

— turning ideas into solutions

mBRAUN

SOLVENT PURIFICATION SYSTEMS

SAFE & ECONOMIC DRYING OF SOLVENTS

INERTGAS TECHNOLOGY



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www.mbraun.com

MBRAUN Solvent Purification Operation:

MBRAUN offers the safest, fastest and easiest way to dispense ultra dry solvents. MBRAUN SPS systems provide laboratories with unique safety features and benefits, specifically designed to meet the needs of the customer.

The MBRAUN Solvent Purification System operates by way of solvent storage vessels being pressurized through an inert gas supply (Typically a nitrogen source of 99.99% purity or better). The solvent rises through the dip tube and flows through a series of two filter columns that absorb moisture from the solvent. Ultra dry solvents are then dispensed into evacuated collection vessels directly at the system and/or into an integrated glovebox system. Exhausted purifier columns are disposed of by the customer and activated replacement columns are provided by MBRAUN.

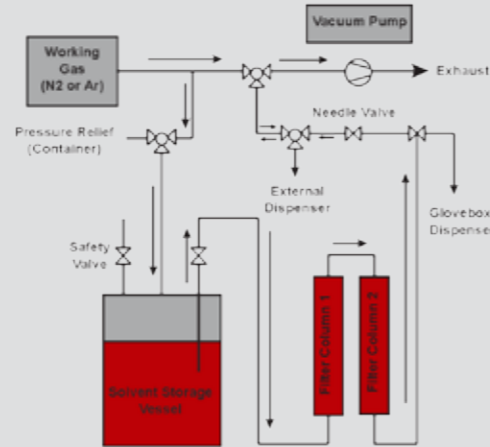


Figure A. Shows the gas and solvent flow throughout the system

MBRAUN Solvent Purification System Features:

