Amber number	**BWL 2011.13.V6**
System name	**Stable with heat heaters with air mixing system for drying litter layer**
Diercategorie	**Rearing hens and roosters of laying breeds (E 1.16), (large) parents of broiler chickens reared (E 3.7), broilers (E 5.14), parents of broiler turkeys reared for up to 6 weeks (F 1.6) and from 6 to 30 weeks (F 2.6) and broiler turkeys (F 4.8)**
System description of	**May 2021**
Replaces	**BWL 2011.13.V5 of November 2017**
Principle of operation	Ammonia emission control is based on drying and heating the manure/litter layer by means of heat heaters and continuously rotating circulation fans. By mixing the barn air, an even temperature is achieved throughout thebarn. The manure/litter layer is dried and the carbon dioxide (CO_2)is expelled from the animals.

DE TECHNICAL IMPLEMENTATION OF THE SYSTEM; ARCHITECTURAL		
	Part	**Uitvoeringseis**
1	Vloeruitvoering	The total barn floor construction including any underlying sand layer must have a heat resistance (Rc value) of at least 0.5.
DE TECHNICAL IMPLEMENTATION OF THE SYSTEM; TECHNICAL FACILITIES		
	Part	**Uitvoeringseis**
2	Huisvestingsvorm	Full litter floor
3	Drinking water	Drinking water supply equipped with anti-spill system
4a	Heating and air circulation system	There must be well-maintained and fire-safe heat heaters[1] that consist of a heat source with fans for the warm air distribution

[1] The point is that air can be heated and that this air is distributed. The combustion chamber in which a fuel is burned may be present in the heater (directly fired heater). The combustion chamber must be a supply channelfor the supply ofcombustion air from outside the barn and a discharge channel for the removal of flue gases outside the barn (closed combustion). It is also possible that there is a combustion device elsewhere outside the animal space and the heatis transferred to the heaters via leads(indirectly fired heater)

4b		The heat heaters for heating the barn are distributed over the length of the barn under the ridge of the barn and/or hung along the side façade of the barn. When the heat heaters are placed under the ridge, it hangs a maximum of 1.5 meters below the ridge. When the heat heaters areplaced along the side façade, it hangs at a maximum distance of 1.5 meters from the façade and at a maximum distance of 1.5 meters above the floor[2]. When the heat heaters are placed outside the barn, the heated air is blown out by each heater parallel tothe side façade at a maximum distance of 1.5 meters from the façade and at a maximum distance of 1.5 meters above the floor[3]. The heated air is mixed with circulating fans with warm air in the barn.
4c		The minimum installed fan capacity of the heat heater is 0.35 m³ per animal place per hour (or 8 m³ per m² of stable area). If the fan capacity of the heat heater is adjustable, a frequency converter is available for this purpose.
4d		When placing the heat heaters in the ridge, the blowing direction of the heaters can be directed both to one and from the middle to both end facades. When the heat heaters are placed along the side façade, the direction of blowing of all heaters must be equalto, or opposite to, the direction of rotation of the hands of the clock. There must be no conflicting air currents.
4E	Circulation fans	The circulation fans hang in line with the heat heaters at a distance of up to 20 meters. When the heat heaters are placed under the ridge of the barn, the circulation fans hang at a maximum of 1.5 meters below the ridge of the barn. When the heat heaters are placed along the side façade of the stable, the circulation fans hang at a maximum distance of 1.5 meters from the façade and at a maximum distance of 1.5 meters above the floor[4].
4f		The circulation fans continuously keep the air movement in the barn going. The blowing direction of the circulation fans is equal to the blowing direction of the heat heater.
4g		The minimum installed capacity of the circulation fans is 20 m³ per m² of stable surface.
5	Registration equipment	The following recording equipment shall be provided: - equipment for recording the lighting of the heat heaters (hour meter); - equipment for recording the realized temperature curve, indoor and outdoor temperature; - equipment for recording the realized ventilation flow rate - equipment for recording the curve fan capacity circulation fans

[2] Distances are measured from the outside of the heater.
[3] The distances are measured from the outside of the heater's outlet in the animal enclosure
[4] The distance is measured from the outside of the circulation fan.

