



COMBINED MINIPIG AND DOG PEN FOR BIOMEDICAL RESEARCH

Tine Jensen, Arrowmight

An increasing number of minipigs are used in research today and as a consequence the demand for minipig pens is growing. Modified dog pens are today often used to house these minipigs.

In a time when research requirements are changing rapidly, flexible solutions are the key to cost effective research and as a supplier of pens for large animals, we acknowledge the need for a combined minipig and dog pen.

This article is the result of a close collaboration between Ellegaard Göttingen Minipigs A/S as the expert on minipigs and Arrowmight as a long-standing supplier of pens for

large animals. The aim of this article is to introduce a pen designed to house both dogs and minipigs. We will be focusing on the different requirements, which are to be met for dogs and minipigs respectively. We will also show you examples on how dog pens have been converted to minipig pens in-house by the users.

Floor Area

According to the revised Appendix A of the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (ETS 123), June 2006, the minimum enclosure dimensions and space allowance is as follows for pigs and dogs respectively:

TABLE G.4. Pigs and Minipigs: Minimum enclosure dimensions and space allowances

Liveweight (kg)	Minimum enclosure size* (m ²)	Minimum floor area per animal (m ² /animal)	Minimum Lying space per animal (in, thermoneutral conditions) (m ² /animal)	Maximum nos of minipigs/pen of 2.25 m ²
Up to 5	2.0	0.20	0.10	11
over 5 to 10	2.0	0.25	0.11	9
over 10 to 20	2.0	0.35	0.18	6
over 20 to 30	2.0	0.50	0.24	4
over 30 to 50	2.0	0.70	0.33	3
over 50 to 70	3.0	0.80	0.41	
over 70 to 100	3.0	1.00	0.53	
over 100 to 150	4.0	1.35	0.70	
over 150	5.0	2.50	0.95	
Adult (conventional) boars	7.5		1.30	

Table D.1. Dogs: Minimum enclosure dimensions and space allowances

Weight (kg)	Minimum enclosure size (m ²)	Minimum floor area for one or two animals (m ²)	For each additional animal add a minimum of (m ²)	Minimum height (m)
Up to 20	4	4	2	2
over 20	4	8	4	2

It is also worth noting that minipigs reach sexual maturity at 3 – 4 months of age when they weigh 5 – 10 kg (farm pigs when they are 7 – 8 months of age), whereas dogs reach sexual maturity at 7 – 8 months of age.

The majority of minipigs used in research weigh less than 50 kg and most of them weigh between 7 – 25 kg. Group housing is recommended whenever possible as dogs and minipigs are social animals. Depending on how the guidelines are interpreted the space taken up by the food bowl, platforms, etc., might be deducted from the floor area and for that reason we have decided on a standard pen module size of 2.25 m².

Each pen can be connected to the adjacent pen by means of a hatch for easy extension of the floor area for housing of larger groups of animals or separation during feeding or experiments.

The height of the pen is a standard 2 metres to allow for housing of both dogs and pigs.

This set-up leaves us with a standard pen module size of 2.25 m² suitable for housing of up to 11 minipigs. Two connected pen modules provide us with a pen size of 4.50m² suitable for housing of two dogs below 20 kg and quite a number of minipigs.



Structure and material

Reinforced glass in combination with bars and laminate panels in the colour of your choice offer a pleasant, light and open environment. This design improves the visibility and reduces the overall noise level, as the animals are calmer when they are able to observe the environment visually.



Ventilation

Good ventilation is essential to keep the facility dry and comfortable (no smell) and to avoid bacterial growth. To that end, supply ventilation should be located in the centre of the corridor and an exhaust should be positioned in the ceiling inside the pens. To avoid short cutting of air, the top part of the pen is made of solid glass panels to force the air down. The lower part of the pen is an open structure formed by stainless steel bars ensuring that the air is directed into the pen at low level.

To save energy and achieve the best possible climatic conditions, the ventilation and temperature may be CO₂ controlled, as is the case at the Ellegaard Göttingen Minipigs production facility. Air samples are taken continuously; the samples are analysed and depending on the result the air change rate is adjusted and / or the air is cooled / heated.

