The Successful Application of PCPs’ Personalized Design in Hailar Oilfield

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Background
In 2006, 4 PCP wells were applied in Hailar Oilfield. The pump efficiency was up to 90% in the beginning.

Several weeks later, operating load oscillation was found. Rod and pump failures became frequent.

Till April, 2007, except that Well#3 operated normally, all the other three wells’ average running life was around two months.

Well#1’s load curve in pilot test
The Mechanism Study of PCP Failure in Hailar Oilfield

◆ “Stick-slip” phenomenon was the source of severe PCP failure in Hailar Oilfield
  ➢ “Stick-slip” refers to the phenomenon of a spontaneous jerking motion that can occur while two objects are sliding over each other. (“wikipedia”)

◆ “Stick-slip” was led by the following factors:
  ➢ changing friction factor
  ➢ Lower rotating or moving speed
  ➢ Lower rigidity of system
The Mechanism Study of PCP Failure in Hailar Oilfield

◆ Pump’s Compatibility.

➢ Medium’s Influence on Elastomer.

An example of medium’s effect on elastomer test
The Mechanism Study of PCP Failure in Hailar Oilfield

◆ Pump’s Compatibility.

➢ Medium Type’ Influence on Pump Performance.

An example of medium type’s effect on pump’s operating load test
The Mechanism Study of PCP Failure in Hailar Oilfield

◆ Operating Parameter’s Influence.
  ➢ The production rates of 4 PCP wells were all under 10m³/day.
  ➢ Three wells’ dynamic liquid level of was near the pump inlet.
  ➢ All the PCP wells operated under 50rpm.

◆ Rod String Design’s Influence.
  ➢ Rod rigidity was lower due to deeper lift.

All the above factors resulted in “Stick-slip”...
PCP Personalized Design Methodology

◆ Personalized Design of Elastomer Formula.
◆ Personalized Design of Pump Structure Parameters.
◆ Rod String Optimal Selection.

PCP’s FEM analysis result
From the end of 2006 to the mid of 2007, the PCP personalized design methodology was implemented in 4 wells. Apart from the small load oscillation in the first few days due to high water cut, all the PCP wells operated stably with high efficiency in the following operation.
Conclusions

◆ In the stage of PCP pilot test in Hailar Oilfield, severe load oscillation was found which resulted in frequent rod fatigue failures.

◆ According to the mechanism study of “slip-stick” issue, three main factors were determined including:
  - Pump’s incompatibility
  - Operating parameter
  - Rod string design
Conclusions

◆ Through personalized design in adjusting elastomer formula and pump’s structure parameters, PCP’s performance was improved considerably.

◆ Although the new PCP systems operated stably with high efficiency in application, the personalized design PCP methodology still needs to be improved and completed in the future.
Comments & Questions?