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Hydraulic bottle jacks

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1 Scope

This document specifies the types, the basic parameters and the technical requirements of hydraulic bottle jacks of rated capacity not greater than 500 t, describes the corresponding test methods and specifies the inspection rules and the marking, packaging, transport and storage.

This document applies to hydraulic bottle jacks used in the motor vehicle, machinery, shipbuilding, building and metallurgical industries and similar sectors.

3 Terms and definitions

3.1 hydraulic bottle jack: a light and small lifting appliance of vertical construction which uses hydraulic oil as the working medium and a ram or hydraulic cylinder as the rigid lifting member, and which raises a load through its bearing surface within its stroke.

3.2 rated capacity, G_n : the maximum load a hydraulic bottle jack is permitted to raise through its whole stroke under normal working conditions.

3.3 lowest height, H : the vertical distance from the bearing surface to the bottom supporting surface when the piston rod and the adjusting screw of the jack are fully retracted.

3.4 lifting height, H_1 : the vertical distance through which the bearing surface of the jack rises from the lowest height position to the position of reliable stop.

3.5 adjusting height, H_2 : the vertical distance through which the adjusting screw of the jack rises from the fully retracted state to the position of reliable stop.

3.6 load limiting device: the safety device that prevents overload in the hydraulic system of

the jack. Note: it is usually a relief valve.

3.7 press down force for piston rod: the force applied to the bearing surface of the jack, with the return valve fully open, which makes the piston rod descend.

3.8 duty: the statement of the series of load conditions to which the motor is subjected, including starting, electrical braking, no-load running, stopping and de-energizing, together with their duration and their sequence.

4 Types and basic parameters

By constructional type, hydraulic bottle jacks are divided into single-stage piston rod jacks and multi-stage piston rod jacks. By method of operation they are divided into manual hydraulic bottle jacks and hydraulic bottle jacks with another power source, whether pneumatic, electric or otherwise. Typical examples are shown in Figure 1, whose reference numbers denote the adjusting screw, the piston rod, the matching handle, the pawl lever, the pump plunger, the base, the return valve, the tension spring, the air hose, the control switch, the air pump, the power plug and the electric motor, and whose symbols denote the lowest height H , the lifting height H_1 and the adjusting height H_2 .

The basic parameters of the jack are the rated capacity G_n , the lowest height H , the lifting height H_1 and the adjusting height H_2 . The rated capacities recommended for preferential use are 2, 3, 5, 8, 10, 12, 16, 20, 32, 50, 70, 100, 200, 320 and 500 tonnes.

5 Technical requirements

The surface coating of the jack shall adhere firmly and be even and uniform in colour, without evident spots, wrinkled skin, blisters or sagging; bare machined surfaces shall be given rust protection; the bearing surface of the jack shall have a non-slip form; and the hydraulic system shall be well sealed, without seepage at the fixed seals, a film of oil being allowed at the moving seals.

On a jack fitted with an adjusting screw, the screw shall turn freely and shall be prevented from coming out of the piston rod.

A jack with another power source shall be operated by a control switch; the switch shall be marked with the direction of movement, the marking being firm, clear and easy to read, and the jack shall stop moving at once as soon as the operator releases the switch.

The lowest height of the jack shall not be greater than the value declared for the product, and the lifting height and the adjusting height shall not be less than the values declared.

The jack shall have a relief valve to prevent overload, whose opening load shall lie between the rated capacity and 1.15 times the rated capacity. The jack shall have a reliable stop device, which shall prevent the piston rod from coming out of the assembly.

When the press down force given in Table 1 is applied, the piston rod shall be able to descend to its lowest position; a jack fitted with an automatic return device shall return automatically. In Table 1 the force is not more than 220 N for a single-stage piston rod and not more than 350 N for a multi-stage piston rod where the rated capacity is not more than 16 t; not more than 445 N and not more than 700 N respectively where the rated capacity is above 16 t and below 100 t; and not more than 785 N and not more than 1 000 N respectively where the rated capacity is 100 t or more.

Under a test load equal to the rated capacity, the mean speed at which the piston rod descends once the return valve has been opened shall be controllable within 0.15 m/s. Under a test load of 1.25 times the rated capacity, the vertical descent of the piston rod shall be not more than 0.7 mm in the first minute and not more than 1 mm in 10 min.

