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Fertigation equipment

水肥一体化设备

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1 Scope

The document specifies the product designation, technical requirements, inspection rules,

marking, packaging, transport and storage of fertigation equipment, and describes the corresponding test methods.

It applies to the design, manufacture, installation and inspection of fertigation equipment fitted at the head of the pipe network for irrigation and fertilization of crops.

2 Normative references

GB/T 4208-2017 Degrees of protection provided by enclosure (IP code); GB/T 5667 Agricultural machinery - Production test method; GB/T 9254.1-2021 Information technology equipment, multimedia equipment and receivers - Electromagnetic compatibility - Part 1: Emission requirements; GB/T 9480 Agricultural and forestry tractors and machinery, lawn and garden power equipment - Operator's manuals, drafting rules; GB 10395.1 Agricultural and forestry machinery - Safety - Part 1: General; GB 10395.8 Agricultural and forestry tractors and machinery - Safety technical requirements - Part 8: Drainage and irrigation pumps and pump units; GB 10396 Agricultural and forestry tractors and machinery, lawn and garden power equipment - Safety signs and hazard pictorials - General principles.

GB/T 13306 Plates; GB/T 13384 General specifications for packing of mechanical and electrical products; GB/T 23821 Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs; JB/T 5673-2015 Coating of agricultural and forestry tractors and implements - General specifications; JB/T 9832.2-1999 Agricultural and forestry tractors and implements - Paint film - Determination of adhesion - Cutting method.

Dated references apply in the edition cited; undated references apply in their latest edition, including any amendments.

3 Terms and definitions

3.1 fertigation equipment: equipment that, according to the needs of the crop, regulates and manages water and nutrients together and supplies the irrigation pipe network with water and fertilizer meeting the requirements of the crop. Note 1 states that fertigation equipment is generally made up of an irrigation pump, a variable frequency device, a fertilization device, a filtration device, a monitoring device and a control device. Note 2 states that by control mode the equipment is divided into automatic and manual, and that by the way the fertilization device is connected to the main irrigation line it is divided into bypass type and main line type.

3.2 maximum water-fertilizer flow rate: the maximum value of the water and fertilizer flow that the equipment can supply to meet the requirements of the crop under the normal operating condition specified by the manufacturer.

3.3 pressure loss: the difference between the pressure at the outlet of the irrigation pump on the main line and the pressure at the water and fertilizer outlet, under the normal

operating condition specified by the manufacturer.

3.4 flow rate ratio of water-fertilizer: the ratio of the fertilizer solution flow of the fertilization device to the irrigation water and fertilizer flow. The example given reads: a fertilizer solution flow of 2 L/h and an irrigation water flow of 198 L/h give a water and fertilizer flow of 200 L/h, so the flow rate ratio is 1 to 100.

3.5 maximum fertilization flow rate: the maximum value of the fertilizer solution flow that the fertilization device can supply under the normal operating condition specified by the manufacturer.

3.6 uniformity in motion: the property whereby, with the water and fertilizer flow ratio set to a fixed value, automatic equipment adjusts the fertilizer solution flow of the fertilization device through the control device as the irrigation water flow changes, so that the equipment runs at a fixed water and fertilizer flow ratio within the permitted range of variation.

4 Product designation

The designation of fertigation equipment is made up of a classification code, a characteristic code and codes for the main parameters, in the form 8 SF, followed by three fields separated by hyphens.

Reading the designation from the front: 8 is the major classification code for drainage and irrigation machinery; SF is the minor classification code, the first letters of the pinyin of the words for water and fertilizer; the characteristic code is S for manual equipment and A for automatic equipment; the first numeric field is the maximum water and fertilizer flow rate in cubic metres per hour; the second numeric field is the maximum fertilization flow rate in litres per hour.

The worked example given reads: automatic fertigation equipment providing a maximum water and fertilizer flow rate of 15 cubic metres per hour and a maximum fertilization flow rate of 500 L/h is designated 8SFA-15-500.

5 Technical requirements

5.1.1 The equipment is to adopt the applicable safety requirements and measures of GB 10395.1 and GB 10395.8 and, following the design principles of GB 10395.1, is to reach an acceptable level of risk through adequate risk reduction measures.

5.1.2 Guards are to be fitted at exposed moving parts and other parts liable to injure people, and are to comply with GB 10395.1 and GB 10395.8. Safety distances for the upper and lower limbs reaching hazard zones are to comply with GB/T 23821.

5.1.3 Safety signs complying with GB 10396 are to be placed near parts that carry a residual risk in normal operation, and are to be reproduced in the operator's manual, which is to include safety precautions to remind the operator.

5.1.4 The equipment is to be fitted with a dedicated control box with reliable protective earthing, and the box is to keep water out. The equipment is to have earth leakage and overload protection devices and an emergency stop button. Electrical conductors are to be sleeved in insulation and fixed securely; the electrical equipment and all exposed conductive parts are to be connected to the protective earthing circuit, and with 500 V applied between the power circuit conductors and the protective earthing circuit the insulation resistance is to be not less than 20 megohm. The degree of protection of the enclosure is to be IP54 as defined in GB/T 4208-2017.

5.1.5 When failure protection is triggered, the equipment is to give an audible or visible alarm or an instant message.

5.1.6 The electromagnetic compatibility emission limits of the communication and control system are to comply with Annex A of GB/T 9254.1-2021.

5.2.1 All parts are to be used only after passing inspection, outsourced and bought-in parts having a certificate of conformity. All pipe fittings, filtration devices, fertilization devices, valves and irrigation pumps in contact with water, fertilizer solution or the water and fertilizer mixture are to be made of corrosion resistant stainless steel or of polyvinyl chloride (PVC) or polyethylene (PE) plastic.

5.2.2 The filtration accuracy of the filtration device is to be not coarser than 178 micrometres (80 mesh). Waste water from cleaning the filtration device is to be discharged separately or collected and treated centrally.

5.2.3 The enclosure and the pipework are to carry clear and durable markings of the direction of flow.

5.2.4 The operator's manual is to be prepared in accordance with GB/T 9480.

5.2.5 All parts and joints are to be reliably sealed, with no leakage of water, fertilizer solution or the water and fertilizer mixture. The pressure bearing capacity of the pipework is to be not less than 1.5 times the design pressure, and the accuracy class of the pressure gauges used is to be not lower than class 1.0.

5.2.6 The equipment is to have at least the following functions: monitoring of the main parameters, including irrigation water pressure, fertilizer solution flow, electrical conductivity (EC) and acidity or alkalinity (pH) of the water and fertilizer mixture; control of the irrigation time; alarm on EC and pH exceeding their limits; and, for automatic equipment, control of the water and fertilizer flow ratio and of the fertilization time.

5.3 Performance indexes. When the equipment runs at an ambient temperature of 5 degrees C to 40 degrees C, a relative humidity of 5 percent to 90 percent, an atmospheric pressure of 0.080 MPa to 0.106 MPa and a rated voltage of 220 V or 380 V, the performance indexes are to comply with Table 1. Table 1 lists fourteen items: maximum water and fertilizer flow rate in cubic metres per hour, not less than the value declared by