

## Continuous Sieving and Dry Cleaning System

We are closing our insect pilot facility and therefore we are selling all of the equipment in there. This is the description and offer for our continuous sieving and dry cleaning system that we used to get a clean larvae fraction out of our crate contents. This is a description including all required peripherals. Note the description of the individual components and of the overall system.

As a complete package, our sieving system comprises equipment covering (1) the material streams and (2) airflow. The material streams (1) pass through (sequentially): 3-deck vibratory screen (top deck: agglomerates, middle deck: larvae, bottom deck: larvae excrements), aspiration channel, optional with differential pressure sensor to PID-control the airflow / sifting behaviour (sold separately).

These 2 steps will suffice for most purposes in maintaining a colony, like sieving out larvae / pupae / beetles, but we have more equipment for additional cleaning steps that can be implemented to achieve further purification of the larvae (/pupae / beetles) fraction: stone sorter to polish the larvae and take out wet agglomerate pieces with same mesh and density as the larvae, plane sifter to further purify the larvae fraction.

The airstream processing (2) is made from typical grain or feed milling components and comprises all the tubing pieces (powder coated steel), connected by clamping rings. The air passes through (sequentially): The aspiration channel, cyclone (with rotary gate and bag holder), bag filter (with automatic pneumatic filter cleaning, downstream either rotary gate (2-floor-setup) or upwards conveyor screw with rotary gate if set up on one floor), fan (7.5 kW, with inverter), silencer.

We used and continuously improved this sieving system in 3 years of pilot plant operation. The system was designed and operated with *alphitobius diaperinus*, but with some modifications (i.e. mesh size adaptation) it can be used for *tenebrio molitor*. We do not believe that the system is well suited for *hermetia illucens*.

Please note that we sell the pieces indicated for separated bids/offers due to different ownership: electrical cabinet including CPU, control software, switches and protection for all motors, inverters for the conveyor screw, the vibrating motors for the vibrating screen, and all other electrical components.

### Key Features in Operation:

- The sieving system was our principal sieving system that we used to separate all kinds of live *alphitobius diaperinus* from crate substrates, in particular:
  - sieving the larvae after a production cycle for harvest and processing or for re-seating with different densities for pupation
  - sieving larvae and pupae during pupation
  - sieving beetles out of substrate
  - all other applications involving live *alphitobius* individuals and loose substrate
- Easy to operate: Principal Feature of the automation of the sieving system is the differential pressure sensor that we used to PID-control the differential pressure across

the aspiration channel (electrics, automation and sensor sold separately). This allows for a very fine adjustment and guarantees a very high degree of separation in the aspiration channel, in particular when running over longer periods of time and with changing substrates or fractions. The sieving system can be set and does not need to be continuously readjusted afterwards, which allows for easy operation with 1 or 2 operators.

- The cleaning of the larvae is achieved without the use of a washing step, which we believe is crucial for achieving microbiology targets in the processing of the larvae. We have produced samples of alphetobius based ingredients sieved with this system that achieve below threshold microbiology counts for food applications without the use of a strong microbiological kill step. Note, however, that the machines are only partially food grade due to various issues with the individual machine designs (i.e. ease of cleaning, dead zones) and material selection (some, but not all contact surfaces are stainless steel). The sieving system is more suited for a food pilot plant operation and maintaining a colony than it is for actual food production, but from a technology perspective it can serve well as a stepping stone to a fully food grade sieving and cleaning system.

### **Key Technical Features:**

- The 3-deck vibratory screen is our latest addition to the system and about 1 year old. It is made completely of V2A stainless steel and comes with 2 vibratory motors and a very sturdy stand to put it above head height to feed into the rotary gate of the downstream aspiration channel. The entire machine was custom made, including material outlets for the 3 decks. The bottom sieve we use to sieve out the majority of the larvae excrements from our rearing cycle, around 0.9mm (to be confirmed) circular holes in metal sheet. The top sieve is a “pen sieve” (around 25 x 4 mm holes in longitudinal and transversal orientation, tbc) that passes through alphetobius larvae but not larger agglomerates and pupae / beetles. Both sieves can be exchanged for new ones, should you intend to use the system for tenebrio molitor.
- The aspiration channel is entered through a rotary gate (special design to avoid harming any larvae). It has transparent screw-on acrylic side windows, that allow monitoring of the material streams and the light and heavy fractions. It is made from stainless steel. There is also a smaller (half size) but as well very functional version available that is powder coated steel. The (larger) stainless steel version is attached to the ceiling via a stainless steel bar construction. The smaller (half size) version stands on a stainless steel stand attached to the floor.
- The plain sifter has 2 extractable decks made from a wood frame construction with a ball cleaning system. Various mesh size sheets or sieves / grates can be attached to the wood frame. The top deck is open and can be viewed when operating the machine. The middle fraction goes out around 90cm wide through a metal sheet at the end of the machine. Top and bottom fractions go out to the left. The machine is made from powder coated steel (white)
- The stone sorter (old Bühler model) has 2 outlets, in operation with a pre-sieved larvae fraction the stone outlet (in classical milling operation the rejects) is where the larvae come out. The grain outlet (in classical milling operation) is where the “rejects” come out. It has a material-flow actuated inlet, and above the deck a large hose connector to