Low ventilation results in:

- Poor air quality (smell)
- High humidity (condensation on walls and windows)
- High concentration of disease producing bacteria and vira
- Non or low requirement of adding of heat

High ventilation results in:

- Good air quality (no smell)
- Dry air (could be too dry)
- Low concentration of disease producing bacteria and vira
- High requirement to adding of heat

It is especially important that the air in the resting / sleeping area is draft free and the air speed in this area is below 0.3 m/sec.

Hatch

A sliding hatch allows you to open up between pens increasing the floor area as required depending on whether you are housing minipigs, dogs or larger groups of either. The hatch is made of bars allowing physical contact between animals in adjacent pens. A transparent panel can be slid in place to prevent physical contact in an experimental situation though still allowing visual contact. The hatch should be positioned at the front of the pen; the front of the pen is defined as the active area closest to the corridor, where feeding and watering will be positioned. This is also where the “toilet” area will be located, whereas the rear end of the pen is for resting and privacy.



The hatches can be placed at different levels to vary the environment, though for pigs only the lower one will be used. The hatch is activated from outside the pen through an articulated arm, minimising animal disruption and stress.

Platform / Shelter

Dogs use the **platform**/shelter for exercise and as an observation point. The platform provides a variation in the environment.

Minipigs need a dry, draft-free, warm and private sleeping and resting area, which can be provided by a **shelter**/platform.

Therefore, the platform/shelter should be designed to meet these two different requirements.

In a dog pen several platforms may be fitted in the pen at different heights to provide variation, exercise possibilities and observation points.

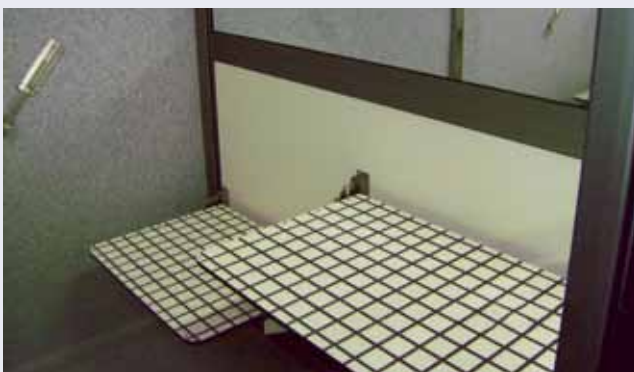


In a minipig pen at least one of the platforms should be placed at a height and location suitable to serve as a shelter. If the pen is deeper than it is wide, the rear of the pen lends itself well to a shelter and provides the minipig with a safe and sheltered area. To avoid draft, it is important that there are no gaps between floor and pen walls in this area. Also the floor should be well insulated and if possible bedding should be provided.

An easy drop-in bedding retainer panel maintains the bedding in place and provides a safe and warm area for the pig. The internal height under the platform should be 35 cm and with the bedding retainer panel in place, the opening into the shelter is reduced to 25 cm.



Typical dog pen used for housing of minipigs. The platform serves as a shelter and offers a private resting area for the pig



The platforms are hinged and can be removed for washing or when not needed e.g. the upper platform may be removed when minipigs are housed.

Temperature

Pigs are highly sensitive to environmental temperature and place a high behavioural priority on thermoregulation. Within the ranges given, suitable temperatures will vary according to body weight, sexual maturity, the presence or absence of bedding, group housing and the caloric intake of the animal. If the minipig is provided with a draft-free shelter with bedding, and / or is group housed, and the room temperature is maintained at 19 – 23 degrees Celsius, extra heating will normally not be required.

Please note that the EU guidelines (table G.3. below) include both farm pigs and minipigs. The growth rate of farm pigs and minipigs are very different. Consequently the age rather than the body weight should be used as reference for room temperature. The temperature should be measured at floor level. At weaning a minipig weighs 2+ kg whereas a farm pig weighs 7+ kg! The temperatures in table 1 below are the temperatures recommended by Ellegaard Göttingen Minipigs A/S.