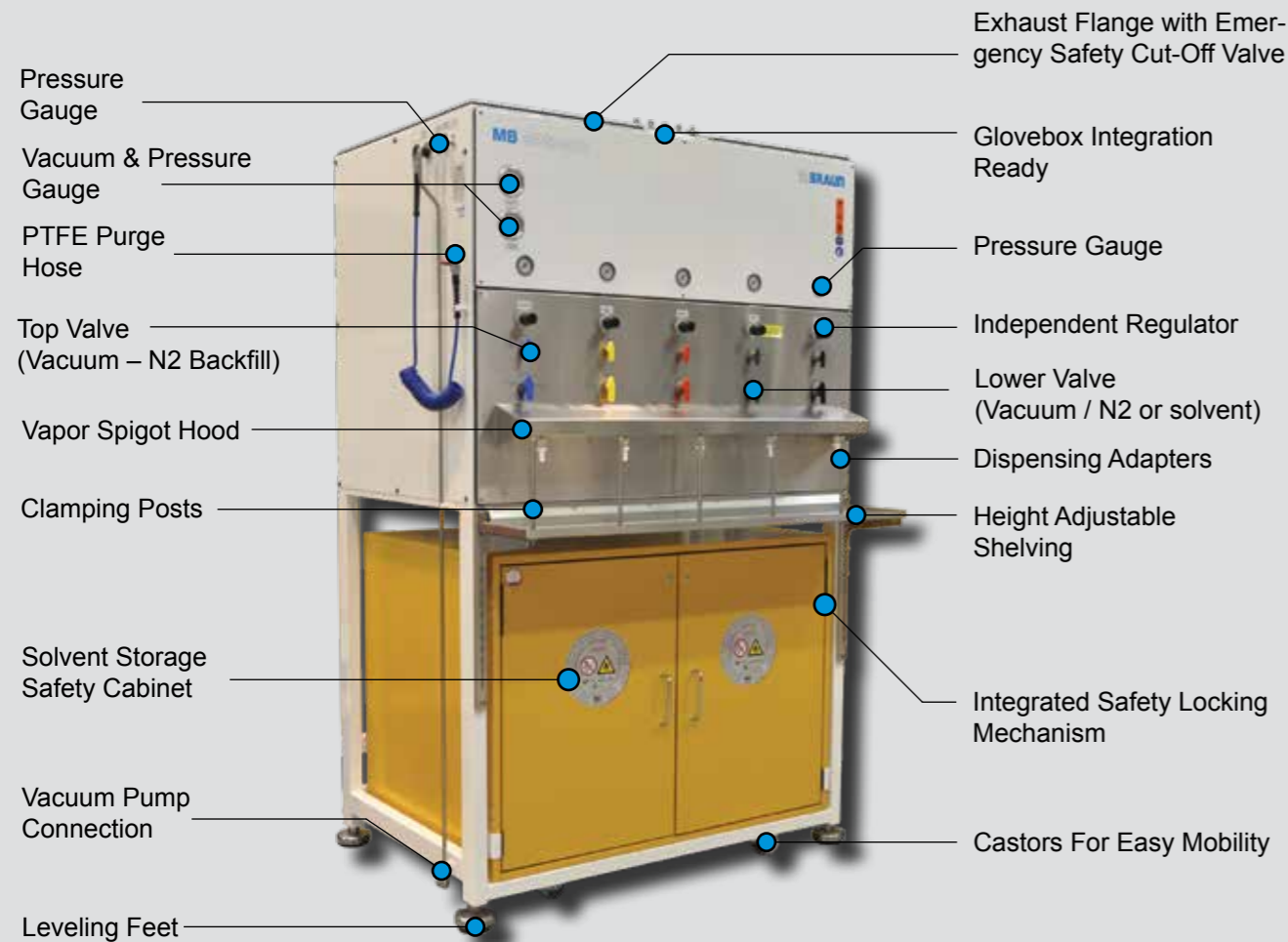


Figure B. Shows the basic system configuration of an MBRAUN SPS-5. System configuration, color and flammable cabinet specification may vary.

MB SPS COMPACT

The MB SPS Compact is a single solvent purification system specifically designed for customers who require a compact more economical setup in their solvent purification needs. The compact design and high quality construction gives customers the ability to dispense ultra dry solvents directly from the laboratory bench top.



MB SPS Compact Standard Features:

- Purifies up to 800 liters of solvent before replacing columns*
- Connects directly to any glovebox system
- Ready to operate completely encapsulated system

MB SPS 5 - MB SPS 7



The MB SPS is designed specifically for laboratories that need a safe, fast and easy method for dispensing ultra dry solvents. Unique features include glovebox integration ready piping, integrated vapor hood with 4 inch ventilation exhaust port, double column filtration, 17 liter solvent reservoir and independent regulators for each solvent line. Up to 7 solvents reservoirs can be fitted into the system.

MB SPS Standard Features:

- Purifies up to 800 liters of solvent before replacing columns*
- Connects directly to any glovebox system
- Ready to operate completely encapsulated system
- Fire resistant storage cabinet ensures laboratory safety
- Each solvent line includes an independent regulator
- No cross contamination of solvent vapors

MB SPS AUTO

MBRAUN offers the industries first and only automatic solvent purification system. With its integrated PLC, the MB SPS AUTO offers a high level of ease of use compared to the MB SPS 5 or 7 platform.

MB SPS AUTO Standard Features:

- World's first fully automated solvent purifier (US patented)
- Ideal for laboratory or industrial environments
- Connects directly to any glovebox system
- PLC controlled dispensing process for all solvent lines
- Each solvent line includes an independent regulator
- Purifies up to 800 liters of solvent before replacing columns*
- No cross contamination of solvent vapors



*Solvent filter column capacity varies according to solvent type and quality of solvent being used.



