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Electrical Equipment Failure Risk Management for Seamless Steel Tube Continuous Production Line in T Company

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Abstract: This paper reviews the background of comprehensive risk management and the development course, analyzed the principle of comprehensive risk management structure and the application of concrete technology, combined with seamless steel tube electrical equipment management present situation analysis, it is concluded that the steel enterprise electrical equipment management, the implementation of the feasibility and necessity of risk management. Through to the electrical equipment running stability influence factors analysis, find out the main risk factors and influence degree, the key factors of electrical equipment management risk identification, risk measurement and evaluation.

1. Introduction

Under the background of globalization and information age, all major enterprises are faced with contradictions and risks that involve a wider range and have a more complex relationship with each other [1, 2]. In the financial crisis of 2008, no matter enterprises, financial institutions or regulators, ignorance of the role of risk management to varying degrees, just led to the rapid spread of risk and had a huge impact on the world [3]. After such events, people are constantly reflecting on why so many well-known enterprises collapse and die out in a short time after decades of ups and downs; how to build a sustainable, healthy, scientific and efficient enterprise development mode, management mode and control mode. Through the analysis of multiple reasons and experience summary, all industries around the world began to pay more attention to the research of risk management [4-6]. In recent years, the full implementation of risk management has gradually replaced the original risk management from a single risk perspective [7].

There is a new production line with an annual output of 50000 tons of stainless seamless steel pipe in T Stainless Steel Pipe Company and the first production line with an annual output of 5000

tons of stainless welded steel pipe was imported from abroad. Its main products are positioned in the middle and high-end market, and even can replace imported products. However, in recent years, due to the overall downturn of the steel industry, the overall profit has been declining, and the steel production capacity has also been decreasing. T Company is also affected by the global economic trend and is in an important period of transformation and development. Higher requirements for equipment management is required for the whole transformation and development stage. In this environment, our common problems are, how to find the important risks in the production process, make decisions against the risks, so as to improve the production capacity, and create the best product quality with the lowest cost.

The equipment of continuous production line is very advanced, but there are complicated and scattered chain points advanced equipment, numerous technical debugging parameters; some software technology is not matched with hardware equipment; insufficient training for professional personnel, etc. All the above mentioned has a great impact on the stable operation of electrical equipment.

2. Risk verifications of main steps for electronic equipment

Seamless steel tube production line is a flow line operation mode. There is a high degree of mutual influence and correlation among each equipment for this kind of equipment layout in series. When the machine is started up and running, the failure of a certain link will lead to the shutdown of the whole line. Electrical equipment links include network communication, hydraulic control system, encoder, high and low voltage power supply and distribution system, and transmission system:

1. Network communication: including PROFIBUS function abnormality / no existence of XX slave station appearing in the alarm area; all button indicators on the console are off; signal indicators with encoder on site change from normal to normal on of US indicator light. The network communication system is the guarantee to ensure the continuous and normal production of the continuous production line. If the network communication system fails, it will lead to the production failure of the whole production line and the automatic shutdown of the production line, which has a great negative impact on the production.

2. Hydraulic control system: the power of the automatic continuous production line of electrical equipment comes from the hydraulic control system, which drives the continuous production of the whole production line through the hydraulic pump, providing continuous power for the production. If the hydraulic system fails, it may cause abnormal start of the production line, loss of power for the equipment, and even automatic production shutdown.

3. Encoder: the encoder is used to convert / compile data / signals in the production process, to provide possibility for the storage and transmission of equipment data signals, ensuring the accuracy of production measurement and the safety of production equipment. If the encoder fails, the functional accuracy of the equipment may be reduced, the product quality may be affected, and safety production accidents may occur in serious cases.

4. High and low voltage power supply and distribution system: including reasonable design parameters, model selection and capacity matching during equipment optimization and transformation. The impact range of system failure is very large, which may cause long-term

shutdown of continuous production line, and may cause major equipment safety accidents in serious cases.

