ISSN 2522-3488 Vol. 5, Issue 3: 42-46, DOI: 10.25236/IJNDES.2021.050305

Study on the Technology Scheme of Preventing Solidification Pipe (Reduce Drag) and Safe and Economic Operation of An Yong Oil Pipeline

Ruihua Yuan

Pipeline Transport Company, Yan Chang Oil Group of Shaanxi, Yan'an 716000, Shaanxi, China

Abstract: *In order to solve the problem of safe and economic operation of An Yong oil line, the author made this study. It is very meaningful and necessary to study and establish this technology scheme, which is in fact the re-optimization design of crude oil pipeline engineering design.The delivery process of An Yong oil pipeline is very complex, variable delivery insecurity and no saving energy become a norm and a serious lack of variables and variable temperature controlling technology based operations in the production running from the 2009 "3 • 14" condensating pipe accident, the low transmission capacity problem of An Yong oil pipeline in snow days and rainy seasons running is more prominent, given the variables and variable temperature controlling technology based operations is particularly important. To take only Zhongshanchuan - Jingjiaping segment as an example in this article, to calculate the temperature indicators of outbound crude oil under different transmission capacities in different seasons in a particularly complex way, which help guide the actual production running of An Yong oil pipeline, according to the variable crude oil to control the temperatures of crude oil out or into the station or valve in different seasons.The research results are shown in Table1, Table2 and Table3 in the following paragraphs.*

Keywords: *Preventing solidification pipe(reduce drag), safe and economic operation, different transmission capacities,temperature indicators, technology scheme,re-optimization design, crude oil pipeline engineering design*

1. Introduction

Optimal Design of oil and Gas Pipeline Engineering (lack of accurate calculation and design data in China) is a kind of design error correction after pipeline engineering operation, because first, internal corrosion, internal wear, resistance and energy consumption along the oil and gas pipeline engineering, no energy-saving, no safety is a worldwide problem; Second, the oil pipeline project is faced with the problem of low-volume operation (continuous snow days, rainy days, lack of oil, heat source or oil production declines or the world oil will run out sooner or later) ;Third, several important parameters in the design of oil and Gas Pipelines are empirical formulas (such as the total heat transfer coefficient of buried pipelines and the IR drop of Cathodic Protection, only these two parameters change in four seasons, which cause too many changes) , as a result, the design parameters do not accord with the actual operating parameters.If the design parameters are too large, the economic losses after the pipeline production and operation are huge, the resources and energy are wasted;And if the design parameters are too small, after the production and operation of the pipeline, it causes safety events, such as condensate pipe, blockage pipe, explosion pipe, oil leakage, environmental pollution, casualties and great harm.The following is a case study of An Yong crude oil pipeline.

The total length of An Yong oil line is 134 kilometers, whose design transmission capacity is 1.85 millions tons every year, which has 7 pumping stations-Zhongshanchuan station, Muyu station, Haojiaping station, Zichang station, Palong station (now it is out of service), Yujiaping station and Yongping station. See figure 1 below.

ISSN 2522-3488 Vol. 5, Issue 3: 42-46, DOI: 10.25236/IJNDES.2021.050305

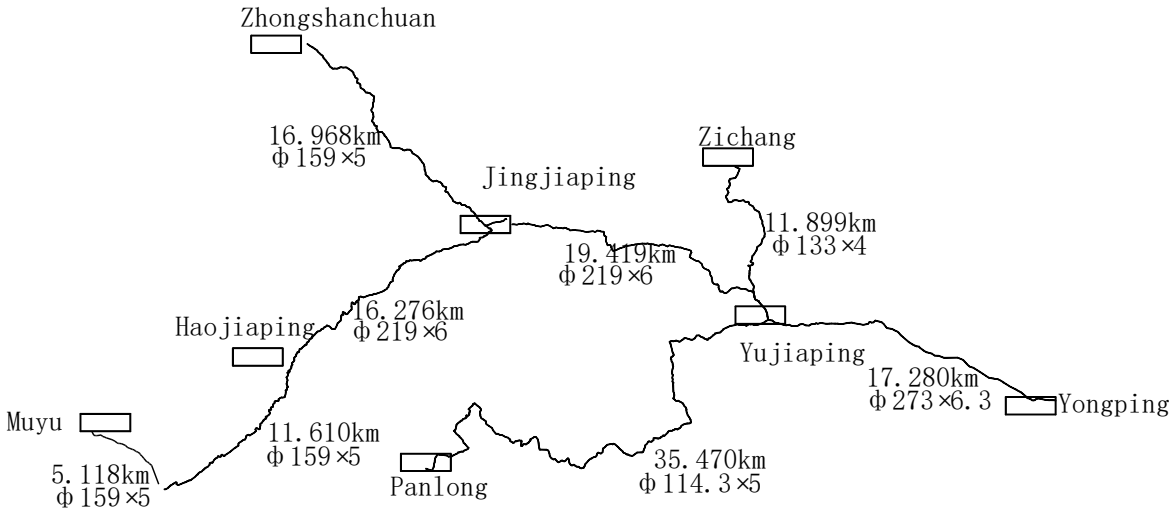

Figure 1 Structure diagram of An Yong oil line

2. Research and establishment of the technology scheme

2.1 Existing problems of An Yong oil line.

(1) An Yong oil line is a low perennial transmission capacity running, around 1.4 million tons of the actual annual output capacity;

