

# OPERATION MANUAL PMS-4



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# 1. Introduction

This manual relates to the PMS-4 compound as manufactured by Zel-Aaren Innovation AB in Sweden.

## 1.1 FIELD OF APPLICATION

PMS-4 is a two-component polyurethane solid type system which is suitable for the fixing of items such as inset light bases, in asphalt and concrete surfaces. It is successfully used to fix bases in taxiways and runways at airfields. PMS-4 is also ideally suitable for the sealing of cable slots in similar surfaces.

The unique properties of PMS-4 opened new markets, which previously had been impossible to handle with polyurethane material. It provides a quick hardening system, which can, after only a few minutes of curing, be driven upon.

PMS-4 has a very high thermostability (>100 °C) connected with a great impact resistance which is an important factor to keep the bases in fixed position when the ground temperature is high. The unique moulding method, which is developed together with PMS-4, keeps the bases in a fixed position in all climates, without sinking, twisting or other changes of the bases position.

Application of the compound can be done with a semi-automatic mixing machine or by hand (not recommended in warmer climates, due to the short curing time).

PMS-4 is used for inset light fixing and cable chase in both asphalt and concrete.

## 1.2 MATERIAL DATA

Table 1: Material data for PMS-4

<b>Density</b>	1,1 kg/litre
<b>Pot life</b>	60-100 sec
<b>Thermostability</b>	>100 °C
<b>Impact stability</b>	45 KJ/m <sup>2</sup>
<b>Tensile strength/temperature</b>	See separate graph
<b>Bending module</b>	See separate graph
<b>Stretch limit 23°C</b>	9-10%
<b>Stretch limit 60°C</b>	14%
<b>Stretch limit 90°C</b>	Outside the extensometer limit
<b>Coef. of lin. exp. 10-5°C-1</b>	13,2
<b>Coef. of cub. exp. 10-5°C-1</b>	39,5
<b>Adhesion to steel</b>	Appr. 9 MPa
<b>Adhesion to concrete</b>	>2,5 MPa (concrete break)
<b>Storage</b>	Max one year in closed container in room temperature (appr. 20 °C)