MB SPS COMPACT



MB SPS 5



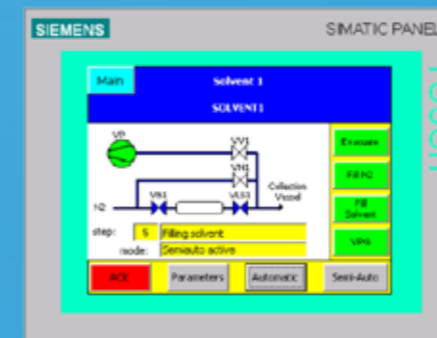
MB SPS 7

| | Encapsulated Solvent Purification System | | Encapsulated Solvent Purification System | |
|--------------------------------------|--|--|--|--|
| | | | (SPS-5) 1300 x 1040 x 2063 mm (W x D x H) | (SPS-7) 1700 x 1040 x 2063 (W x D x H) |
| Solvent purification system | Type | Encapsulated Solvent Purification System | | |
| | Dimensions | 275 mm x 873 x 520 mm (W x H x D) | | |
| | Number of solvents lines | 1 | Up to 5 solvents | Up to 7 solvents |
| | Operation | Hand valves | Hand valves | |
| | Material | Stainless steel (1.4301 / US 304) | Stainless steel (1.4301 / US 304) | |
| | Leveling feet | Included | Included | |
| | Manifold | Stainless steel piping w/ three way hand valve | Stainless steel piping w/ three way hand valve | |
| | Work shelf | - | Height adjustable rack w/ vertical clamping posts | |
| | Castors for easy mobility | - | Included | |
| | Solvent flow rate | < 1 l/min | < 1 l/min | |
| | Power | 230V / 50-60Hz, 10 amps, 115v / 50-60 Hz, 15 amps | 230V / 50-60Hz, 10 amps, 115v / 50-60 Hz, 15 amps | |
| | Solvent storage safety cabinet | - | Cabinets available for 2, 5 and 7 solvent systems | |
| | Solvent storage safety cabinet EU | - | Type 90 (EN 14470-1), Fire resistance up to 90 minutes | |
| | Solvent storage safety cabinet US | - | Meets NFPA regulation code 30 | |
| | Vapor removal for dispensing area | - | DN 75 connection to exhaust system & emergency cut-off valve | |
| Vapor removal for the safety cabinet | - | DN 50 connection to exhaust system & emergency cut-off valve | | |
| Dispensing | From the SPS system | From the SPS system, inside glovebox, or combination of both | | |
| Working gas | Nitrogen or argon (typically a nitrogen source of 99.99% purity or better) | Nitrogen or argon (typically a nitrogen source of 99.99% purity or better) | | |
| Solvent regulation pressure | Individual regulation for each solvent line, 0.3 - 0.5 bar | Individual regulation for each solvent line, 0.3 - 0.5 bar | | |
| Solvent line material | Stainless steel line (1.4301 / us 304) | Color coded stainless steel line (1.4301 / US 304) | | |
| Inlet pressure | Inlet pressure set between 4.0 bar and 6.0 bar | Inlet pressure set between 4.0 bar and 6.0 bar | | |
| Working pressure | Set between 0.3 bar and 0.5 bar | Set between 0.3 bar and 0.5 bar | | |
| Filter type | Double column solvent filtration | Double column solvent filtration | | |
| Filter column | Two stainless steel columns (1.4301 / US 304) | Two stainless steel columns per solvent (1.4301 / US 304) | | |
| Filter column size | 4.8 l (1 gallon) | 4.8 l (1 gallon) | | |
| Particle filtration | Filter columns equipped w/ pre-filters | Filter columns equipped w/ pre-filters | | |
| Filter material | Depends on solvent type | Depends on solvent type | | |
| Filter column capacity | Up to 800 l (depends on solvent type) | Up to 800 l (depends on solvent type) | | |
| Filter column activation | Columns activated before shipment | Columns activated before shipment | | |
| Attainable purity | Below a few ppm H2O and O2, varies according to solvent type | Below a few ppm H2O and O2, varies according to solvent type | | |
| Reservoir material | Stainless steel reservoir (1.4301 / US 304) | Stainless steel reservoir (1.4301 / US 304) | | |
| Reservoir capacity | 17 l (optional sizes available) | 17 l (optional sizes available) | | |
| Reservoir features | Two shut off valves, Swagelok connectors, over pressure relief valve | Two shut off valves, Swagelok connectors, over pressure relief valve | | |
| Reservoir piping | Stainless steel jacket and 1/4" piping w/ Swagelok fittings | Stainless steel jacket and 1/4" piping w/ Swagelok fittings | | |
| Options | Vacuum pump | Oil free diaphragm vacuum pump, resistant to aggressive gases (reinforced with a PTFE layer) | Oil free diaphragm vacuum pump, resistant to aggressive gases (reinforced with a PTFE layer) | |
| | Glass ware storage flask | 250 ml | 250 ml | |
| | Optional positioning system | Jack stand for the correct positioning of the collection vessel | Vertical clamping posts included | |



