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Conservation tillage equipment - Part 2: Subsoiler

保护性耕作机械 第2部分：深松机

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1 Scope

The document lays down the product designation, the technical requirements, the inspection rules and the marking, packaging, transport and storage provisions, and describes the matching test methods.

It applies to the manufacture of subsoilers.

3 Terms and definitions

Subsoiler: an implement whose loosening depth goes beyond the plough pan.

Depth of subsoiling: the vertical distance from the bottom of the subsoiling furrow to the

ground surface at that point before the operation.

Remote monitoring system for subsoiling operation: a system that monitors the working of the subsoiler automatically and processes the monitored data in real time.

Operation area: the product of the forward working distance of the subsoiling unit in working state and the working width.

4 Product designation

The product designation is drawn up according to JB/T 8574. The designation is built from a category code, in which 1 stands for tillage and land preparation machinery; a class code, in which S stands for subsoiler; the main parameter, which is the working width in centimetres; and an improvement code lettered A, B, C and so on in order.

The example given is a subsoiler of 210 cm working width at its second improvement, whose designation is 1S-210B.

5.1 Safety requirements

The safety guarding of the subsoiler shall comply with GB 10395.1.

The hydraulic pipes and couplings of a folding subsoiler shall have a reliable guard against the spraying of high-pressure fluid.

The safety distances keeping the upper and lower limbs away from danger zones shall comply with clause 4 of GB/T 23821-2022.

Every subsoiler shall carry fixed safety signs complying with GB 10396: a sign on keeping a safe distance between persons and the implement during work; a sign against opening or removing the guards while the implement is running; signs for crushing and shearing hazards, for instance near the hitch lifting system and when the machine is being raised or lowered; on a folding subsoiler, a sign near the folding device on the crushing and shearing hazard and on locking the locking device when the implement is folded; a sign on the hydraulic pipes and couplings of a folding subsoiler against spraying of high-pressure fluid; and, where in any operating or transport position, or when the working parts are folded up or opened out, a working part rises above 4 m, a safety sign and hazard information in a conspicuous position on the machine against entanglement with overhead power lines, the danger warning about contact with power lines being also stated in the instruction handbook.

A subsoiler more than 2.1 m wide shall have contour reflectors fitted, or contour strips made of reflective material.

The instruction handbook shall give the safety points to be watched in operation and maintenance and shall be drawn up according to GB/T 9480.

5.2 Operating performance requirements

The test field shall be level, the vegetation cover above the surface, stubble included, shall be not more than 1 kg per square metre, the stubble height not more than 30 cm, the soil moisture content 15 % to 25 % and the soil firmness not more than 2.0 MPa.

Table 1 fixes the operating performance indices: subsoiling depth not less than 30 cm; subsoiling depth stability not less than 85 %; soil breaking rate, counted on clods no larger than 4 cm within 10 cm of the surface, not less than 35 %; soil looseness 10 % to 40 %; soil disturbance coefficient not less than 50 %; unit slip rate not more than 20 %; entry travel not more than 4 m; and operational reliability, expressed as availability, not less than 95 %.

Table 2 fixes the indices of the remote subsoiling monitoring system: subsoiling depth measurement error not more than 3 cm; subsoiling operation area measurement error not more than 3 %; sampling interval of the implement positioning data not more than 2 s; working speed measurement error not more than 1 %; and interval between reports of operating data by the terminal not more than 10 s.

5.3 General technical requirements

Subsoilers shall be made to drawings and technical documents approved by the prescribed procedure. All parts and assemblies shall have passed inspection, and bought-in and subcontracted parts shall carry an inspection certificate before assembly.

Machined and pressed parts shall be smooth and even, free of burrs and flash, and shall have no cracks or marked wrinkling. Castings and forgings shall be free of visible defects such as blowholes, slag inclusions, shrinkage porosity and sand holes. Welded assemblies shall be firmly welded, with even and clean weld seams and free of defects such as missed welds, oxidation and burning.

A subsoiling unit should have a remote subsoiling monitoring system fitted. The system shall position accurately and shall be able to measure in real time the working parameters of the subsoiler, such as working depth, working speed, working time, missed tillage, operation area and real-time geographical position, and shall be able to take photographs and to transmit data to a server in real time.

The remote monitoring system shall have a memory function: where the network connection is not working normally, the subsoiling monitoring terminal shall be able to store the detected data and make them available for enquiry.

The instruction handbook shall be drawn up according to GB/T 9480.

5.4 Technical requirements for main parts

The type and dimensions of the subsoiler points and shanks shall comply with clauses 3

and 4 of JB/T 9788-2020.

Subsoiler points shall be heat treated to a hardness of 40 HRC to 45 HRC.

Subsoiler points shall be made of 35MnB or 40MnB steel whose mechanical properties are not lower than those given in 6.4 of GB/T 3077-2015.

Medium and heavy subsoiler shanks shall be heat treated to a hardness of not less than 48 HRC, or built up by tungsten carbide surfacing with a surfaced layer hardness greater than 60 HRC; the surfaced layer shall not peel or come away in use.

5.5 Assembly requirements

After the machine is assembled, the difference in vertical height from the point tip of each group of subsoiler points to the underside of the beam shall be not more than 10 mm.

For fasteners at load-bearing positions such as the main beam, the bearing housings and the hitch, bolts and screws shall be of a mechanical property class not lower than 8.8 as given in clause 7 of GB/T 3098.1-2010, and nuts not lower than class 8 as given in clause 7 of GB/T 3098.2-2015; a reliable locking arrangement is required and the tightening torque shall comply with Table 3.

Table 3 gives, for each nominal thread size in millimetres, the minimum and maximum tightening torque in newton metres: 8 mm, 22 to 29; 10 mm, 44 to 58; 12 mm, 76 to 102; 14 mm, 121 to 162; 16 mm, 189 to 252; 18 mm, 260 to 347; 20 mm, 369 to 492; 22 mm, 502 to 669; 24 mm, 638 to 850; 27 mm, 933 to 1244; 30 mm, 1267 to 1689; 36 mm, 2214 to 2952.

After assembly the working depth and the other adjusting mechanisms shall be easy, free and reliable to adjust, rotating parts shall turn freely without jamming or striking, and all lubrication points shall be charged with lubricant.

With the implement set to the transport position, the distance from its lowest point to the ground, that is the transport clearance, shall be not less than 110 mm for a trailed subsoiler and not less than 300 mm for a mounted subsoiler.

5.6 Painting and appearance quality

Rust, oil, welding slag and dirt shall be cleaned off the surface before painting.

Soil-working parts such as subsoiler points need not be primed and may be given only a black top coat.

The painted surface shall be even in colour, flat and smooth and free of bare patches. The machine shall look clean and shall have no defects such as rust or knocks.

The paint thickness shall be not less than 40 μm; three places are checked and at least two shall reach an adhesion of grade II or better as laid down in JB/T 9832.2-1999.