(2) The operating pressure of each running station of An Yong oil line occur to influence each other, pump pressure fluctuates high or low, not running smoothly;

(3) An Yong oil pipeline has no temperature controlling indicators of crude oil going through the station, the valve and so on;

(4) Transmission capacity of An Yong oil pipeline has been volatile,insufficient amount of its each station crude oil months ago, at the end of months more adequate;

(5) Operators only relying on experience are monitoring, controlling operating crude oil temperature indicators of An Yong oil pipeline;

(6) The annual outbound temperature of each oil pumping station of An Yong oil pipeline changes little, it is mainly considered to safetly operate and is ignored to Economically operate;

(7) The shutdown time of safe and economic operation of An Yong oil pipeline is more difficult to calculate, because the transmission capacity and crude oil temperature are instability,which changes in many factors.

2.2 The temperature indicators of outbound crude oil of preventing solidification pipe and safely and economically operating under different transmission capacities in different seasons.

Research ideas and methods of the paper is based on researching,testing and collecting a lot of data of An Yong oil pipeline running,to select the stability array of transmission capacity, outbound temperature, entering station (through the valve) temperature from a large array,according to these relative stable array to anti-calculate overall heat transfer coefficient of each pipe segment of An Yong oil pipeline,again according to the anti-calculated overall heat transfer coefficient of each pipe segment of An Yong oil pipeline to approximately calculate the temperature indicators of crude oil going out of station,entering station and going through valve of each pipe segment of An Yong oil pipeline safely and economically operating under different transmission capacities in different reasons,and to make appropriate amendments to its deviation.In this paper, take Zhongshanchuan crude oil pumping as only an example of process calculation, its specific calculation results in Table 1, Table 2 and Table 3.

ISSN 2522-3488 Vol. 5, Issue 3: 42-46, DOI: 10.25236/IJNDES.2021.050305

Table 1 The temperature indicators of outbound crude oil of preventing solidification pipe and safely and economically operating under different transmission capacities in the winter

Station (valve chamber) name	Transmission capacity T/h	Crude oil density g/cm3	Pipeline outside diameter mm	Pour point crude oil ℃	Temperature passing by Jing jiaping inserted transmission station ℃	Crude oil outbound temperature ℃
Zhongshanchuan crude oil pumping station	24	0.8498	159	20-26	42≦	65.09±2
	25	0.8498	159	20-26	42≦	63.96±2
	26	0.8498	159	20-26	42≦	62.91±2
	27	0.8498	159	20-26	42≦	61.94±2
	28	0.8498	159	20-26	42≦	61.09±2
	29	0.8498	159	20-26	42≦	60.25±2
	30	0.8498	159	20-26	42≦	59.54±2
	31	0.8498	159	20-26	42≦	58.83±2
	32	0.8498	159	20-26	42≦	58.25±2
	33	0.8498	159	20-26	42≦	57.66±2
	34	0.8498	159	20-26	42≦	57.09±2
	35	0.8498	159	20-26	42≦	56.62±2
	36	0.8498	159	20-26	42≦	56.11±2
	37	0.8498	159	20-26	42≦	55.70±2
	38	0.8498	159	20-26	42≦	55.25±2
	39	0.8498	159	20-26	42≦	54.84±2
	40	0.8498	159	20-26	42≦	54.50±2
	41	0.8498	159	20-26	42≦	54.15±2
	42	0.8498	159	20-26	42≦	53.81±2
	43	0.8498	159	20-26	42≦	53.52±2
	44	0.8498	159	20-26	42≦	53.23±2
	45	0.8498	159	20-26	42≦	52.94±2

Table 2 The temperature indicators of outbound crude oil of preventing solidification pipe and safely and economically operating under different transmission capacities in the summer

Station (valve chamber) name	Transmission capacity T/h	Crude oil density g/cm3	Pipeline outside diameter mm	Pour point crude oil ℃	Temperature passing by Jing jiaping inserted transmission station ℃	Crude oil outbound temperature ℃
Zhongshanchuan crude oil pumping station	24	0.8498	159	20-26	42≦	56.26±1
	25	0.8498	159	20-26	42≦	55.56±1
	26	0.8498	159	20-26	42≦	54.96±1
	27	0.8498	159	20-26	42≦	54.36±1
	28	0.8498	159	20-26	42≦	53.86±1
	29	0.8498	159	20-26	42≦	53.35±1
	30	0.8498	159	20-26	42≦	52.93±1
	31	0.8498	159	20-26	42≦	52.52±1
	32	0.8498	159	20-26	42≦	52.11±1
	33	0.8498	159	20-26	42≦	51.78±1
	34	0.8498	159	20-26	42≦	51.45±1
	35	0.8498	159	20-26	42≦	51.12±1
	36	0.8498	159	20-26	42≦	50.83±1
	37	0.8498	159	20-26	42≦	50.55±1
	38	0.8498	159	20-26	42≦	50.30±1
	39	0.8498	159	20-26	42≦	50.05±1
	40	0.8498	159	20-26	42≦	49.84±1
	41	0.8498	159	20-26	42≦	49.60±1
	42	0.8498	159	20-26	42≦	49.43±1
	43	0.8498	159	20-26	42≦	49.22±1
	44	0.8498	159	20-26	42≦	49.02±1
	45	0.8498	159	20-26	42≦	48.86±1