connect to the aspiration system to suck away dust or small particles from polishing. The stone outlet is “closed” by a pinched rubber hose (works well in operation). The grains-outlet is not closed in our setup, we suggest adding a rotary gate to prevent air from entering the process through the stone outlet.

- The cyclone is an old but functional model made from powder coated steel and comes with a rotary gate, a viewing glass and a bag holder.
- The bag filter is an old Bühler type filter with 7 filter bags and an automatic pneumatic cleaning system. It can be set up with a conveying screw and a rotary gate behind, or with a funnel and rotary gate below to drop the filter rejects to the floor below. Note that the automatic cleaning consumes a lot of pressurised air when continuously switched on, we had that switched on intermittently by our automation system, alternatively you could setup a simple switch based system with a timer to prevent having the cleaning on all the time (and save a lot of pressurised air).
- The fan is an old but functional model that is slightly too large for the sieving system (may be ideal for tenebrio molitor), we controlled the fan speed via an inverter controlled by the CPU and fed with the signal from the differential pressure sensor on the aspiration channel. We highly recommend using this setup for consistent results.
- The tubing is standard milling grade tubing made of thick welded non-stainless but powder coated steel connected by rubberised ring clamps.

## **History of the System**

We initially started with a pieced together sieving setup bought from a used equipment trader in 2020. We then continuously improved over various iterations, including Version 3 of the first sieving machine and version 3 of the aspiration channel until we got satisfactory results from the sieving system. The last improvement were a new vibratory screen and new aspiration channel in 2023. The system overall has been in operation in our pilot plant since late 2020.

## **Full Equipment List**

see Offer form below for full equipment list.

## **Teardown, Transport, Installation, Commissioning, Training of Operators.**

The sieving system can be fully disassembled, the largest remaining pieces would be the aspiration channel and the plain sifter, which cannot be disassembled.

If you buy the whole system, we can support you on teardown, packaging, installation, commissioning, and training for operators on your site based on your requirements. please contact us for a separate quote for this.

