

Reliability Assessment of Practical Hose Reel System a Contemporary Perspective

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Abstract:- Reliability evaluation of an engineering system or component or element is very important in order to predict its availability or unavailability and other important indices. Reliability is the parameter which tells about the availability or unavailability of the system or component under proper working conditions for a given period of time. In this paper a analysis of reliability of a Hose Reel system installed for safety purpose is done and different parameter are obtained. For evaluating the reliability of the Hose Reel system a large number of events of different parameters have been taken into consideration. A Hose Reel system installed for fire fighting and safety purpose of the educational institute was taken for study.

Keywords:- Reliability, Availability, Hose Reel System, Fire Fighting, Safety.

I. INTRODUCTION

Reliability evaluation of a system or component or element is very important in order to predict its availability and other relevant indices. Reliability is the parameter which tells about the availability of the system under proper working conditions for a given period of time. A Markov cut-set composite approach was proposed by Singh et al. [1]. The reliability indices have been determined at any point of composite system by conditional probability approach by Billinton et al. [2]. Wojczynski et al. [3] discussed DS simulation studies. New indices based on probabilistic models

and fuzzy concepts were presented by Verma et al. [4]. Various reliability indices studies were presented [5-9]. Different methods for reliability of distribution system were discussed [10-15]. Studies based on fault tree, safety, DS reliability are presented [16-24]. Tiwary et al. [25] has discussed a methodology for evaluation of customer orientated indices and reliability of a meshed power distribution system. Reliability evaluation of engineering system is discussed [26]. Battu et al. [27] discussed a method using MCS. Various reliability assessment has been presented [28,29].

Hose Reel system is very important in order to control fire at a particular place. In order to minimize the effect of fire at any location proper utilization along with the reliability of the system is very important aspect to look after. Therefore there is need for evaluation of reliability of the hose reel system. In view of the above, reliability assessment of a complex engineering system installed at an educational institution is done and different reliability parameters are obtained. A large number of events consisting of the failure rate of each and every component of the hose reel system was taken into account for evaluating different reliability parameters.

II. RELIABILITY EVALUATION OF THE ENGINEERING SYSTEM AND ITS ACCOMPLISHMENT

If one assumes time independent reliability r_1, r_2, \dots, r_n of each and every component present in the system, then reliability of the combination of the components connected in a series configuration is given as

$$R_s = \prod_{i=1}^n r_i \tag{1}$$

The above relation is important in order to evaluate the value of the reliability when the components or elements in any practical system are connected in series manner.

The reliability of the system having constant failure rate is evaluated by using the following relation.

$$R(t) = e^{-\lambda t} \tag{2}$$

Where $R(t)$ represents the reliability of each component. λ represents the failure rate per year and t represents time period which is taken as one year.

A large number of events were taken into account and therefore various samples of the failure rate for each and every seven components were taken for study purpose and then reliability of each and every component was evaluated separately. After evaluating the reliability of each component the mean reliability of each and every component was obtained.

Figure 1 provides the block diagram of the practical Hose Reel system taken for the evaluation purpose. It provides the detail of the different components which are a part of the hose reel system. The hose reel system consider consists of different components such as: Terrace Tank, Centrifugal Pump, Pipes, Accessories (NRV/Water flow control valve/Joints and Bends), Hose reel drum and mounting, Hose reel pipe and shut off nozzle and Electrical panel.

