A 20 YEAR FIGHT AGAINST SUCKER ROD PIN FAILURES

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This article covers the actions taken and results obtained in controlling sucker rod pin failures in the period 1963-1983 at the Cerro Dragon Area, Comodoro Rivadavia, southern Argentina.

GENERAL DATA

The field had 307 pumping wells in 1963 and 820 today. Pump depth ranges between 750 and 2500 m (1650 m average). Only API class D rods are used and maximum pump size is 2-3/4". Peak polished rod load on wells with 2-3/4" pump could reach 32,000#. Current production is 30,000 BOPD of sweet, 20° API oil.

THE PROBLEM

During the period 1963-1965 the number of pin failures averaged 13 per month, or 50% of the total sucker rod failures. Despite the efforts made to control cleaning of joints and make-up torque, pin breaks kept increasing to a maximum of 25 in May 1966.

THE CAUSE

A careful inspection of the broken pins indicated clean joints but "frozen" threads apparently caused by the pin threads being already damaged at the time of make-up (due to dirty connections on previous jobs).

THE SOLUTION

With that finding in mind, the following procedure was implemented in 1966 for sucker rod make-up:

1. Make up the joints by hand, to the hand-tight position in order to detect damaged threads, and only then apply the correct make-up with hydraulic tongs.

2. Calibrate the hydraulic tongs by the displacement gauge method recommended by one sucker rod manufacturer (Displacement I, Figure 1).

3. Repair the damaged pin threads at the well head with chaser dies.

4. Last but not least, it was decided to put most of the responsibility on the shoulders of the pulling contractor by not paying for any future "frozen" pin break job.

THE RESULTS

Results were dramatic. The "frozen" pin break occurrence stopped after 52 unpaid frozen pin breaks (13 months) and total pin failures decreased from 25 to an average of less than 5 per month in less than one year (Figure 2).

LATER CHANGES

In April 1970 the make-up torque was substantially reduced when we decided to apply the API guidelines (Displacement II, Figure 1). However, as some new rods where this lower torque was applied were found unscrewed, we started the practice of making up, breaking out and making up again the new rods. Pin failure frequency went down further.

In 1978 and probably due to higher well loads, occurrence of wet rod connections started increasing, suggesting torque was too low. To prevent an increase in pin breaks, torque was increased on all rods to the displacement recommended by API for new rods (Displacement III, Figure 1). But pin failures increased instead of decreasing, so in 1981 the torque was reduced back to Displacement II with an immediate reduction in sucker rod pin failures.

SOME FINDINGS AND THOUGHTS

1. Magnetic particle inspection (Magnaflux) of sucker rod pins on recycled rods pays off. Out of 38,000 old rods inspected in the period 1981-1984, 500 rods had fatigue cracks on their pins.

2. Sucker rod coupling shoulder geometry differs among manufacturers. As a consequence the same displacement make up could produce different pin pre-stress on different coupling brands. This was confirmed by lab tests performed on 7 different coupling brands by Avan S.A., an Argentina rod manufacturer (Figure 3). The subject should perhaps be analyzed further by the API.

3. Even though our pin failure rate is acceptable, pins keep breaking. Is it due to too much torque or too little? A theoretical approach would be possible only if a fatigue (Goodman type) diagram for undercut pins were available. Unfortunately this is not the case. We must rely then on field experience to answer this question. Our field records indicate that not a single rod has unscrewed in the last 12 months. We would expect, if torque was too low, that some joints would come loose. As this is not the case it is our opinion that pin fatigue cracks are caused by excess torque.

NEXT LOGICAL STEP

If pins fail due to high torque, a torque reduction is the answer.

In order to test this hypothesis we plan to make up the rods with a lower torque (to get only 30,000 psi pin pre-stress instead of 50,000 psi) in a couple of wells with very heavy loads and watch pin performance. If, as we expect, pins neither fail nor come loose, we will be closer to the goal of zero pin failures.