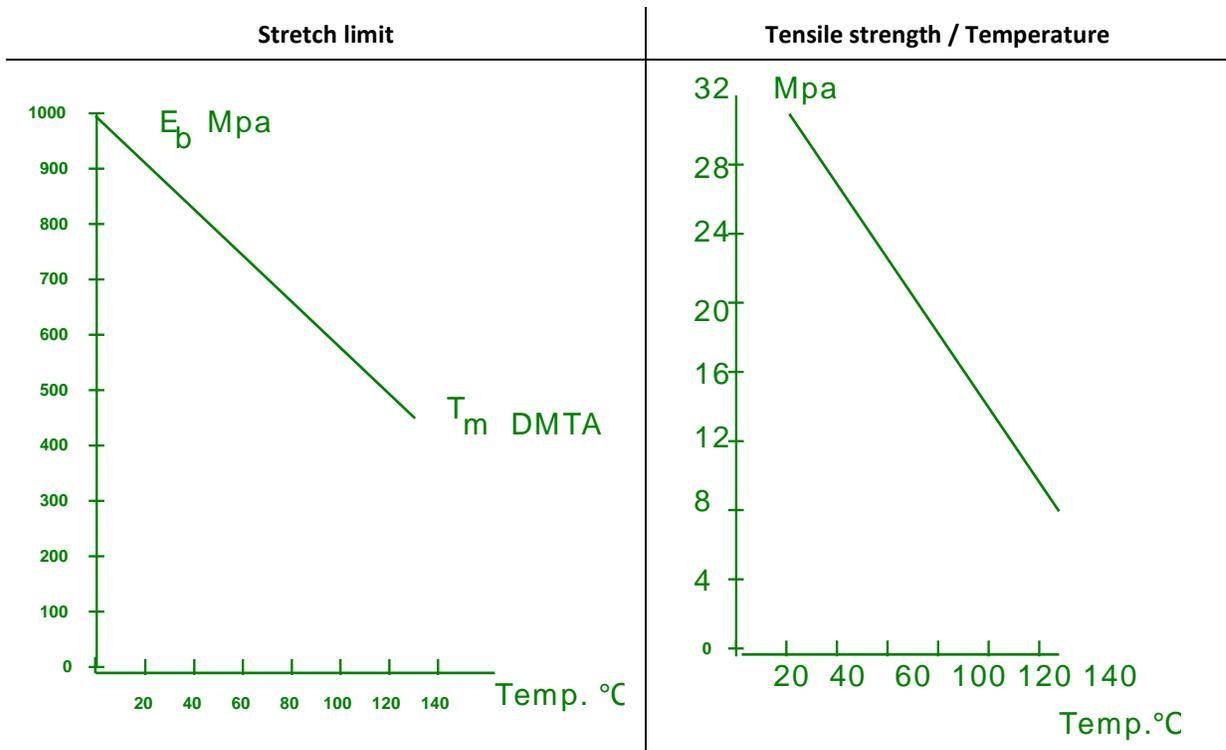


Image 1: PMS-4 kit; A component, B component and moisture pickup agent.

## 2. Handling of PMS-4

### 2.1 STORAGE

PMS-4 shall be stored:

- In well closed containers. The containers should be sealed with duct tape after every use.
- In even room temperature, at ~ +20 °C.

If the material has been stored too cold and has crystallized, see section 7 Troubleshooting for a solution.

### 2.2 MIXING

#### 2.2.1 MEASURING PMS-4

The measuring of the PMS-4 is done in volume dimensions (litre).

1. First measure the A component (the black material) according to the table below.
2. Mix the dehydrating material (the white material - Purmol) into the A component.
3. Measure the B component (yellow/brown material) and mix with the A component & Purmol mixture.

Table 2: Mixing proportions

<b>Mixed material</b>	<b>A component Colour: Black</b>	<b>Dehydrating agent Colour: White</b>	<b>B component Colour: Yellow/Brown</b>
<i>litres</i>	<i>litres</i>	<i>litres</i>	<i>litres</i>
1.05	0.60	0.05	0.40
1.58	0.90	0.08	0.60
2.10	1.20	0.10	0.80
2.63	1.50	0.13	1.00
3.15	1.80	0.15	1.20
3.68	2.10	0.18	1.40
4.20	2.40	0.20	1.60
4.73	2.70	0.23	1.80
5.25	3.00	0.25	2.00

In humid weather the dehydrating agent can be raised from about 5% up to about 10% of the finished mixture. The amount of this absorption agent used is not critical.

**Application must be done within 60 seconds after mixing!**

### 2.2.2 MIXING PMS-4 WITH A SEMI-AUTOMATIC MACHINE

The mixing and application of PMS-4 is done by loading the two components into a mixing machine. This makes for very easy handling and practically no waste after the work is finished. The compound is delivered through a spiral nozzle where the actual mixing of the two major components takes place.

## 2.3 APPLYING

The drilled wall of the core holes as well as the bottom of the hole shall be absolutely clean and dry before applying PMS-4. See section 5 PMS-4 Mixing Machine Operation for more information.

### 2.3.1 APPLYING PMS-4 IN COLD CLIMATE (BELOW 10 °C)

The PMS-4 material can be used to mould cable chase and inset lights in temperatures down to  $-5\text{ °C}$  and even lower. However, there are some precautions which must be considered when working in cold conditions.

- ✓ The PMS-4 should all ways be stored at room temperature before use.
- ✓ The drilled holes shall be heated just before pouring the material.



Keeping the material and the machine warm can be done by building a simple box around the machine and by warming inside of the box by means of a fan heater.

## 3. PMS-4 Mixing Machine

### 3.1 PRINCIPLE OF THE PMS-4 MIXING MACHINE

The PMS-4 mixing machine is composed of two gear pumps, gravity fed with material (PMS-4) from two tanks containing the A component and the B component. The pumps charge the A + B component to the right proportions through two pressure safe tubes to a pistol nozzle which is equipped with a mixer pipe mixing the two components into a homogenous plastic mass, which then is cured within two or three minutes.



Picture 2: PMS-4 moulding machine and moulding pistol

### 3.2 TECHNICAL DATA

Table 3: Technical data for mixing machine

<b>Power</b>	220 VAC
<b>Dimensions (L x W x H)</b>	1010 x 600 x 1005 mm
<b>Weight (empty)</b>	75 kg
<b>Connections 5 pin. Connector</b>	3 phases + neutral + earth
<b>Noise level</b>	Not higher than 70 dB (A) depending on generator.
<b>Capacity</b>	1-6 litre /minute
<b>Maximum working pressure</b>	150 bar (Normally 20-50 bar)
<b>Temporary cleaning</b>	PMS-4, A Component
<b>Ambient temperature</b>	Not lower than appr. -5 °C
<b>Mixing ratio</b>	100:75 (weight) 100:63 (volume)
<b>Applications</b>	PMS-4 Material

## 4. PMS-4 Mixing Machine Start-Up

The machine is supplied with the hoses dismantled but with the mixing handle fitted. Before first use, attach the hoses to the machine and tighten the screws.