6	Capacity	As a rule of thumb, the following heating capacities to be installed are used (at a desired barn temperature of 35°C): - nieuwbouwstallen; 100 W/m² - existing stables; 125 W/m² For broiler turkeys, abnormal situations may occur: - in addition to the space heating by the heaters, local heating is also present: the capacity of the heaters can then be reduced (the desired room temperature is 25 - 28 °C). - some of the animals (usually the roosters) are transferred to another barnafter a rearing period of about 6 weeks: in this barn a lower room temperature is needed, of 20 - 23 °C. The capacity of the heaters can be adjusted accordingly The following applies to all situations: calculation of the capacity of heaters by the supplier.

USEOF THE SYSTEM		
	Part	**Gebruikseis**
a	Leefoppervlak	<u>For (large) parents of broiler chickens rearing up to 19 weeks:</u> minimum 900 cm² and maximum 1100 cm² per animal by design (8.3 to 11.1 animals per m ²) <u>In parents of broiler turkeys rearing up to 6 weeks:</u> Minimum 625 cm² per animal by design (16 animals per m²) <u>In parents of broiler turkeys rearing up to 6-30 weeks:</u> Minimum 1330 cm² per animal at set-up (7.5 animals per m²) <u>In broiler turkeys:</u> Male animals: Minimum 3330 cm²/animal by design (3.0 animals per m²) Female animals: Minimum 2040 cm²/animal by set-up (4.9 animals per m²)
b	Airflow	Due to the continuous switching on of the circulation fans, the barn air is well distributed over the litter surface.
c	Temperature curve setting	The heating is switched on as there is a need for extra heat in the barn, for this the temperature curve is followed.
d	Fan setting in heat heater when heating	The heating is switched on when the room temperature falls below the set temperature, when heating the fan runs in the heater.
and	Fan setting in heat heater when not heated	When there is no extra heat requirement and therefore no heating is done, the fan in the heater is off.
f1	Setting circulation fans	The circulation fans run at a minimum of 20% capacity when the animals are placed. This is increased to a minimum of 30%, as soon as the maximum capacity of the heat heaters is reached. The capacity may be controlled on the basis of the fancapacity for total air exchange. When heating is no longer the case, the circulation fans must run at at least 30% of the capacity. At maximum ventilation requirement, the capacity of the circulation fans should also be 100%.
f2		The circulation fan located within a few metres of the heat heat ejection may be switched off during heating[5].

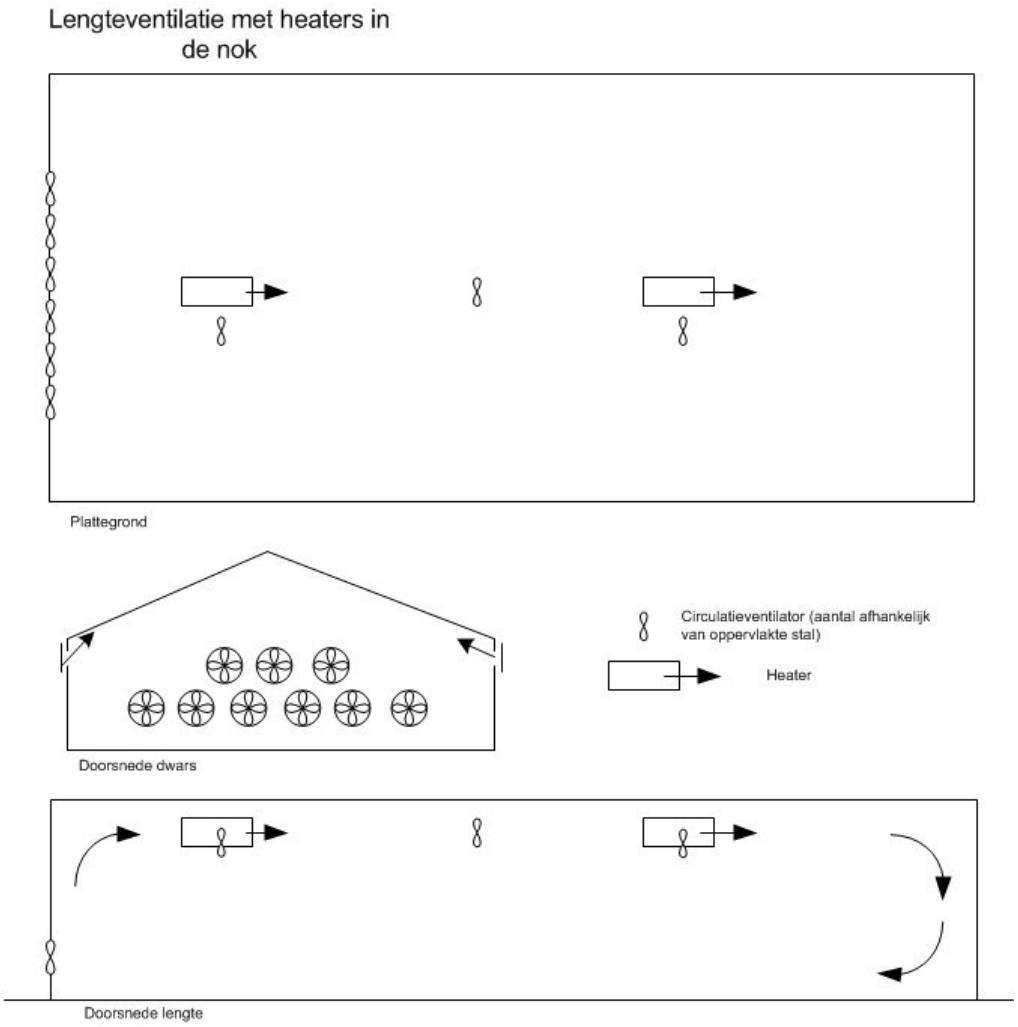
5 The operation of the circulation fan is taken over by the fan in the heater during heating.