However most importantly watch the animals, if they are piling together, it is too cold. If they are lying far apart or soiling themselves, it is too warm. As a general rule, if bedding is available the room temperature can be lowered a couple of degrees.

For young piglets it may be necessary to increase the temperature under the shelter. This may be done by floor heating or by automatic temperature controlled platforms/shelters.



Minipig keeping warm in the shelter with plenty of bedding.

TABLE 1

Age	Weight	Temperature °C
Newborn piglets	0.4 – 0.5 kg	34
4 weeks *)	2 – 3 kg	28
6 weeks	3 – 5 kg	26
3 months	6 – 7 kg	22-24
6 months	13 - 14 kg	20-22
More than 6 months	>13 kg	18-20

Source: Ellegaard Göttingen Minipigs A/S

*) Local temperature under the shelter, should be gradually lowered until weaning at 4 weeks.

TABLE G.3. Pigs and minipigs:

Guideline temperature ranges for single-housed animals

Liveweight	Recommended temperature range (°C)
Less than 3 kg	30 to 36
from 3 to 8 kg	26 to 30
over 8 to 30 kg	22 to 26
over 30 to 100 kg	18 to 22
over 100 kg	15 to 20

Source: Appendix A of the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (ETS 123)

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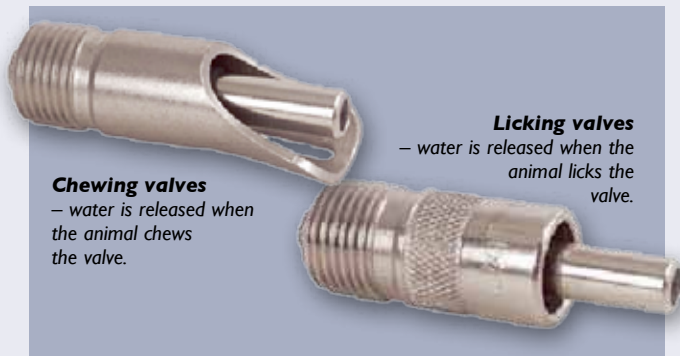


Minipig drinking from chewing valve.



Watering

Minipigs are particularly sensitive to water deprivation. Therefore group-housed pigs should have access to at least two drinking points. Two types of drinking valves are currently used in pens:



Chewing valves
– water is released when the animal chews the valve.

Licking valves
– water is released when the animal licks the valve.

We have seen both chewing valves and licking valves used for both minipigs and dogs. Minipigs like to chew on chains and bars and providing chewing valves for the minipigs would be an additional enrichment.

To keep the pen dry and clean the drinking valve should be placed outside the pen or at the very front of the pen. The pen should be sloping towards the pen front (an incline of minimum 3%) to ensure that any spillage of water will drain off into the corridor drains. If possible drains should be

placed right outside the pens and not at the centre of the corridor, to keep the corridor and pens dry at all times. In some facilities mainly production facilities slatted floors are used for ease of cleaning. In research facilities it is normally not possible to have a slatted floor.

Solid flooring is often preferred as it facilitates observation of faeces. Minipigs quickly learn where to defecate and if the floor is slatted they will press the faeces through the slats with their hooves. This will not be the case if you are using the pens for dogs.

If you are considering slatted flooring, the slats should be 10 – 20 mm and the openings between the slats should be 10 – 11 mm. Housing of pigs younger than 4 weeks require smaller openings, which can be achieved by covering the slats with a rubber mat with smaller openings.

The height of the drinking valve needs to be adjustable 10 – 50 cm; always located at the upper shoulder height of the pig. This way the pig will have to lift its head to drink and the water will run directly into its mouth instead of out of its mouth. Also the size of the opening through which the pig is drinking should be adjustable to accommodate the snout of the pig's head.

The water valve must provide 1 – 2 litres of water per minute at a water pressure of 1 – 2 bar.