MB SPS-5 and MB SPS-7 are also available in bench-top version

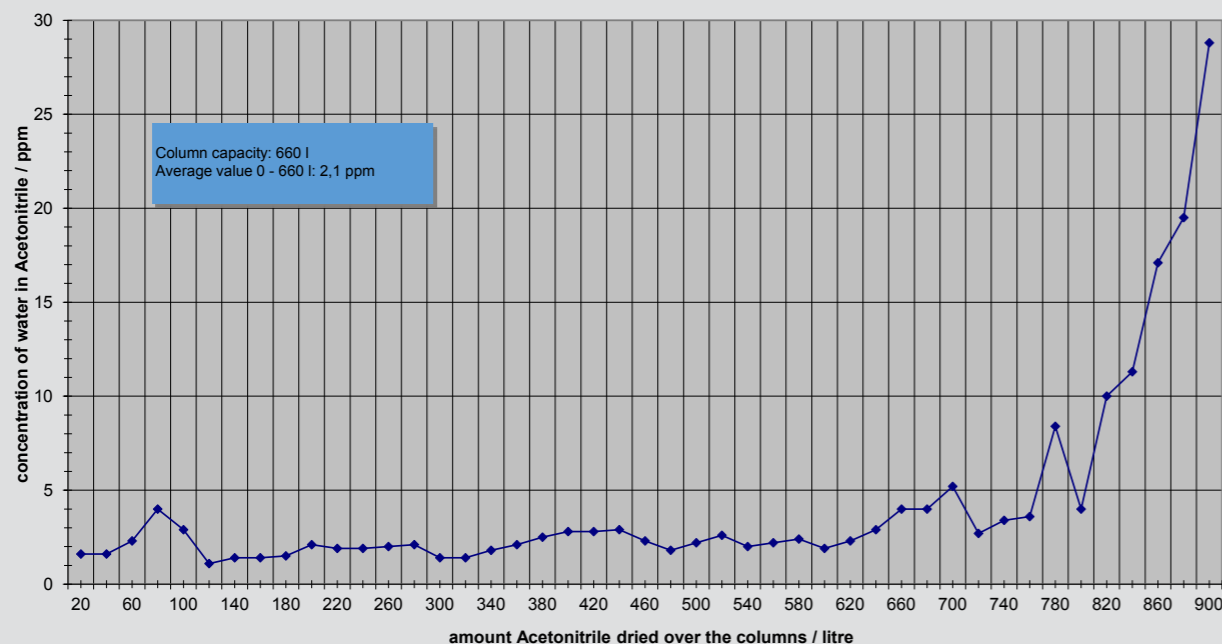
MB SPS AUTO
Increased ease of use through PLC unit



Please Note: Test results may vary

| Solvent | Type | Water concentration in solvent feed | Mean value of residual water after drying | Capacity of the columns |
|----------------------|-------------------------|-------------------------------------|---|-------------------------|
| n-Hexane | Aliphatic hydrocarbon | 53 ppm | 0,3 ppm | Theoretical 9000 l |
| Toluene | Aromatic hydrocarbon | 302 ppm | 1,4 ppm | 1090 l |
| Dichloromethane | Halogenated hydrocarbon | 436 ppm | 0,3 ppm | 500 l |
| Acetonitrile | Dipolar aprotic solvent | 560 ppm | 2,1 ppm | 660 l |
| THF - Inhibitor free | Ether | 550 ppm | 7,2 ppm | 400 l |

SPS column capacity for Acetonitrile
(feed concentration of water in Acetonitrile approx. 556 ppm)



List of Solvents Purified:

| | | |
|--|----------------------------------|--------------------------|
| Acetic Acid | Diethylene Glycol Dimethyl Ether | 2- Methoxyethanol |
| Acetic Anhydride | Diisopropylamine (DIPA) | Methylcyclohexane |
| Acetic Acid Ethyl Ester, Ethyl Acetate | Diisopropyl Ether | N,N-Methylpyrrolidone |
| Acetic Acid Methyl Ester | Dimethylbenzene | Nitromethan |
| Acetone * | N,N-Dimethylformamide (DMF) | Pentane |
| Acetonitrile | Dimethyl Sulfoxide (DMSO) | Petroleum Ether |
| Benzene | 1,4-Dioxane | 1-Propanol |
| 1-Butanol | Dipropylamine | 2-Propanol |
| 2-Butanol | Dipropyl Ether | 1,2 Propylene Carbonate |
| tert-Butanol | Ethanol * | Pyridine |
| t-Butyl Methyl Ether | N-Ethyl-diisopropylamine | Tetrachloromethane |
| Chlorobenzene | Ethylene Glycol Dimethyl Ether | THF - Inhibitor free |
| Chloroform | Formic Acid Ethyl Ester | Tetramethylethanediamine |
| Chloromethane | n-Heptane | Toluene |
| Dichloromethane * | n-Hexane | Triethylamine |
| Diethyl Ether * | Methanol * | Xylene |

More on request, please contact MBRAUN

(*) Notes:

For Diethyl Ether, Dichloromethane or Chloroform: if it contains a stabilizer this may be removed partly by the drying procedure.
 For Methanol, Ethanol or Acetone: Requires a special filter (provided with the system). However the filter cartridge may need regular replacement.
 For Acetone: Side reaction due to Aldol condensation may occur during the drying procedure
 For Methanol: Determination of the residual water concentration using the Karl-Fischer method may be difficult.