ACKNOWLEDGEMENTS

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BIBLIOGRAPHY

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Rod Size	Displacement (1/32") I	II	III
3/4"	13	8.5	11
7/8"	20	11.5	12
1"	20	14	16

Figure 1 - Make-up torque values

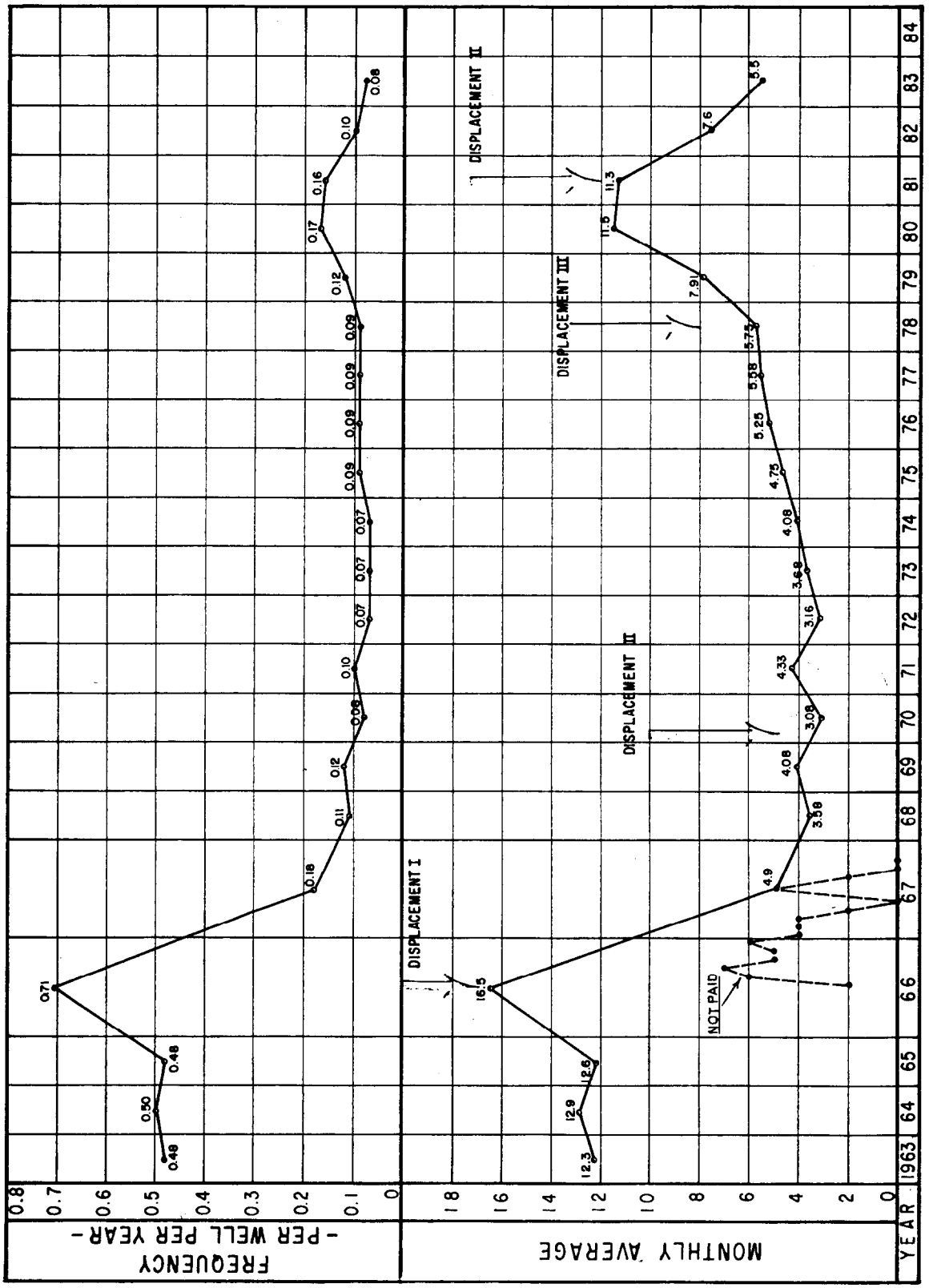

Figure 2 - Sucker rod pin jobs

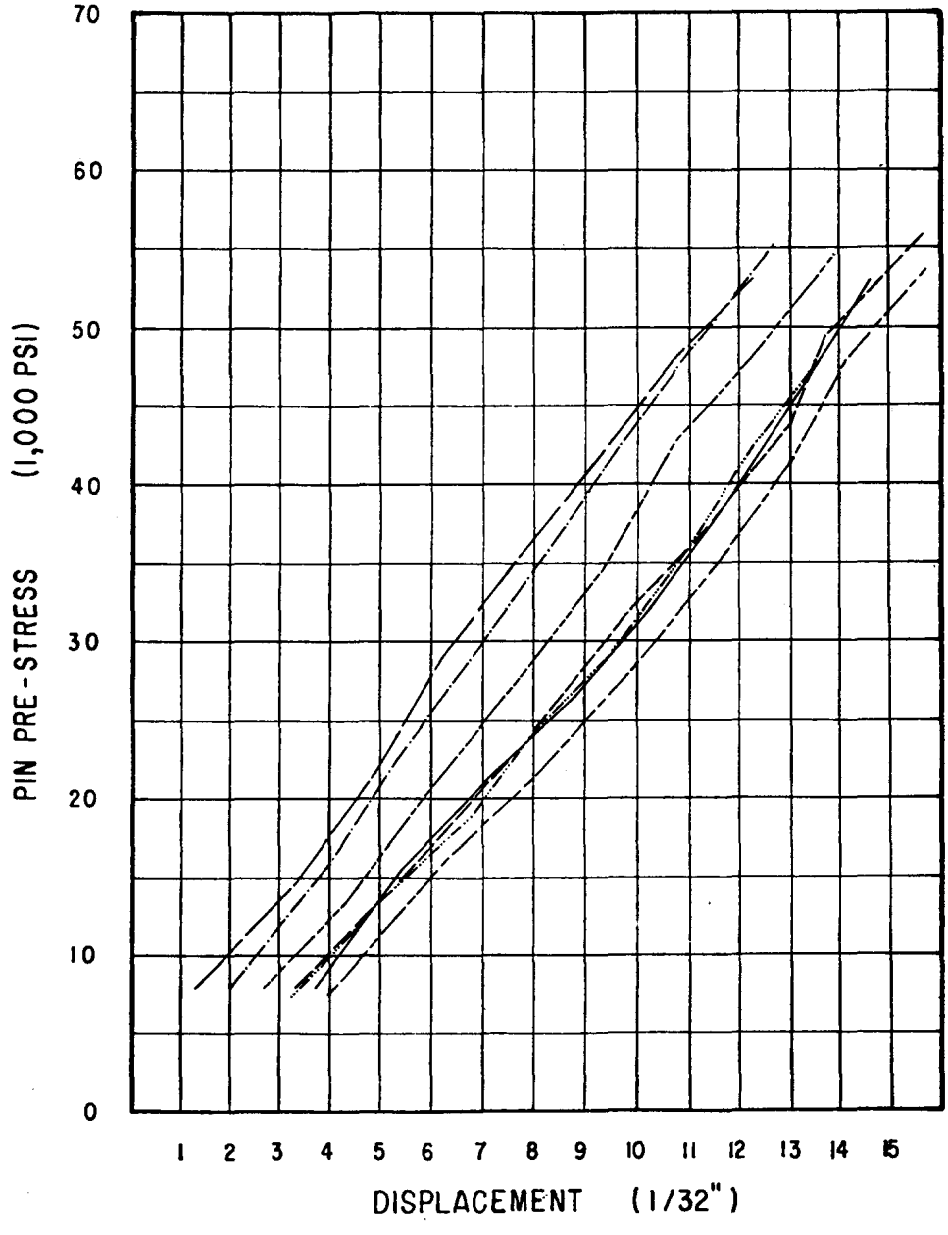

Figure 3 - Test with 7 coupling brands (1")