TABLE G.6. Pigs and minipigs:
Minimum drinking point allowances

Drinker type	No. of pigs per drinking point
Nipple or bite drinkers	10
Large bowl drinkers (which allow at least two pigs to drink at the same time)	20

TABLE G.7. Pigs and minipigs:
Minimum drinking water flow rates for pigs

Type of pig	Minimum water flow rate (ml/min)
Weaners	500
Growers	700
Dry sows and boars	1000
Lactating sows	1500

Source: Appendix A of the European Convention for the Protection of Vertebrate Animals used for Experimental and other Scientific Purposes (ETS 123)

Cleaning

It is important to keep the pen as clean and dry as possible to minimise bacterial growth. The mini pigs will normally use the “wet” area as the toilet. The pigs are clean animals and they will find a place which they will use as a toilet, normally where there is a bit of water, for example by the water valve. A good trick is to wet with water the area that you want the pigs to use as a toilet - before introducing the pigs into the pen. To reduce the consumption of water and to maintain a dry, healthy environment and to minimise bacterial growth, it is worthwhile considering to spot clean daily and only deep clean weekly. A foam cleaning system like the Dosatron system lends itself well for this purpose. Apply the foam on the surface, leave it to work for five minutes, rinse with water and clean off with a squeegee. The foam loosens the dirt and as a result the amount of water required is reduced and the relative humidity is maintained at a reasonable level. High pressure cleaning requires a large amount of water and leaves you with a high relative humidity.

Flooring

The floor should be sloping 3% towards the pen front / corridor. It should be made of non-slip material e.g. epoxy with sand. This type of flooring also allows for natural wear of the hooves and offers a good non-slip play area for dogs.

Feeding

The food bowl should be height adjustable to ensure that also small mini pigs can eat from it. It should be firmly secured to ensure that it does not come off when the pigs/dogs eat and play. For minipigs the bowl should be adjustable from 7 – 15 cm from floor to the edge of the bowl.



User modified food bowl height adjustable and locked in chosen position for minipigs



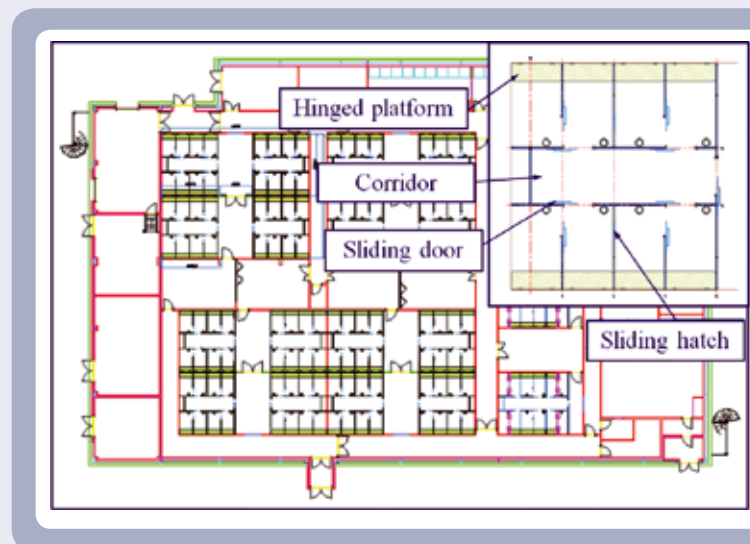
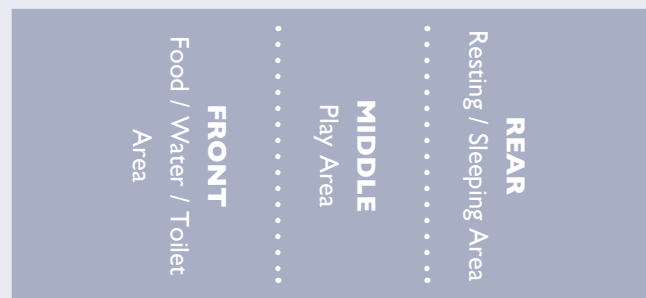
Food bowl hatch located at different heights for variation, only the lower one would be used for minipigs. It is easy to fill the food bowl from outside and swing it back into the pen.