5. Transmission system: this link is one of the risk links causing many faults, long accumulated time of faults and large accumulated loss. The transmission system is connected with the power supply and distribution system of the upper level and the drive motor system of the lower level. The normal operation of the transmission system ensures the matching of the upper level and the lower level, which directly affects the safe and stable operation of the electrical equipment of the whole continuous production line.

The continuous production of electrical equipment is inseparable from the common support of the above links. There are many risk factors that affect the normal operation of electrical equipment due to the multiple links of electrical equipment in continuous production line. First of all, the risk accident failure rate, failure time, loss of personnel and funds in the operation of electrical equipment in each link in the past five years was synthesized, as well as the risk degree calculated by the expert investigation team, to determine which link in the electrical equipment of the continuous production line is more likely to generate production failure, that is, which link in the production line the risk often occurs, and then determine the power of the continuous production line Key risk links in gas equipment.

3. Description of risk failure of main links of electrical equipment

According to the statistics of the fault occurrence time and times of each link of the electrical equipment in the continuous production line, they are the hydraulic control system, the network communication system, the encoder, the transmission system and the high and low voltage power supply and distribution system based on the fault time sequence; the main links with more times are the encoder, the network communication system, the hydraulic control system And transmission system and high and low voltage power supply and distribution system based on the fault frequency sequence.

Table 1 Failure of electrical equipment of continuous production line in 2011-2016

Links of electrical equipment production line	Failure duration (h)	times	Failure ratio (%)
Network communication system	356	105	25.2
Hydraulic control system	430	51	30.4
Encoder	280	140	19.8
High and low voltage power supply and distribution system	168	2	11.9
Transmission system	180	32	12.7
In total	1414	330	-

4. Risk assessment of main links of electrical equipment

Risk assessment is carried out for each main link of electrical equipment, calculate the risk degree, find out the most important risk occurrence link according to the expert scoring method further, and then carry out detailed exploration, further analyze the risk factors affecting the risk occurrence of these links.

According to the on-site investigation and expert scoring method, the risk degree (S), risk occurrence probability (O), and difficulty (D) of early detection and prevention of risk in the process of maintenance are scored (see the following for scoring standards, which can be discussed and scored separately or averaged); RPN (RPN = S × O × D) of each item is calculated; screening Projects with single S/O greater than 6 or RPN greater than 120 are selected as key risk assessment projects, and their influencing factors are further analyzed.

Table 2 scoring standard of severity caused by the risk in the production process

Influence	Reference standards	S
Specially serious harm	it occurs in a short time after operation, which not only causes damage to this part, but also affects other parts, and the time for immediate shutdown and repair is more than 72 hours;	10
Serious harm	After the occurrence, it will only cause the failure of this part and will not damage other parts, but it must be repaired immediately, and the recovery time is more than 60 hours;	9
Very large	After the occurrence, the major hidden danger of this part can be maintained for less than 7 days, affecting the production capacity and specifications, and the maintenance time is more than 48 hours;	8
Big	After the occurrence , the major hidden danger can be maintained for 7 days to 1 month, affecting the production capacity and specifications, and the maintenance time is more than 30 hours;	7
Medium	After the occurrence, there will be hidden dangerof this major part; it can be maintained and operated through regular inspection (24 hours), without affecting production capacity and specifications, and can be persisted to the next annual inspection;	6
Small	After occurrence, there will be ordinary hidden danger of this part, which can be maintained and operated through regular inspection (12 hours), without affecting the production capacity and specification, and can be persisted to the next annual inspection;	5
Very small	After the occurrence, there will be hidden danger of this part which will not affect the operation without special measures, without affecting the production capacity and specifications;	4
Slight	It can be handled in production, which may cause the production period to be extended for less than 4 hours	3
Very slight	Easy to be handled in production	2
None	No special affection even without handle	1

Table 3 scoring standard for the possibility of risk in a certain link in the production process

Possibility of occurrence of risk	Possibility of occurrence	Manufacturing process capability	Possibility
Almost inevitable	1/2	＜0.33	10
	1/3	≥0.33	9
recurrence	1/8	≥0.51	8
	1/20	≥0.67	7
Occasionally	1/80	≥0.83	6
	1/400	≥1.00	5
Rarely	1/2000	≥1.17	4
	1/15000	≥1.33	3
Almost impossible	1/150000	≥1.50	2
	1/1500000	≥1.67	1