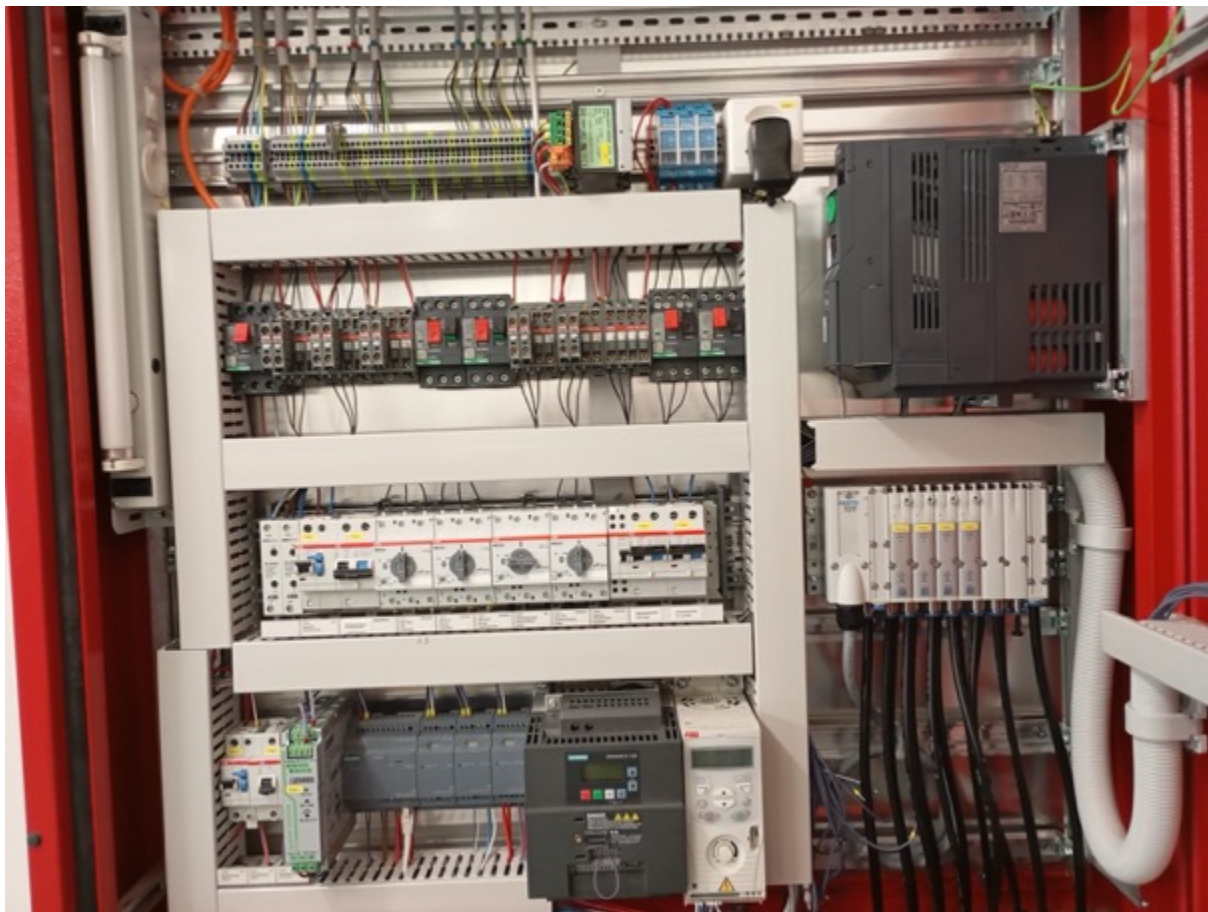
## **Legal Disclaimer**

Please note that we do not give any guarantees to the state and conditions of the system. The system is working and operational without fault at our site, but we reject any liability

claims for damage during teardown, transport, assembly or operation at your site. We are selling the equipment as is and we do not give any guarantees with it.

## Bidding Process

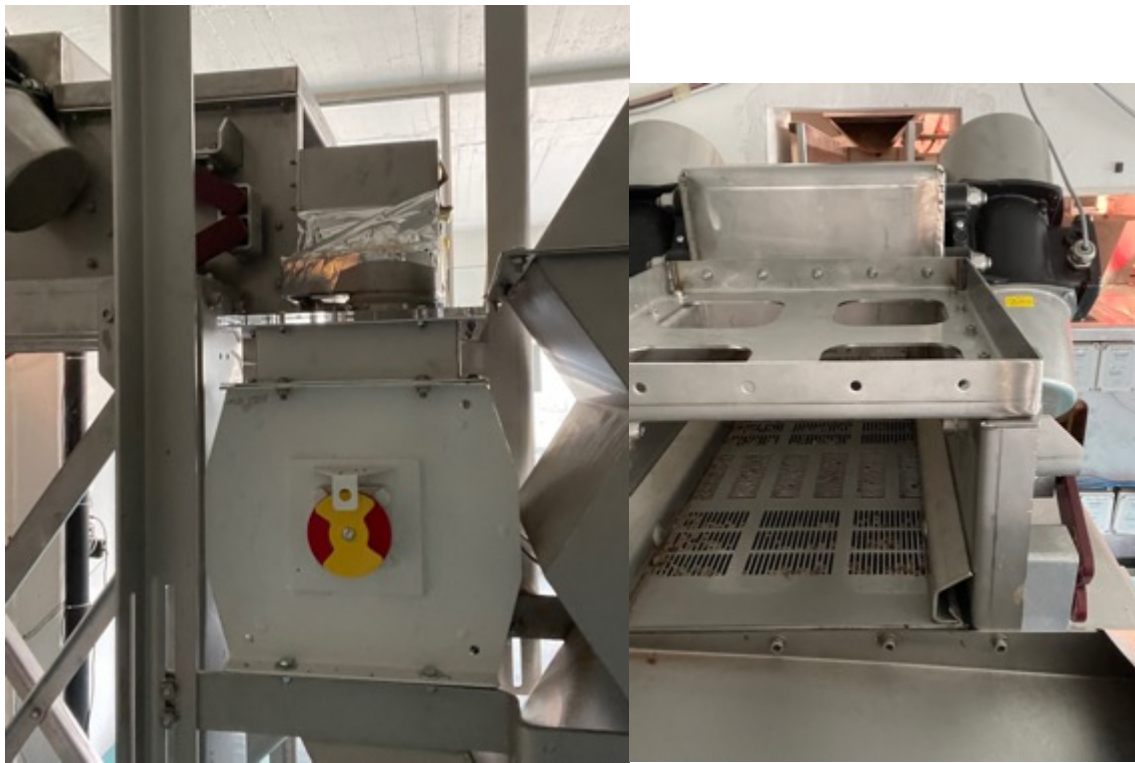
We will receive Bids for the entire system (see form below) in a first round until May 31<sup>st</sup>. We will inform bidders on their offer following the closing of the first rounds and will offer them the option to improve their bids until June 14<sup>th</sup>, 2024. Indicative price for a complete bid is above 50'000 CHF in total. If we do not receive sufficient bids, we will sell the components individually afterwards.