ISSN 2522-3488 Vol. 5, Issue 3: 42-46, DOI: 10.25236/IJNDES.2021.050305

Table 3 The temperature indicators of outbound crude oil of preventing solidification pipe and safely and economically operating under different transmission capacities in the spring and fall

Station (valve chamber) name	Transmission capacity T/h	Crude oil density g/cm3	Pipeline outside diameter mm	Pour point crude oil ℃	Temperature passing by Jing jiaping inserted transmission station ℃	Crude oil outbound temperature ℃
zhongshanchuan crude oil pumping station	24	0.8498	159	20-26	42≦	60.44±1.5
	25	0.8498	159	20-26	42≦	59.49±1.5
	26	0.8498	159	20-26	42≦	58.70±1.5
	27	0.8498	159	20-26	42≦	57.93±1.5
	28	0.8498	159	20-26	42≦	57.26±1.5
	29	0.8498	159	20-26	42≦	56.61±1.5
	30	0.8498	159	20-26	42≦	56.05±1.5
	31	0.8498	159	20-26	42≦	55.50±1.5
	32	0.8498	159	20-26	42≦	55.00±1.5
	33	0.8498	159	20-26	42≦	54.56±1.5
	34	0.8498	159	20-26	42≦	54.11±1.5
	35	0.8498	159	20-26	42≦	53.72±1.5
	36	0.8498	159	20-26	42≦	53.33±1.5
	37	0.8498	159	20-26	42≦	52.98±1.5
	38	0.8498	159	20-26	42≦	52.64±1.5
	39	0.8498	159	20-26	42≦	52.34±1.5
	40	0.8498	159	20-26	42≦	52.04±1.5
	41	0.8498	159	20-26	42≦	51.75±1.5
	42	0.8498	159	20-26	42≦	51.50±1.5
	43	0.8498	159	20-26	42≦	51.25±1.5
	44	0.8498	159	20-26	42≦	51.01±1.5
	45	0.8498	159	20-26	42≦	50.76±1.5

3. Conclusions drawn from the analysis of the tabular data above

(1) Table 1, Table 2 and Table 3 show that the outbound temperature of Zhongshanchuan station crude oil changes with flow under different transmission capacities in different seasons, when the crude oil flow of Zhongshanchuan increase,its crude oil outbound temperature should decrease.

(2) Table 1, Table 2 and Table 3 show that the Correction factors of crude oil outbound temperature of Zhongshanchuan crude oil pumping station are not the same under different transmission capacities in different seasons: the correction value of outbound winter temperature is approximately ±2℃, because temperature is also changing in the winter every day and every night; the correction value of outbound summer temperature is approximately ±1℃, because temperature is also changing in the summer every day and every night;the correction value of outbound spring and fall temperature is approximately ±1.5℃, because temperature is also changing in the spring and fall every day and every night.

(3) Table 1, Table 2 and Table 3 show that the crude oil outbound temperature of Zhongshanchuan crude oil pumping station under different transmission capacities in different seasons can be more precisely controlled than before,which will ensure Zhongshanchuan-Jingjiaping pipeline safely and economically operate, and which will avoid staff just by experience in the past to controll defects and deficiencies of outbound crude oil temperature,for example, if the temperature of outbound crude oil is too high it will result in significant loss of heat, if the temperature of outbound crude oil is too low it will cause downstream condensate pipe.

(4) Table 1, Table 2 and Table 3 can be used as the operating technical index of Zhongshanchuan-Jingjiaping pipeline safely and economically operating.Any operator or on-duty personnel can operate strictly according to the technical indexex of Table 1, Table 2 and Table 3 so that they can ensure Zhongshanchuan-Jingjiaping pipeline safely and economically operate under different throughput and in different seasons.

ISSN 2522-3488 Vol. 5, Issue 3: 42-46, DOI: 10.25236/IJNDES.2021.050305

4. Conclusion

Research has shown that it is feasible and reasonable for Zhongshanchuan-Jingjiaping segment of An Yong oil pipeline to research and establish the technology scheme of preventing solidification pipe and safe and economic operation under different throughput and in different seasons, so it is very meaningful and necessary to study this technology scheme.

References

[1] Zhang Qimin,Meng Jiang.Oil and Gas Pipeline Technology[M], Beijing,China Petrochemical Press, 2008.
[2] GB 50253-2014,2014(Design Code for oil pipe).
[3] Yang Xiaoheng.Design and Management of Oil Pipeline[M], China Petroleum University Press, 2005.