g	Registration	For the purpose of checking the operation of the system, the following data shall be automaticallyrecorded: - turning on the heat heaters; - the activation of the circulation fans and the course of the capacity over a round. This is to determine that sufficient drying air is continuously blown over the litter bed; - of temperatuurcurve.

Emission factor	Rearing hens and roosters of laying breeds; younger than 18 weeks; 0,088 kg NH_3 per animal place per year (Grand)parents of broiler chickens in rearing: 0,129 kg NH_3 per animal place per year Broiler chickens: 0,035 kg NH3 per animal place per year Free-range broilers: 0,035 kg NH3 per animal place per year Organic broiler chickens: 0,035 kg NH3 per animal place per year Parents of broiler turkeys in rearing up to 6 weeks: 0.08 kg NH_3 per animal site per year Parents of broiler turkeys rearing from 6 to 30 weeks: 0.24 kg NH_3 per animal site per year Vleeskalkoenen: 0.35 kg NH_3 per animal pitch per year
Reference measurement report	Research ammonia emissions Wesselmannheaters (BL2009.13756.01, version 3, March 2009) Update ammonia emission factors poultry; Advice for adjusting ammonia emission factors of poultry in the Regulation on ammonia and livestock farming (Rav). Wageningen Livestock Research, Report 1015

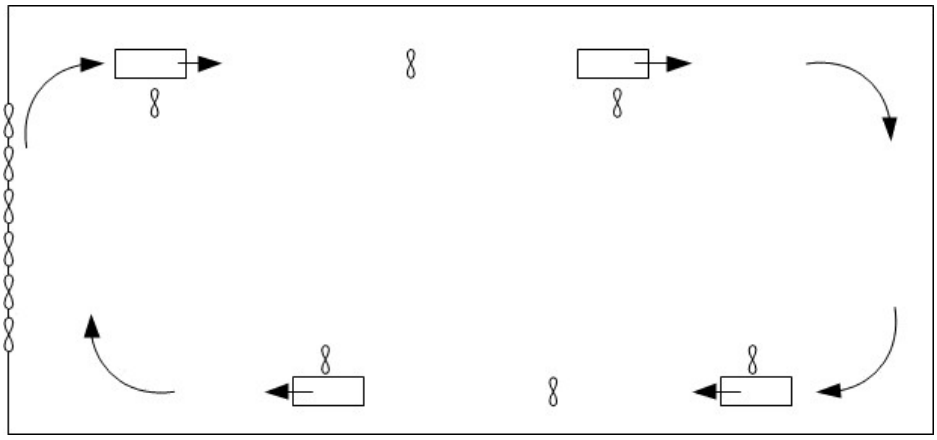
Floor plan and cross-section when using heat heaters and circulation fans

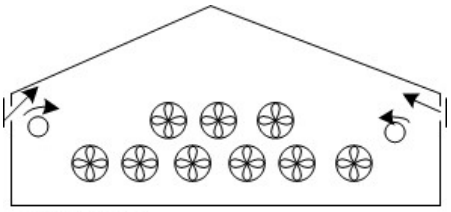
Versions with longitudinal ventilation:



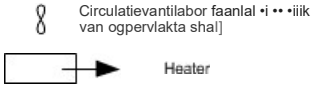
Note: the blowing direction of the heat heaters can also be directed from the center to both sides.

