Frequently asked Questions

How do you calculate wireline stretch in a well?

November 2014

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Depth determination during wireline operations is critical and one of the primary functions of the wireline industry. The primary obstacle to obtaining an accurate depth using a wireline cable is factoring the stretch inherent in every wireline into depth calculations. While there are multiple factors that affect cable stretch, this article will discuss current common practices and explain general stretch principals for the daily wireline operator rather than speculating about theoretical material stretch characteristics and the multiple variables that can affect it.

There are two types of "stretch" that occur with any cable including wireline cables, permanent or constructional and elastic. Permanent or constructional stretch is the amount a cable will permanently elongate during exposures to tensions higher than those experienced during the manufacturing process usually during the first operational uses. In a wireline cable, the permanent stretch is removed during the "seasoning" period which occurs in the first 20-25 runs of a cable's life. Camesa recommends best practices for seasoning a new wireline which are crucial to achieving the maximum life of a wireline and are in place to properly remove permanent stretch of every new wireline. Permanent stretch occurs only during the first 20 -25 runs of the cable's life, and then remains for the rest of the life of the cable. Permanent stretch cannot be compensated for in depth measurement calculations.

Elastic stretch, sometimes referred to as elongation, always occurs when a wireline is placed under working conditions that expose the cable to tension under a load. This type of stretch is primarily caused by the mechanical stretch inherent in the double counter helical design of a wireline cable's inner and outer armor wires and to a lesser degree factors including weight of tools, heat, well fluid density and well bore inclination. Elastic stretch differs from permanent stretch in that once the tension is removed, the cable will recover to its original length much like a rubber band. Elastic stretch is reasonably predictable and is measured with a stretch coefficient and must be compensated for in depth measurements.

Calculating Elastic Stretch

The two situations wireline operators are concerned with elastic stretch are when determining total depth of tools and when calculating at what depth tools or wireline is stuck. Calculating stretch to locate a stuck point is different than calculating depth of tools in that a uniform tension is being placed on the section of wireline from the truck to the stuck point and is therefore calculated differently. For a detailed description of calculating stuck point please refer to Camesa technical bulletin #007, Stuck Point Location or Camesa Question of the Month, What is the recommended method of calculating a stuck point? July 2013.

When determining depth of tools in a vertical section of a well it is important to remember that the tension the wireline cable is experiencing is not uniformed across the entire length of the cable. This is demonstrated in figure 1. The tension experienced at the wireline drum will always be the highest because the cable is supporting the full weight of the tool string and entire length of cable. If we assume a 10,000 Ft. length of wireline in a vertical well with a 9/32" wireline's weight in water of 130 lbs./Kft. and a 200 lb. tool string, the weight displayed on the weight indicator in the truck should be (10)(130) + 200 = 1,500 lbs. of tension. We will call this the tension at point "A". If we then calculate the tension at point "B" assuming half the cable length or 5,000 Ft. using the same formula used to calculate point "A", we can see that the actual tension experienced at point "B" is (5)(130) + 200 = 850 lbs. tension. And, if we calculate the tension at the rope socket or point "C", we can see that there is only the tool weight or 200 lbs. of tension experienced. This demonstrates that the tension across the entire length of wireline in a vertical well is not uniform which is significant when calculating cable stretch.

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In order to calculate stretch, the cable manufacturer provides a cable stretch coefficient for each cable on the specification sheet. For a Camesa standard 9/32" wireline (1N29PTZ-EHS) the cable stretch coefficient is 1.55 ft./Kft./Klbs. So, if we calculate the amount of lines stretch at each point along the cable we can see that the stretch along the length of a wireline is not the same as a function of the tension that is not uniformed across the cable. Point "A": (10 Kft.)(1.5 Klbs.)(1.55 Coefficient) = 23.25 Ft. If we assume a uniformed stretch across the entire cable we would therefore correct our total tool depth by 23.25 ft. deeper than the length of cable in the well but if we calculate stretch at points "B" & "C" 6.59 ft. and .31 ft. respectively, we can see that we would be over correcting and shooting guns off depth. The correlation between actual stretch and tension can be seen in figure 2. In order to compensate for non-uniform stretch along the cable, we must average the stretch at the highest point of tension. So, if we use our initial calculation of tension at point "A" and then divide the calculated stretch by 2, we will get an average stretch across the cable and get a much better estimated stretch correction.