Table 4 difficulty scoring standard for risk detection and prevention in advance through inspection

Possibility of checking out	Scoring standard	Difficulty in checking D
absolute impossible	Cannot be inspected	10
Very tiny possibility	Very tiny inspecting possibility	9
Tiny possibility	Tiny inspecting possibility	8
Very small possiility	Very small inspecting possibility	7
Small possibility	Small inpecting possibility	6
Midium possibility	There is possibility foe inspection, but its complex.	5
Midium to large possibility	There is possibility foe inspection, but its complex.	4
Large possibility	Can be inspected	3
Rather large possibility	Easy inspection	2
Almost sure	Easy to be inspected	1

Table 5 risk assessment of each link of electrical equipment in continuous production line

links of electrical equipment production line	S	O	D	RPN
Network communication	6	9	9	486
Hydraulic control system	7	7	8	392
Encoder	7	8	6	336
High and low voltage power supply and distribution system	8	2	3	48
transmission	5	4	3	60

After field investigation and expert scoring, the results are shown in Table 5. According to the severity caused by the failure of each risk link, it is divided into: risk failure of high and low voltage power supply and distribution system, risk failure of hydraulic control system, risk failure of encoder and risk failure of transmission system. According to the possibility of failure, the order is: network communication system, encoder, hydraulic control system, transmission system and high

and low voltage power supply and distribution system. According to the possibility of early detection of faults to play a preventive role, they are: network communication system, hydraulic control system, encoder, high and low voltage power supply and distribution system and transmission system. The RPN is divided into network communication system, hydraulic control system, encoder, high and low voltage power supply and distribution system and transmission system.

Based on the time, frequencies, severity, possibility, difficulty of pre detection and risk score of faults in all links, we find that the main links of faults in electrical equipment of continuous production line are network communication system, hydraulic control system and encoder, although the fault severity of high and low voltage power supply and distribution system It is 8, more than 6, but the failure frequency of this link only occurs twice in 5 years, and the detection of high and low voltage power supply and distribution system in production is very fine, so it is very possible to detect its risk, so the system is not regarded as an important risk link of electrical equipment in continuous production line.

5. Conclusion

In this paper, the theory of risk management is applied to the management of electrical equipment in steel pipe plant. Through the overview of the background and development of risk management, the principle of risk management, the fields that risk management can be used, the research methods of risk management, the application at home and abroad, and the application of risk management in the risk assessment of electrical equipment are understood. Under the guidance of the theory of risk management, we have studied the main links of the failure risk of the electrical equipment in the continuous production line of the steel pipe plant, and evaluated the main risk factors that affect the failure of each link.

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References

[1] Brian W. Nocco, René M. Stulz. Enterprise Risk Management: Theory and Practice [J]. Journal of Applied Corporate Finance, 2006, 18.
[2] Carroll, R. Identifying risks in the realm of enterprise risk management. J Healthc Risk Manag, 2016, 35 (3), 24-30.
[3] James J. Kline, Greg Hutchins. Enterprise risk management: A global focus on standardization [J]. Global Business & Organizational Excellence, 2017, 36 (6): 44-53.
[4] Carter A, Chinyio E. Effectiveness of risk management: barriers and solutions [J]. 2017, 4 (4): 368-378.
[5] Thöns, Sebastian. On the Value of Monitoring Information for the Structural Integrity and Risk Management [J]. Computer-aided Civil & Infrastructure Engineering, 2018, 33.
[6] Kate Hogarth, Marion Hutchinson, Wendy Scaife. Corporate Philanthropy, Reputation Risk Management and Shareholder Value: A Study of Australian Corporate giving [J]. Journal of Business Ethics, 2018, 151.
[7] Lawrence A. Gordon , M. P. L. C. Enterprise risk management and firm performance: A contingency perspective. Journal of J. Account, 2009, 28.