When the jack raises the rated capacity with the handle supplied, the handle operating force shall be not more than 400 N; on a jack that works with more than one pump, the handle operating force with each pump working separately shall likewise be not more than 400 N.

The jack shall withstand a rated load test at the rated capacity. After the test, the visible sealing surfaces of the piston rod and of the pump plunger shall show no scoring that affects performance, the fixed seals shall not leak oil, a film of oil only being allowed at the moving seals, the adjusting screw shall still turn freely, the stop shall remain reliable and the performance of the machine shall not have failed.

The jack shall withstand a static load test at 1.5 times the rated capacity. After the test there shall be no permanent deformation, oil leakage or other abnormality that affects the performance of the machine in use, and the adjusting screw shall still turn freely. The jack shall withstand a dynamic load test at 1.25 times the rated capacity, and on an inclined surface a dynamic load test at the rated capacity, with the same requirements after each test.

Under a test load equal to the rated capacity, the number of continuous full-stroke operating cycles shall be not less than the number given in Table 2, and after the test the performance of the machine shall not have failed and it shall still work normally. Table 2 requires 100 cycles for a single-stage and 70 for a multi-stage piston rod where the rated capacity is not more than 20 t; 30 and 22 respectively where the rated capacity is above 20 t and below 100 t; and 15 and 10 respectively where the rated capacity is 100 t or more.

The jack shall work normally in an ambient temperature from minus 20 degrees Celsius to 50 degrees Celsius, the hydraulic system remaining well sealed, without seepage at the fixed seals and with a film of oil allowed at the moving seals.

Where the jack weighs more than 10 kg, not counting the handle, it shall be fitted with a carrying handle or a moving device. A single carrying handle shall withstand twice the weight of the jack without visible permanent deformation.

The electrical system of an electric jack shall conform to GB/T 5226.32. For an electric jack powered from a vehicle cigarette lighter socket, the maximum input power shall not exceed 120 W.

6 Test methods

Visual inspection covers the appearance quality of the jack, the effectiveness of the sealing and the non-slip form of the bearing surface. The adjustment check is made with the jack unloaded, the adjusting screw being turned by hand to check its rotation and its stop. The control switch check consists of inspecting the firmness of the marking, which shall not lift or peel off, and of connecting the jack with another power source to that source and operating and releasing the control switch at least three times with the jack unloaded, to check how the jack runs and whether the direction shown by the marking matches the direction of movement.

Dimensional check. The jack is placed on a flat plate with the piston rod and the adjusting screw fully retracted and the vertical distance from the bearing surface to the bottom supporting surface, that is the lowest height H , is measured; the jack is then operated to raise the piston rod to the position of reliable stop and the lifting height H_1 is measured; on a jack with an adjusting screw the screw is raised to the stop position and the adjusting height H_2 is measured.

Relief valve test. The jack is placed beneath a force measuring device and operated until the bearing surface touches the device, then operated further until the relief valve opens; the steady load shown by the device at that moment is the opening load of the relief valve. A multi-stage jack is tested with the last stage extended, although for the piece-by-piece inspection the first stage extended is allowed.

Stop check. With the jack secured against overturning, the jack is operated to raise the piston rod until the stop device acts, and the stop is checked. On a jack where operating the handle at the stop position would open the relief valve, the handle shall be operated until the relief valve opens, in order to check that the stop device is reliable.

Press down force test and return valve test. With the piston rod at the lifting height position, the return valve is fully opened and the press down force of Table 1 is applied vertically to the bearing surface, the descent of the piston rod being observed; on a jack with an automatic return device the return of the rod is observed. For the return valve test, with the piston rod at the lifting height position, a test load equal to the rated capacity is applied to the bearing surface, the return valve is opened and its opening controlled, and the distance and time taken by the piston rod to descend from the start to one tenth of the lifting height are recorded, from which the mean descent speed is calculated.

Descent test. The piston rod is raised to half the lifting height, or, on a multi-stage jack, to half the stroke of the last stage; a test load is applied gradually to the bearing surface up to