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CYCLONE SEPARATORS FOR SCREW SYSTEMS

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Technical task:
The current battery systems require compliance with a cleanliness requirement.
On the drawing of the battery system C-BEV 4KE.915.100., compliance with particles smaller than 700 micrometers is required.

In the worst case, metallic particles could cause short circuits or even electric arcs. Air and creepage distances must be maintained.

Particles generated in the process must either be avoided or the components cleaned.

It is currently known that the most dirt at the screw connection points is caused by underhead friction of the screws.

The largest particle input comes from the module screw connection, since the friction components are unfavorably located here (steel rubs against aluminum).

Vacuum cleaners at the robots are rejected by the planning due to accessibility of the screw head and, due to longer suction distances, lack of suction power.
Surface vacuum cleaners do not provide the necessary suction power reliably.
Solutions in the process were also not available in terms of cycle time.

The modules are screwed together using Weber vacuum screw spindles with dirt brake, but these vacuum spindles must not currently be used for the extraction of particles, as otherwise the silencer or prefilter would become dirty too quickly and the TPM effort would increase extremely.

The technology is currently only designed in such a way that the screw is tightened to the bit and does not "fall down". As soon as the screw is in the insertion stage, the vacuum switches off as system protection in order not to get too dirty.

At the moment, the silencers in belt section 1 Brussels battery production AP0 alone have to be cleaned once a week with 14 screw systems. If this maintenance is not carried out, the silencers will close. As a result, too little negative pressure is generated in the venturi and the screw bit error pattern does not find the screw. As a result, a higher need for reworking arises.

Initial situation:
The Weber vacuum screw spindle is currently only allowed to suck until the bit is extended.
For this reason, an enormous amount of effort is currently being invested in manual double suction.
There are currently no process-related solutions, which is why design changes are being tested in order to meet the specification. This causes correspondingly higher component costs.

Solution:
We could install a cyclone separator or centrifugal separator with a correspondingly large dust chamber the size of a laboratory bottle between the tube end, spindle and venturi nozzle.
The venturi nozzle generates a suction volume flow which is cleaned/separated by the cyclone separator. The whole process takes place in a screwing system during which components are screwed together.
To remove particles from a surface, a volume flow of approx. 30 m/s is required. Due to the small diameter of the vacuum tube, this can be safely achieved.
Cyclone separators with correct dimensioning can reliably separate particles of up to 2 micrometers.
If brush hairs are also applied around the end of the pipe, the volume flow would increase and particles cannot fly away uncontrolled.

Principle of the idea see sketch.

Advantages:
The vacuum suction could remain switched on throughout the entire screwdriving process and thus significantly and specifically reduce the resulting particles without any loss of cycle time.
In addition, the TPM effort could be reduced many times over. This would also mean that the line would have to be shut down less frequently for this type of maintenance.
The conversion costs amount to a minimum. A technical cyclone in metal design costs approx. 100 euros, which is why added value can be achieved very quickly.
The qualitative advantage and the component savings potential for the CBEV project and for subsequent projects are enormous.

Sketch 1:

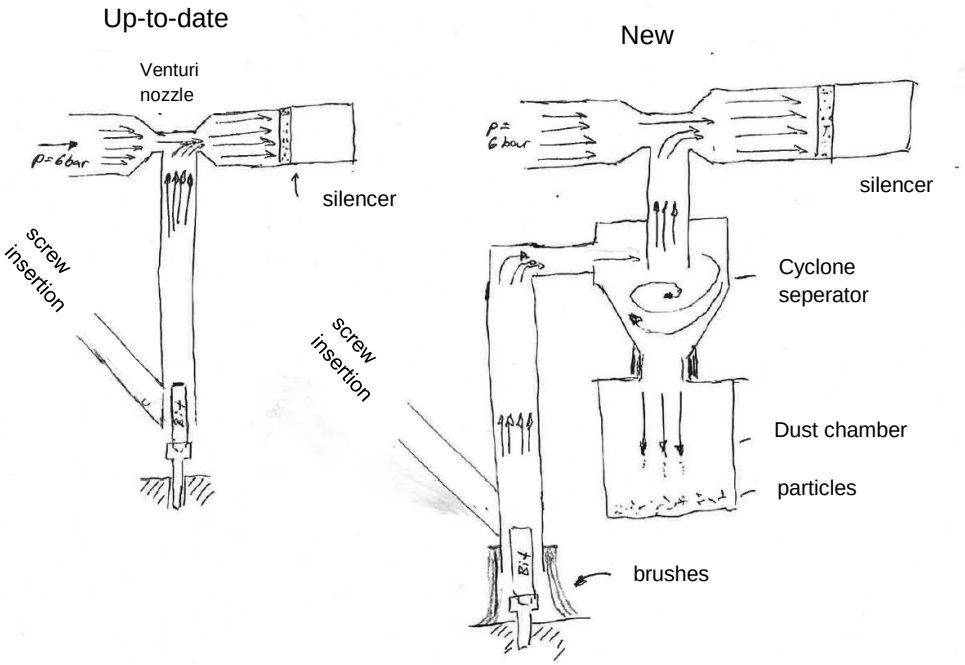


Image View 1:

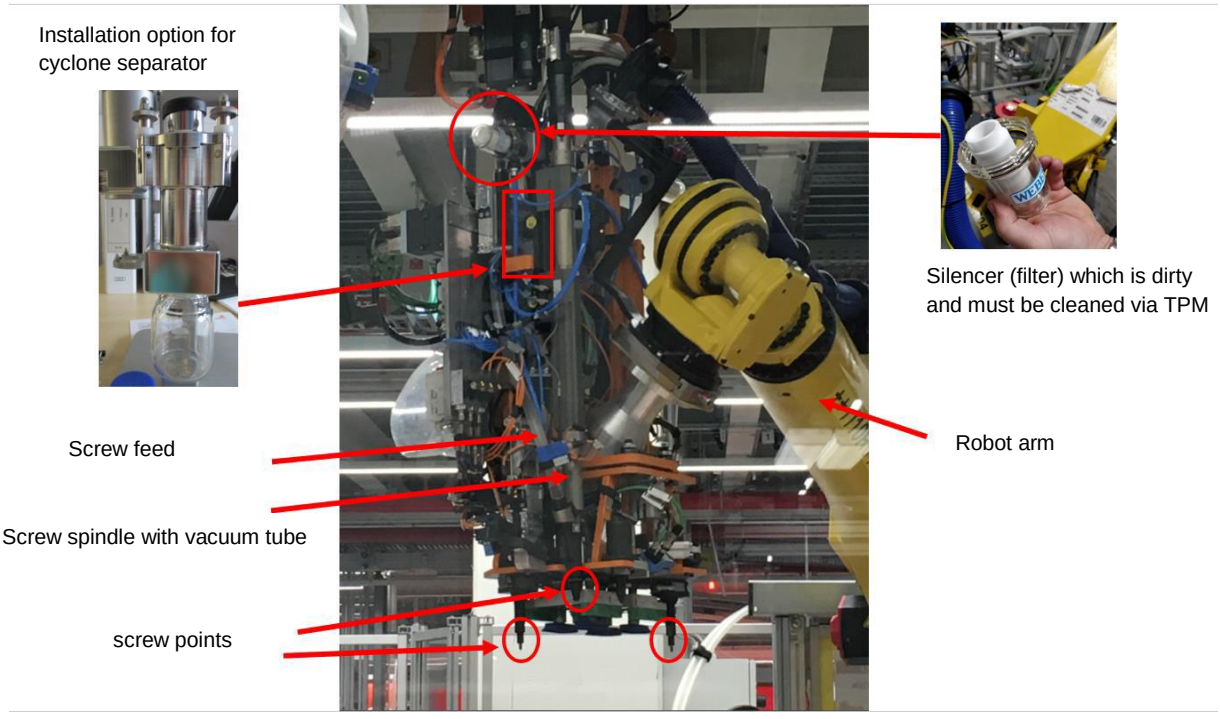
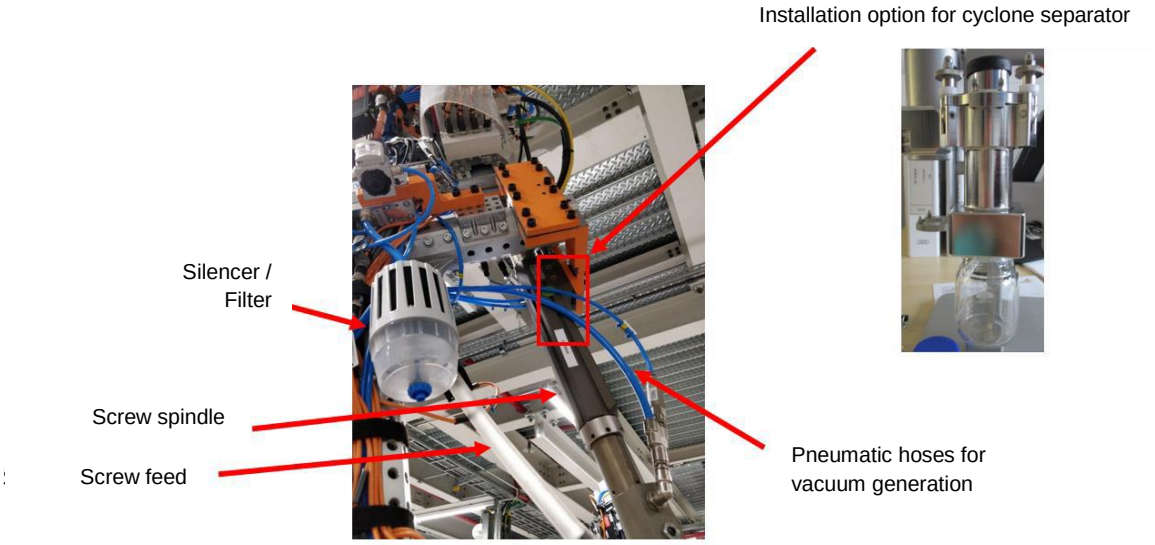


Image View 2:


Installation option for cyclone separator
Silencer /
Filter
Screw spindle
Screw feed
Pneumatic hoses for
vacuum generation