**Before each use:**

1. Check that all connections are well tightened. **Open the valves under the two containers.**
2. Check, by hand with a 5 mm drill bit, that there are no blockages in the nozzle manifold.
3. Connect the electric plug to a 220 V source. Turn the main switch ON, the lamp should illuminate. Turn the control switch to "FLOW CONTROL" or "AUX", a lamp will illuminate on the door of the control housing. You are now ready to run the machine.
4. Push the handle forward and the machine will run. When the machine is operating satisfactorily a green light should show on each of the proximity switches on the mixing handle.
5. **(Only for old machines with 380 V engine)** Check that the pump is turning in an anti-clockwise direction. If not, change the polarity in the plug turn two of the turn-able pins in the plug). Failure to do this will cause the pump seals to blow.

**The machine is now ready to use.**

**Always turn the main switch to OFF and the operating knob to OFF when working on the machine.**

6. Fill the A tank (the larger tank) with A component and the B tank (the smaller tank) with B component. Ensure that only one lid is removed from a tank at a time. **Ensure that you do not remove both lids at the same time – this can cause contamination of the compounds.**
7. In the A tank, add the Purmol water absorbing agent (a 1 litre tin to each 20-litre tin of A component) and thoroughly mix to a homogenous solution. Put the lids on both containers.
8. Run the machine (without the mixing pipe or the cone nut) until you have both A and B components flowing strongly. The B component should now be clear and yellowish in colour and the A component will be black.
9. Screw on the mixing pipe (spiral nozzle) and run one or two small test containers with material.
10. Check the result in the test containers, it should be black/grey and become a warm medium hard plastic material within 2-3 minutes and after 10-15 minutes becoming hard. The curing time depends upon the ambient temperature.
11. After the test run, clean the spiral mixing nozzle by pulling out the knurled knob on the machine pistol and pushing forward only the right side of the mixing handle. The pump will run and only the A component will flow through the pipe (do this for approximately 5 seconds).

Now you have done a complete test and are **ready to fix the bases with PMS-4 material.**

## 5. PMS-4 Mixing Machine Operation

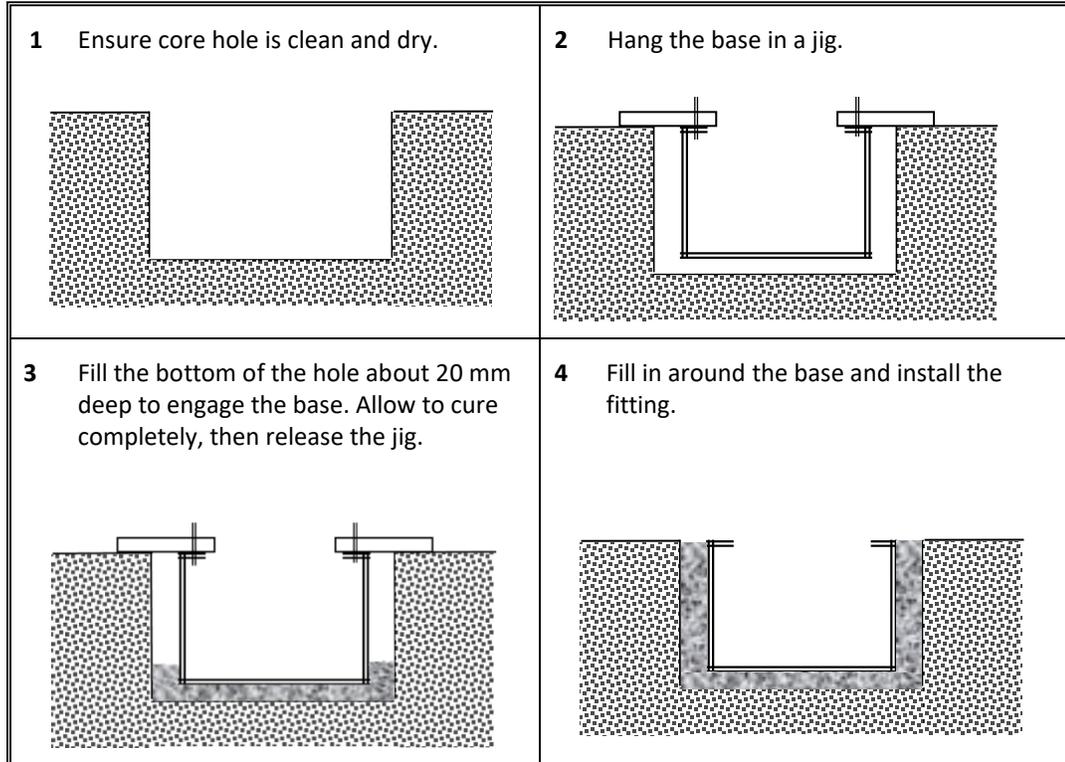
Once the machine is primed and ready for operation, apply the compound in the following manner:

### 5.1 INSTALLATION OF LIGHT FITTINGS

1. Ensure that the core hole is totally clean and dry.

2. Place the base and alignment jig in the core hole.
3. Fill the core hole to a level about 20 mm up the side of the base. Do not remove the jig until the material has cured completely.
4. Fill the core hole to within 4-5 mm of the top of the fitting.

**NOTE:** It is essential that the mixing nozzle be flushed with A compound every time application is stopped. Failure to do this can cause the nozzle to block up leading to blockages in the pistol manifold and hydraulic lines. Blocked lines should be immediately replaced.



## 5.2 SEALING CABLE SLOTS

1. Ensure that the slot is totally clean and dry.
2. Fit the cable and backing rod/sheet in the slot.
3. Apply the PMS-4 starting at the top of the slope.
4. Flush A compound from spiral nozzle.
5. Go to next slot or clean the machine.

**NOTE** – The spiral nozzle can be removed from the application pistol and drained for future use.

## 5.3 TEMPORARY STOPS

### 5.3.1 SHORT STOPS (A FEW MINUTES)

When a temporary (if only for a few minutes) stop is done:

1. Disconnect the B component pump by pulling the right part of the handle forward to start just the A component. Only A component is now flowing through the mixing pipe. A few seconds shot is enough.

2. Then disconnect the mixing pipe and hang it up with the nose down. The A component will leave the pipe and after a while you can visually see that the mixing pipe is OK for use again.

An easier way: While you are waiting to continue the mould push the handle every 20 seconds for a small shot of material, just to have fresh material in the pipe preventing it to cure.

### 5.3.2 LONGER STOPS (MORE THAN A FEW MINUTES)

For stop longer than a few minutes:

1. Unscrew the mixer pipe and press out the mixing device inside the pipe (looks like a screw) with the help of a rod from the orifice part of the pipe. Force may be necessary to press out the mixing device.
2. The mixing device can then be cleaned with a steel brush, it is a quick and easy operation and can ALWAYS be done to used mixer pipes.
3. Put the mixing device back in to the pipe again and the mixing pipe is ready for moulding once again. Alternatively, hang the mixing pipe to drain the unused compound.

## WARNING

Do not attempt to mould with a clogged mixing pipe!

Any attempt to mould with a clogged mixing pipe will result in the A component flowing into the B component part of the pistol. As this mixture cures a sludge forms in the pistol and a cleaning operation must take place. Always be watchful of the mixing pipe and change it at the slightest suspicion. The mixing pipe can ALWAYS be cleaned after work.

## 6. Maintenance

### 6.1 THE A COMPONENT CONTAINER

The A component part of the machine is generally free from any maintenance procedure.

### 6.2 THE B COMPONENT CONTAINER

The B component part of the machine must be periodically maintained:

1. The container for B component should be inspected on the inside for crystallising hardener on the walls of the container.
2. If that is the case, remove the container, empty it, and clean it out. Crystals may otherwise form a sludge and clog the pump or the pistol.

### 6.3 THE PUMP

At a longer interval (e.g., monthly) the B component container should be emptied and replaced with PMS-4 Cleaner, which is pumped through the pipe and the pistol until a clear liquid is obtained through the nozzle.



Picture 3: Filling cable slots with PMS-4.  
Capacity = 146 metres in 20 minutes.

## 7. Troubleshooting

### 7.1 NO MATERIAL IS FLOWING THROUGH THE PISTOL, THE MOTOR HAS STOPPED

The pressure switches have released because the curing agent in the pipe has reached a 50-bar pressure.

In most cases a material stop is caused by clogged pipes to the pistol, this is caused by A component going into the B component and curing taking place. Switch off the machine by closing the handle on the pistol, then switch off the control switch on the machine.