Enrichment

Group housing whenever possible as both minipigs and dogs are social animals. For dogs, platforms should be placed at different heights to provide good exercise possibilities and excellent observation points. For minipigs the provision of straw and hay will be welcomed. The straw is excellent as bedding material and it keeps the animals occupied with rooting and chewing activities. If straw cannot be used for experimental reasons, a stainless steel chain is a good alternative. There should be one chain per pig and they should be hanging 5 – 10 cm from floor level. A plastic chew stick is also a good supplement. Plastic balls with holes (ferret balls) can also be used as enrichment. Make sure the holes are not too big; the pig should not be able to get its head through, only its snout.



General pen arrangement



Special requirements

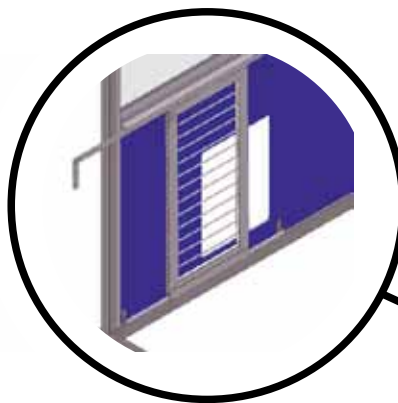
This article does not cover special requirements for housing off newly born piglets and juvenile studies.

Acknowledgement

Arrowmight has been a leader in the design, fabrication and installation of large-scale bespoke animal housing facilities for over 25 years. We would like to thank Ellegaard Göttingen Minipigs A/S for inviting us to write this article and for sharing their knowledge and experience on minipigs with us. Together our knowledge and understanding of these animals will contribute to the ongoing development of our minipig / dog pens, ensuring that we continue to provide the best environment for the animals' welfare.

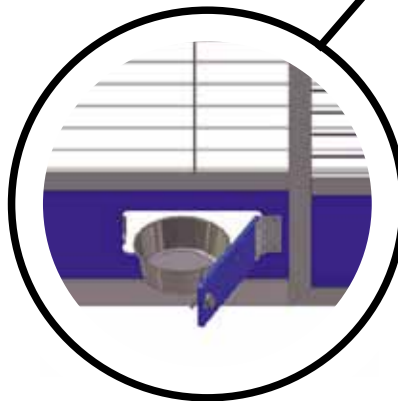


The hatch can be formed from either solid panels, stainless steel bars or glass for no contact, physical contact or visual contact only as required by the experimental situation