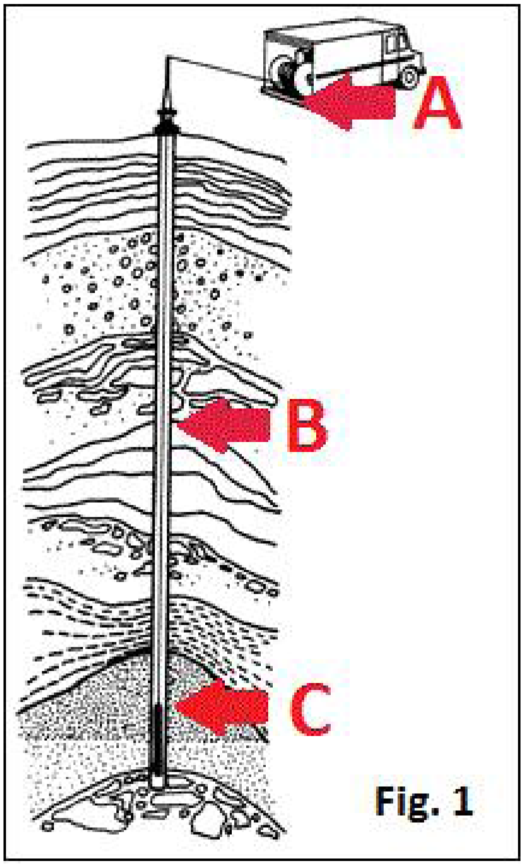

Fig. 1

Point "A": (10 Kft.)(1.5 Klbs.)(1.55 Coefficient) = 23.25 Ft. ÷ 2 = 11.63 Ft. So, in this example the actual tool depth would be measured cable length (10,000 ft.) + stretch correction (11.63 ft.) for an actual tool depth of 10,011.6 ft.

This method is fairly close to the real line stretch encountered in vertical well, in highly deviated wells the accuracy decreases with depth and does not work at all in horizontal sections. In order to obtain true tool depth in a well, multiple factors must be taken into account that are currently not possible during field calculations. In deviated wells obtaining total depth by correlating with a depth marker, such as a short joint or a nuclear marker is a more accurate method and is recommended.

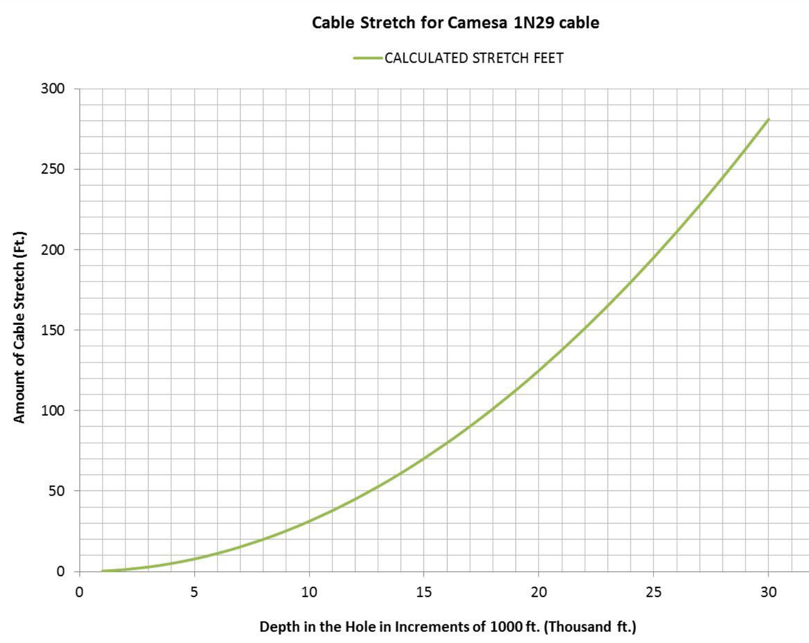

Fig. 2

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