#### SOLUTION

Open the pistol handle, to get rid of the pressure in the pipes. Unscrew the B component pipe from the pistol, carefully - the pipe can still be under some pressure!

When the pipe is loosened, place the pipe opening in a container along with the pistol, pull the handle on the pistol forward, the material immediately flows – this shows that the B component side of the pistol is clogged.

Unscrew all openings in the pistol and check carefully visually, as well as with a screwdriver or 5 mm drill bit.

All openings MUST be clean! The pistol can be disassembled, and all components soaked in a solvent such as acetone or methyl ethyl ketone (MEK).

Ball valve and non-return valve can be ordered as spare parts and can then be changed while the blocked parts are cleaned. In this way you can avoid long delays in the moulding process.

### 7.2 NO MATERIAL IS FLOWING THROUGH THE PISTOL - THE MOTOR IS NOT RUNNING

#### SOLUTION

The micro switch in the right-hand side of the pistol is not working meaning that the current to the motor is broken. Change this micro switch.

It can also be that the pressure switch has shut down the machine because the handle is blocked by material. Clean the pistol (handle) from blocked material.

### 7.3 NO B COMPONENT MATERIAL IS FLOWING THROUGH THE PISTOL

#### SOLUTION

The micro switch in the left-hand side of the pistol side is faulty. Change this micro switch.

The pressure switch has shut down the machine because the handle is blocked by material. Clean the pistol (handle) from blocked material.

If the hydraulic hose or pump is blocked – change components as necessary.

## 7.4 NO COMPONENT MATERIAL IS FLOWING – MOTOR IS RUNNING

### SOLUTION

Check that the ball valves under the tanks are open.

## 7.5 IF PMS-4 HAS BEEN STORED TOO COLD

**Instructions for use in case the curing agent (component B) has been transported / stored in temperatures below 0 °C.**

The hardener (B component) to PMS-4 is a light brown liquid. It may crystallise in temperatures below 0 °C. A small amount of crystallisation is acceptable and does not distort the function of the material.

**If larger amounts are crystallised:** Crystals are transformed into a liquid state when warmed cautiously to a temperature of approximately. 60 °C. The heating should be done in a dry place with good air ventilation.

The vessel cover (or barrel bung) shall be opened to avoid overpressure of the vessel and the risk of explosion.

**WARNING** – Do not heat the vessel with open flame or use open fire close to the vessel.

Please check the bottom of the vessel of the product either visually or by using a rod. With a rod you will feel if there are any solid residuals on the bottom of the vessel.

## 8. Daily Checklist

- ✓ Remove the sealing tape around the tank lids.
- ✓ Check the compound in the tanks to ensure there has been no contamination or crystallisation of the compounds since last use.
- ✓ Check, by hand with a 5 mm drill bit, that there are no blockages in the nozzle manifold.
- ✓ Check that all connections are well tightened. **Open the valves under the two containers.**
- ✓ Turn the main switch ON, the lamp should illuminate. Turn the control switch to “FLOW CONTROL” or “AUX”, a lamp will illuminate on the door of the control housing. You are now ready to run the machine. Push the handle forward and the machine will run. When the machine is operating satisfactorily a green light should show on each of the proximity switches on the mixing handle.

**Always turn the main switch to OFF and the operating knob to OFF when working on the machine.**

- ✓ If PMS-4 Cleaner has been used: Empty the cleaning agent from the B component container by pumping it out.
- ✓ Screw on the mixing pipe and run one or two small test containers with material until you have both A and B components flowing strongly (until all the cleaning agent is flushed through). The B component should now be clear and yellowish in colour and the A component will be black.
- ✓ After the test run, clean the mixing pipe by pulling out the knurled knob and pushing forward only the right side of the mixing handle. The pump will run and only the A component will flow through the pipe (do this for approximately 5 seconds).
- ✓ Look for the result in the test containers, it should be black/grey and warm medium hard plastic material within 2-3 min. and after some 15 min. becoming rigid hard.
- ✓ Now you have done a complete test and are ready to fix the bases with PMS-4 material.

**REMEMBER** - When you begin, **the first few seconds of flow is ONLY A component** (the flushed compound remaining in the pipe). Put this small amount in a waste bucket.



When you are working, always try to do as many fittings as possible at one time without a break longer than 30-60 sec. This is the most effective way of using a PMS-4 mixing machine.

## 9. Contact

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