Longitudinal ventilation with
heaters along side walls

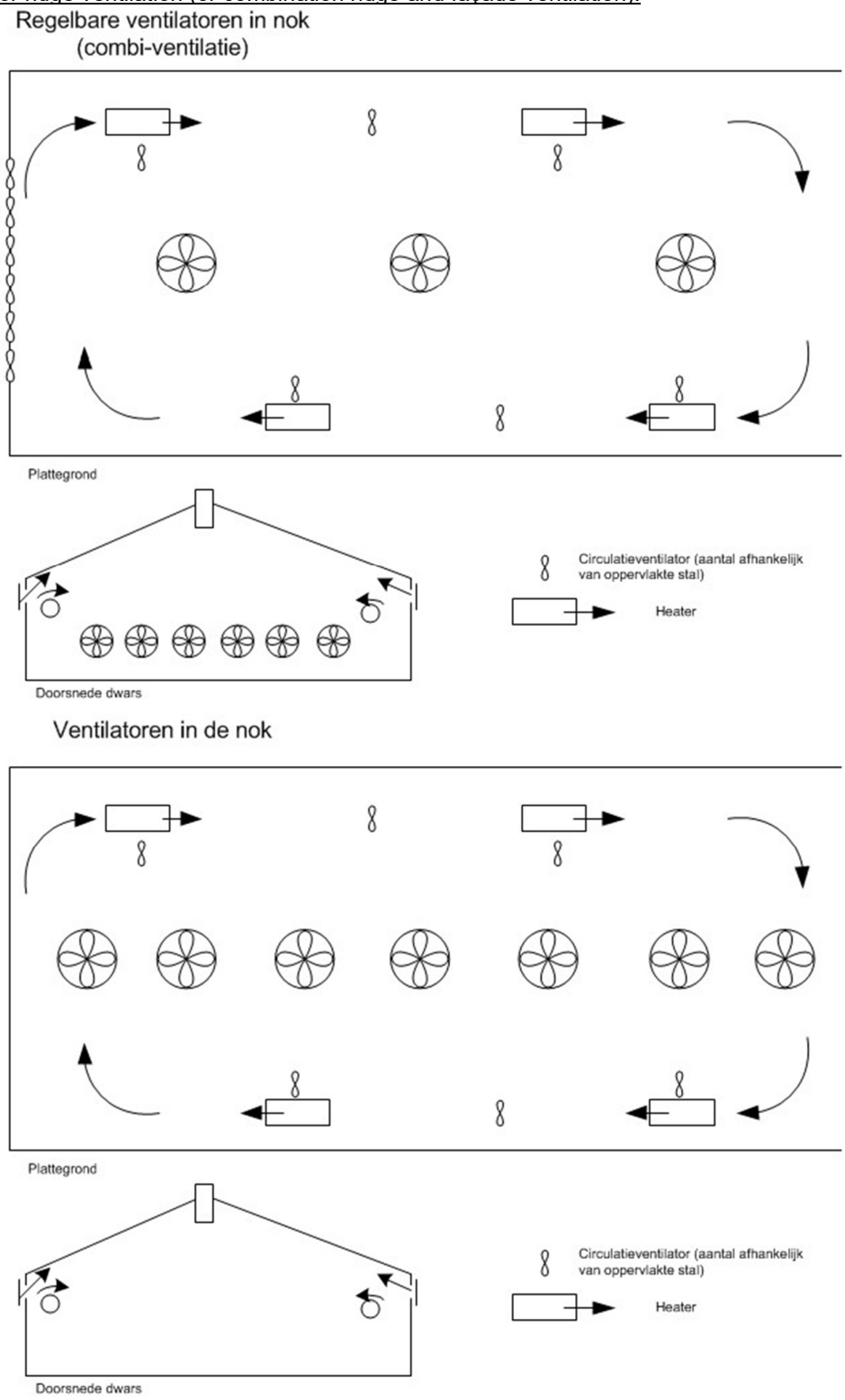




Doorsnede dwars



Versions for ridge ventilation (or combination ridge and façade ventilation):



Note: The heat heaters can also be placed in the ridge in this variant. However, due to negative effect on the air movement, this is not preferable.

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