PROVISION OF PRESTRESSING SAFETY IN REINFORCED CONCRETE STRUCTURES

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Safety of stretching out and transpassing jacks was discussed. Losses caused in result of friction in various types of collars and seals between piston, rod and cylinder found in a jack have been shown. The losses depend on constructional design of material and degree of cylinder and rod surface treatment, their state and other reasons and loss can consist 10 – 12 %.

The definite construction of a device for jack calibration which was used actually for calibration of two kinds of jack was presented. Losses at friction and their influence on reliable values of the jack was shown.

One of the main characteristics of structure in prestressed reinforced concrete constructures is the value of reinforcement stressing. State of stressed deformation of the structure at its exploitation finally depends on it.

Stressing of reinforcement is conducted by a hydraulic jack. There are two kinds of jacks – a stretching out one, used on a stand as well as on concrete at stressing of one reinforcement and another one – to stress simultuneously several reinforcements attached to a traverse, by pulling a jack pistol on a traverse and , respectively, moveing the latter. The second kinds of jack is used to stress reinforcement before concreting.

The value of reinforcement stressing force developed by a hydraulic jack is controlled by monometer indices. Various types of collars and seals between piston, rod and cylinder found in the hydraulic jack condition losses at friction. The losses depend on a constructional design of a sealing material and on treatment of cylinder and metal rod surface, their condition, degree of rod tension, etc.

At the same time losses that can be found in a pressure hose, which connects a jack and a pumping station must be taken into consideration. So recommended length of the hose mustn`t exceed 1,5÷ 2,0 m.

The force, developed by a hydraulic jack. depends on different factors, in particular, on active area of a pistol section and on a liquid working pressure, it is calculated by a formula

$$\mathbf{N} = \frac{\pi(\mathbf{D}-\mathbf{d})^2}{\mathbf{4}}\mathbf{P}\text{, kg,}$$

Where D – inner diameter of a cylinder, cm; d – rod diameter, cm; p – working pressure of a liquid (monometer index), kg/cm^2.

On fig. 1. a graph of hydraulic jack calibration is given.

Losses can reach 10-12 % of stressing force and, of course, it must be taken into consideration at stressing of reinforcement, especially, in case when the value of loss changes according to the working pressure.

Issuing from the above said in order to determine the actual strength developed by a jack it must be calibrated.

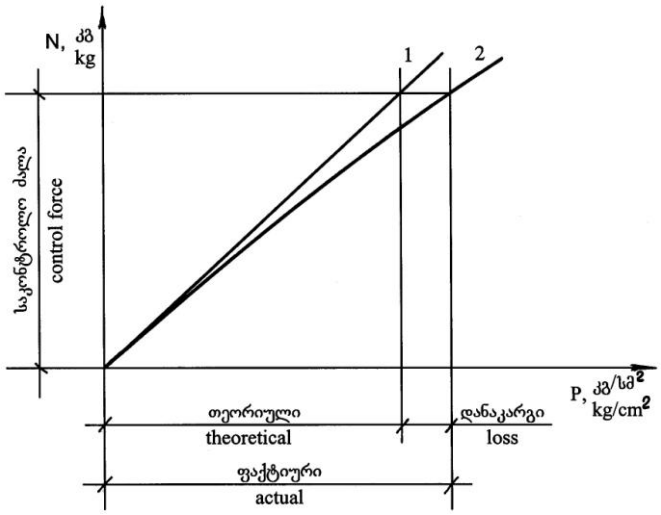

Fig. 1. Force and monometer indice correlation:
1- Theoretical (calculated); 2 - Actual

Jack test (once every 6 - 12 month) is conducted by static loading, it must exceed the limiting values given in the jack certificate for 10%. At this time a jack rod must be stretched out in the most upper position for at least 10 minutes.

At working with a hydraulic jack it is porbidden to stay on the opposite side of its protective seal.

According to this worked out method the calibration of two kinds of jack was performed on Ruisi - Agara section of Highway to make reinforced beam for the bridges.

For calibration of the second kinds YDT 3000 jack a special rigid frame was made consisting of 4Φ 80 mm pivots, two upper and lover slabs δ=35 mm thick and № 20 channel bars welded to them. This frame had to endure 3000 kN developed in the jack.

Photo 1. Steel frame for calibration together with YDT 3000 jack

Inside this frame a jack to be calibrated was placed (photo 1), on which later DOC – 500 standard dynamometer was installed, it measured force, developed in the limit of 500-5000 kN (photo 2). The strength developed by a jack was transmitted to dynamometer and its value was fixed by calibrated indicator placed on it, with scale reading 0,01 mm. Later according to this indicator values a correction of values of the manometer installed on a pumping station was performed.

Photo 2. Dynamometre placed on YDT 3000 type jack

For calibration of the first kinds of a stretching out jack, preliminarily, in our laboratory a test of control samples of 25 mm diameter steel pivot for stretching with hydraulic press was performed. On this pivot watch type indicators with readings 0,01 mm were installed. By these indicators it was possible to fix pivot deformations developed by loading through pressure.

In result of this work a graph of loading and deformation correlation was drawn, and used at jack calibration.

In order to conduct calibration a steel frame it was put into horizontal position (photo 3), with the help of holes in upper and lower steel slabs, a lineary element – steel pivot was stretched through. Its one side was fixed deadly into a frame slab with the help of a screw, but the second end which was a rod, a stretching out of this element with a jack to be calibrated was performed (photo 3). Before stretching out on a steel pivot, two watch type indicators were installed in the same way as in the laboratory.

Photo 3. QYC 240 type jack in the process of calibration

According to deformation of the control steel rod which was fixed by indicators installed on it, a correction of manometer reading installed on a pumping device was performed.

CONCLUSION

1. For safety of a force value developed by a jack it must be calibrated cvery 6 – 12 month.

2. Force developed at a jack calibration must exceed for 10 % the limiting index given in the jack certificate.

3. At calibration a jack piston must be stretched out in the most upper position and remain there at least for 10 minutes.

4. The length of pressure tranpassing hose from pumping device to the jack mustn`t exceed 1,5 ÷ 2,0 m.

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