

PROJECT AND CONSTRUCTION OF A PAIR OF CLAMPS TO PERFORM TESTS ON SYNTHETIC FIBER ROPES

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1. Introduction

To guarantee the total reliability of an anchorage system of a petroleum platform, it is essential to test intensely the ropes used on this application, ensuring a perfect idea about their properties. However, testing synthetic fiber ropes is not an easy task. To do that, it is important that these tests could be applicable for most different architecture, size or material as possible, reproducing the real studied rope characteristics.

POLICAB (Stress Analysis Laboratory) has been studying this subject for a long time, trying to create a device that could perform reliable tests. Therefore, the present paper will talk about the last one developed in the laboratory, the Sandwich Clamps for 10 ton load tests performance.

2. Previous Researches

In 2006, considering the lack of devices created to perform tests on synthetic fiber ropes, Pfarrius [1] started to project a different apparatus to solve this great problem. The idea was to hold the ends of a specimen with a kind of pair of clamps, using some glue for it. Each clamp would be constituted by two parallel steel plates made of AISI 4340 (picture), which would be screwed one to another. So, this device was designed for 2.5 ton loads and constructed at POLICAB - FURG (Federal University of Rio Grande), receiving the name of Sandwich Clamps.

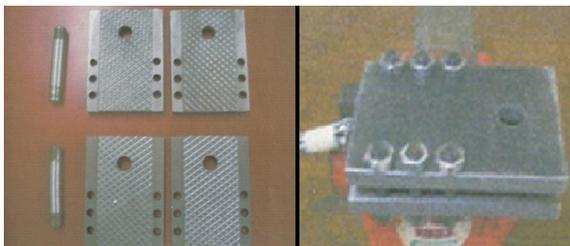


Fig. 1: Sandwich Clamps for 2.5 ton loads

After that, some tests were performed using the clamps. They were considered satisfactory, and then Pfarrius [3] exposed its solution at the 6th

YSESM, on Serbia. The pair of clamps still exists and works well on POLICAB.

3. Sandwich Clamps for 10 ton Loads

In view of the necessity of testing larger ropes, it was decided to design a new pair of Sandwich Clamps in 2010, with a capability to support 10 ton loads.

In the first place, the necessary area of contact between the glue and the aluminum plates to support the shear load was defined. It was calculated on 211 cm², and distributed just like it is shown in the picture (**Fig. 2**). The geometry was chosen to better fit the filaments of the specimen end.

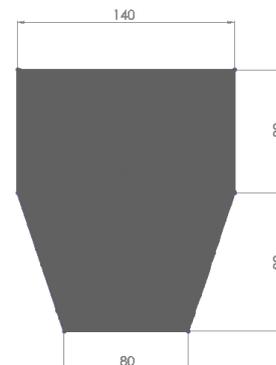


Fig. 2: Area of contact between the glue and the aluminum plates [dimensions in millimeters]

After that, the steel plates and the basis of the clamps were designed, considering for it tension loads of 10 ton.

In the end, the device was constructed at FURG mechanical workshop. It is possible to take a look at the new Sandwich Clamps and its appropriate attachments for the testing machine in figure 3.



Fig. 3: Clamps for 10 ton loads and attachments.

4. Pre-Test Procedure

Preparing the specimen to test with the Sandwich Clamps requires a lot of attention, and some steps need to be followed. So, it was used the procedure already developed by Pfarrius [1] to do it. The steps:

1. Choose a specimen of 20 cm length;
2. Paste each end rope between two aluminum plates;
3. Apply a compression load on the plates while the glue sets;
4. Position each end in each clamp;
5. Screw the clamps.

After this, it is finally possible to place the clamps on machine and perform the test.

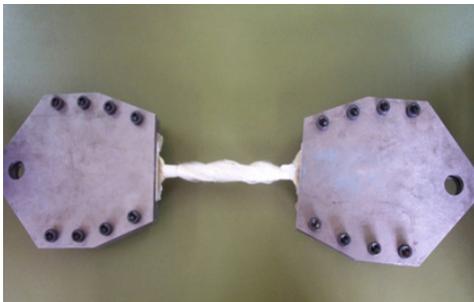


Fig. 4: Specimen ready to test

5. Experimental Results

Some tests were performed to verify the effectiveness of the Sandwich Clamps constructed. They were realized between December 2010 and March 2011 at POLICAB.

However, the results obtained were not good. A slippage problem was verified on every test. The adherence between the glue and the aluminum plates wasn't enough to support the rope breaking load.

Three different glues were tried out: Araldite[®] Professional 24 hours, Tigre[®] Plastic Adhesive for PVC, Poxipol[®] Transparent - 10 min. Among

these, the best results were obtained using the third one. But it was still not enough. The highest reached load was 5,72 ton, when some filaments started to slip from the plates.

At the end, the aluminum plates were replaced by pressed wood (Eucatex[®]) ones. Even this way, the result wasn't good, reaching a 6 ton load.

The tests were performed into an Instron 8800 Servohydraulic Fatigue Testing Machine up to 100 kN Capacity, with a Dynacell[®] load cell for the same 100kN. The curve of figure 5 shows the result of one of the tests performed with aluminum plates and Poxipol[®].

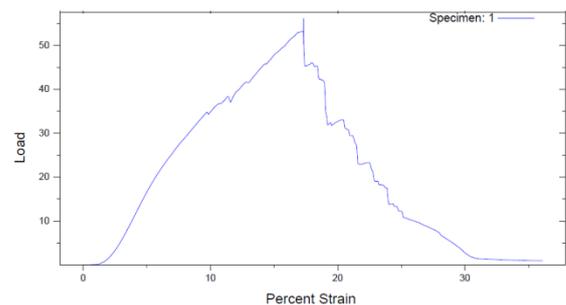


Fig. 5: Curve of a Tensile Test: Load [kN] x Percent Strain [%]

6. Conclusion

After all of those tests, it is concluded that the Sandwich Clamps did not work the way it was expected because a slippage between glue and aluminum plates happened. Different materials would be tested from now on. This way, the studies will continue, looking for a pair glue/plate with enough adherence to make the device work well.

References

- [1] Pfarrius D. J., "Modelagem Teórica e Experimental de um Soquete Tipo Sandwich para Utilização em Ensaio de Tração de Cabos Sintéticos", Graduation Project, 2006.
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- [3] Pfarrius D. J., Chimisso, F. E. G., Duarte, E. J., "Theoretical and Experimental Modeling of a Socket Sandwich for Use in Tension Tests of Synthetic Ropes" – 6 th YSESM, Vrnjacka Banja, Serbia, 2007.