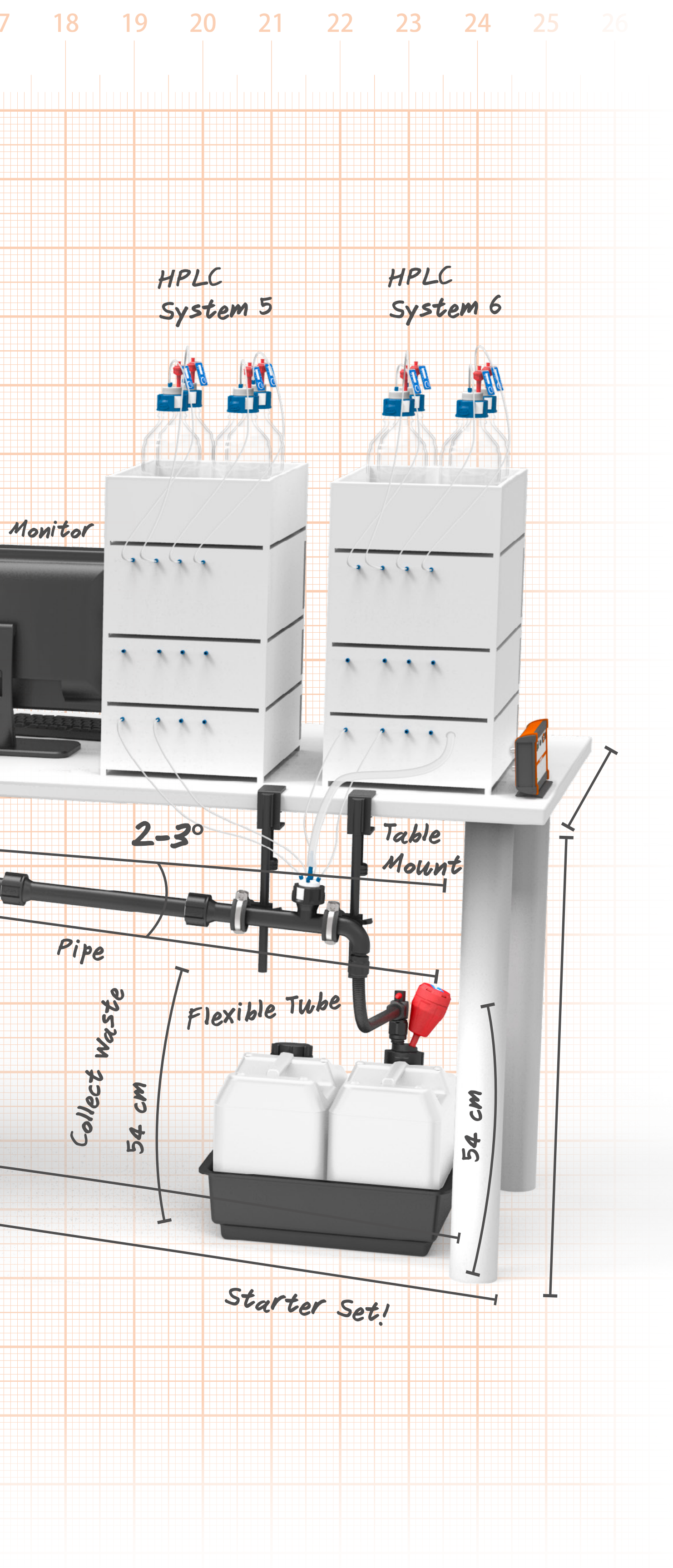
We're here to help

Do you have any questions about SymLine® or would you like to tell us something? Contact us, we look forward to hearing from you.



We provide BIM data!

Building Information Modeling (BIM). We provide BIM data for your technical department. Contact our SymLine team for a download link.



You are in the planning phase?
We are ready to assist you!

Ask your lab furniture manufacturer, lab planner or the SymLine planning team.

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