MBRAUN Solvent Purification Glossary:

• **Dispensing** - Dispensing solvent is performed using a three step process. The first step involves evacuating the collection vessel to create a dry environment. The second step is the actual dispensing. Step three clears the line, so solvent does not remain stored in the dispensing line while the system is not in use.

• **Solvent Storage Reservoir** - MBRAUN includes a 17 liter solvent storage reservoir per solvent line along with the SPS system. (Additional vessel sizes available upon request) Each storage vessel is equipped with connections for bubble degassing procedure. MBRAUN solvent reservoirs include an overpressure valve, solvent supply line, nitrogen push line and a dip tube assembly with clamp. MBRAUN SPS systems can also hook up directly to any third party solvent keg system.



• **Working Gas** - MBRAUN SPS Systems are pressurized by an inert working gas (Typically a nitrogen source of 99.99% purity or better) with a minimum working pressure of 4 bars.



• **Filter Column** - MBRAUN utilizes a double filter column per solvent. The filter column is designed to absorb the moisture from organic solvents and is equipped with pre-filters and a quick connection system for easy replacement once the column is fully saturated. New fully activated columns are available as spare parts.

• **Exhaust** - The SPS system is equipped with two connections for exhaust (located at the top of the SPS system and at the rear side of the solvent storage safety cabinet) to be connected with customer's ventilation system.

• **PTFE-Purge Hose** - The PTFE-Purge Hose is located on the left side wall of the system and is connected to the working gas. The purge hose is equipped with an adapter and a manual valve. The purpose of the purge hose is to clear the solvent line after dispensing.

• **Vacuum Pump** - MBRAUN provides an oil free diaphragm pump as an optional item on all SPS systems. Customers may utilize other vacuum systems as well, including facilities vacuum system.

• **Pressure Reducing Valve** - The pressure reducing valve is utilized to adjust the secondary pressure for pressurizing the solvent reservoirs. The pressure depends upon the viscosity of the solvent being used as well as the intended flow rate during dispensing. The permitted pressure range is 0.3 to 0.5 bar (30 to 50 kPa).

• **The Top Valve** - The top valve opens/closes the connection to the vacuum pump and the working gas (N2 or Ar) which is used to purge out and back fill the collection vessel.

• **The Lower Valve** - The lower valve dispenses ultra dry solvents into collection vessels that have been purged with the working gas via the top valve.

• **Degassing** - The degassing process removes dissolved air from solvents by purging with inert gas (Nitrogen). Degassing is performed after installing the solvent reservoir inside the safety cabinet. The exhaust of the safety cabinet should be connected to the laboratory ventilation system during degassing, so that any solvent vapor released during purging is safely removed.

• **Clamping Posts and Shelving** - Stainless steel clamping posts and shelving are standard features on the MB SPS 5 or 7 and the MB SPS AUTO. Clamping posts are used to secure the collection vessels for dispensing solvents. The stainless steel work shelf offers a height adjustable work space to which the clamping post are connected to.

• **Vapor Spigot Hood** - MBRAUN offers an integrated vapor hood that connects directly to customers supplied HVAC system via a 4" port located at the top of the system.



• **Solvent Collection Vessel (Glassware)** - Glassware is used to dispense ultra dry solvents into. Specially designed glassware for the MBRAUN SPS system are available.

• **Dispensing Adapters** - MBRAUN offers NS 29/32 6 mm ground neck-fitting made from fluorocarbon polymer and/or glass, for connection to piping with an outer diameter of Ø 6 mm, with screw nut made from polypropylene (PP).

• **Glovebox Integration** - All MBRAUN SPS systems have the option to dispense ultra dry solvents directly at the system or into an existing glovebox. Optional items include piping solvent lines directly through the glovebox or coming through the KF 40 vacuum feedthrough.

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