Electrical cabinet for controls of the sieving system (inside)

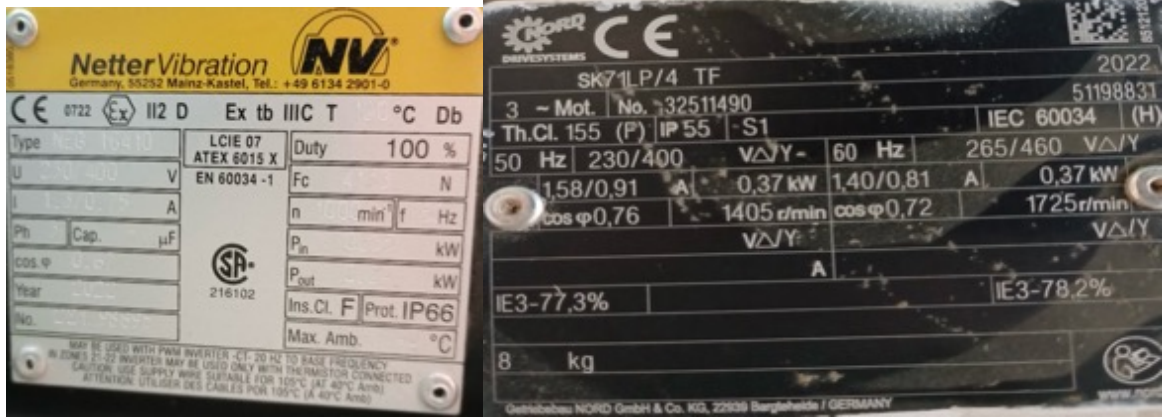


Vibrating Screen on sturdy steel frame construction



rotary gate of aspiration channel (left) and

inside view of vibrating screen



vibratory motors of vibrating screen and motor of the rotary valve between the slot sieve outlet and the Aspiration Channel



Aspiration Channel (large)



Aspiration Channel (small)



Plane Sifter



Cyclone and rotary gate



motor plate for rotary gate motor





Exhaust air filter

|   |       |                |               |       |              |
|---|-------|----------------|---------------|-------|--------------|
| MT<br>Motori Elettrici - (BO) ITALY   |       | US             |               | CE    |              |
| Tipo INT0154 B5   |       |                | Nr. A49077329 |       |              |
| Prot. IP  | Serv. | Cos. $\varphi$ | Is. Cl.       |       |              |
| V   | Hz    | HP             | kW            | min-1 | A $\Delta/Y$ |
| 240/400   | 50    | 1              | 0,75          | 1415  | 3,5/2        |
| 240/400   | 50    | 1              | 0,75          | 1435  | 3,7/2,1      |
| II 3G Ex nA IIC T4/T3 Gc<br>II 3D Ex tc IIIC T135°C/T200°C Dc IP65<br>Cert. N. TÜV IT 13 ATEX 042 X<br>AVVERTIMENTO - NON APRIRE SE SOTTO TENSIONE<br>ITALIAN ORIGIN AND PRODUCTION (BOLOGNA) |       |                |               |       |              |



Drive of the rotary valve at the outlet of the filtered fraction



Fan and silencer