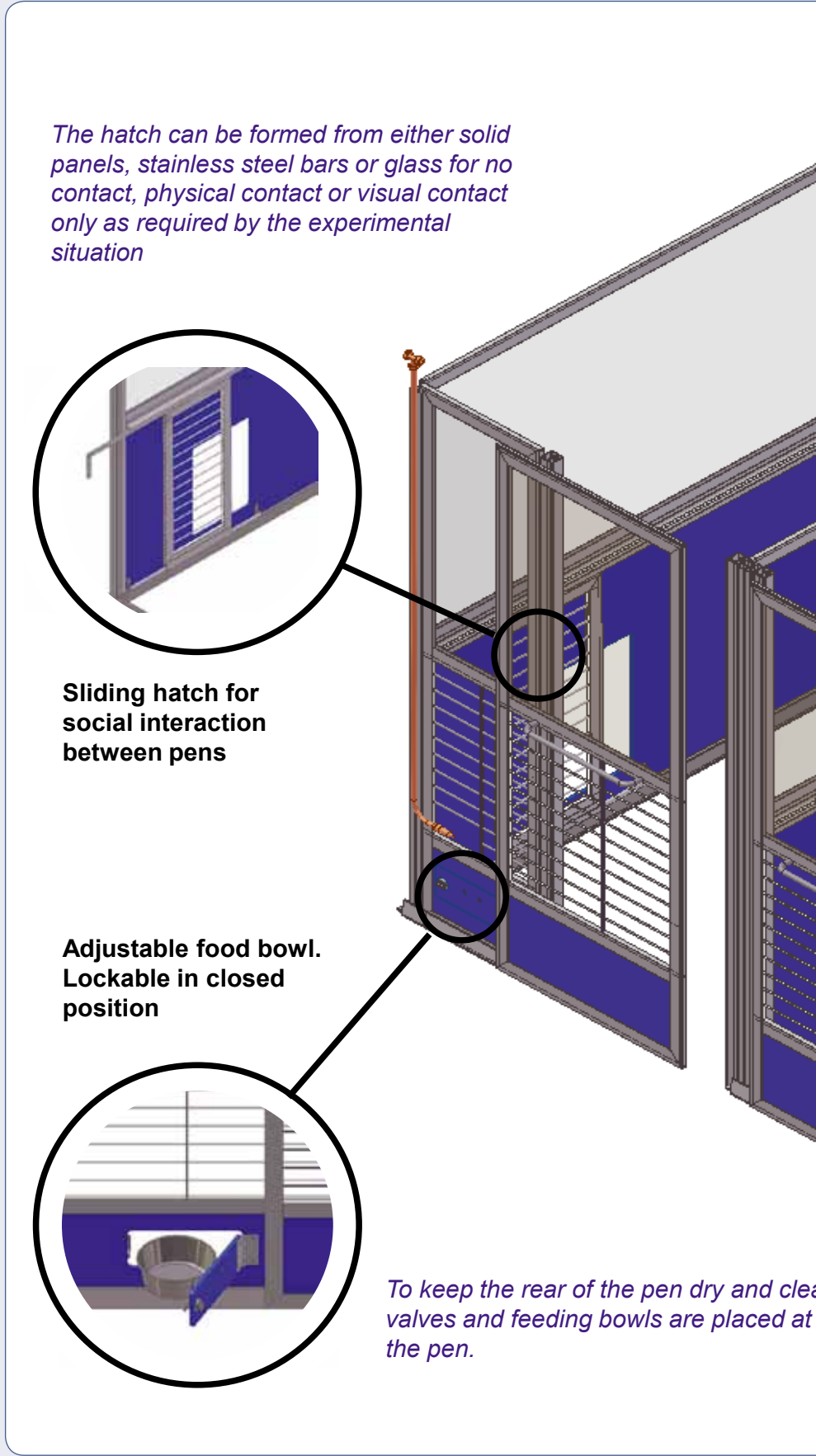


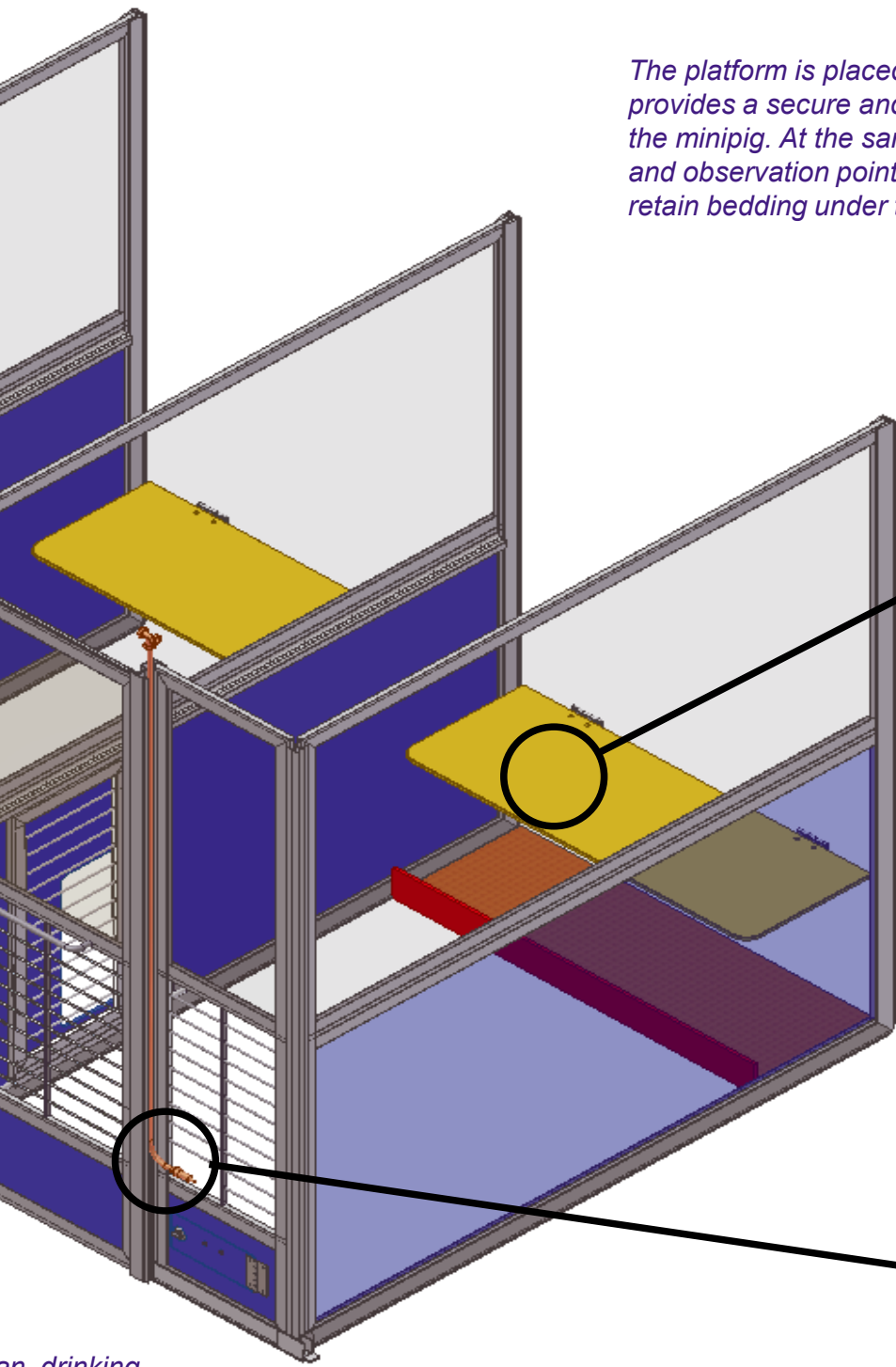
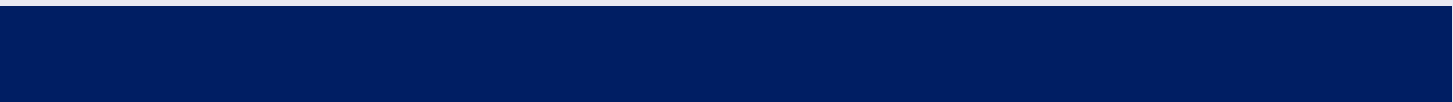
Sliding hatch for social interaction between pens

Adjustable food bowl. Lockable in closed position

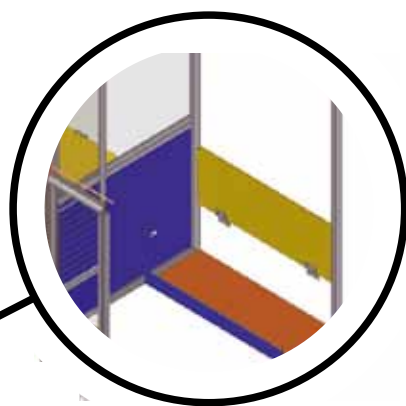


To keep the rear of the pen dry and clean valves and feeding bowls are placed at the pen.



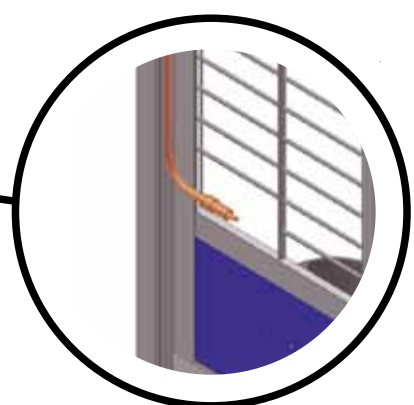


The platform is placed at the rear of the pen and it provides a secure and warm resting / sleeping area for the minipig. At the same time it serves as a raised area and observation point for the dog. A low panel is fitted to retain bedding under the platform



Hinged platform for ease of cleaning and removal if required

Adjustable drinking valve to accommodate pigs and dogs at different age



*an, drinking
the front of*