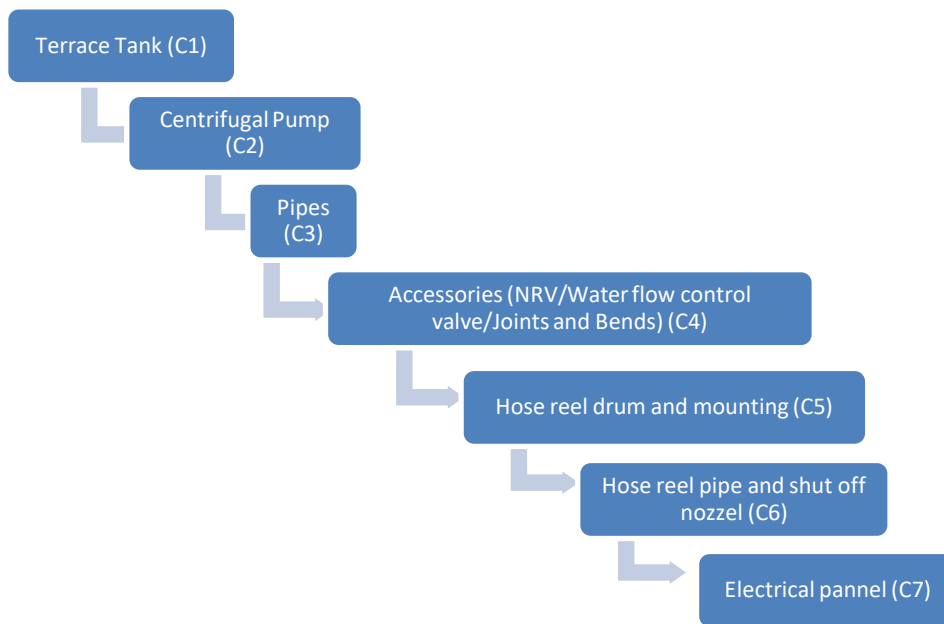


Fig. 1 Block Diagram of the Hose Reel System [30]

III. RESULTS AND DISCUSSION

There are seven components in the hose reel system and are shown in Fig. 1. Table 1 provides the evaluated mean reliability for each and every component of the hose reel system. For components 1 to 7 evaluated mean reliability value is 0.9952, 0.9518, 0.9950, 0.9949, 0.9952, 0.9950 and 0.9511 respectively. Table 2 gives up the component level evaluated mean reliability for each component. Fig. 2 provides the magnitude of mean reliability of each and every component from 1 to 7. Fig. 3 gives magnitude of mean reliability at component level.

Table 1: Evaluated mean reliability for each and every component of the hose reel system.

component	1	2	3	4	5	6	7
Evaluated Mean Reliability	0.9952	0.9518	0.9950	0.9949	0.9952	0.9950	0.9511

Table 2: Component level evaluated mean reliability for each and every component of the hose reel system.

Component Level	C1	C2	C3	C4	C5	C6	C7
Evaluated Mean Reliability	.9952	.9472	.9424	.9376	.9331	.9285	.8831

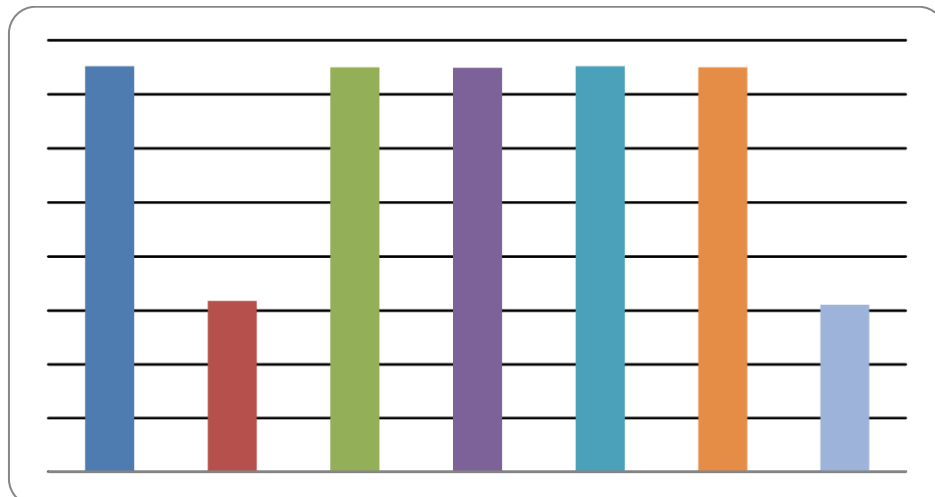


Figure 2: Magnitude of Mean Reliability of each and every component from 1 to 7.

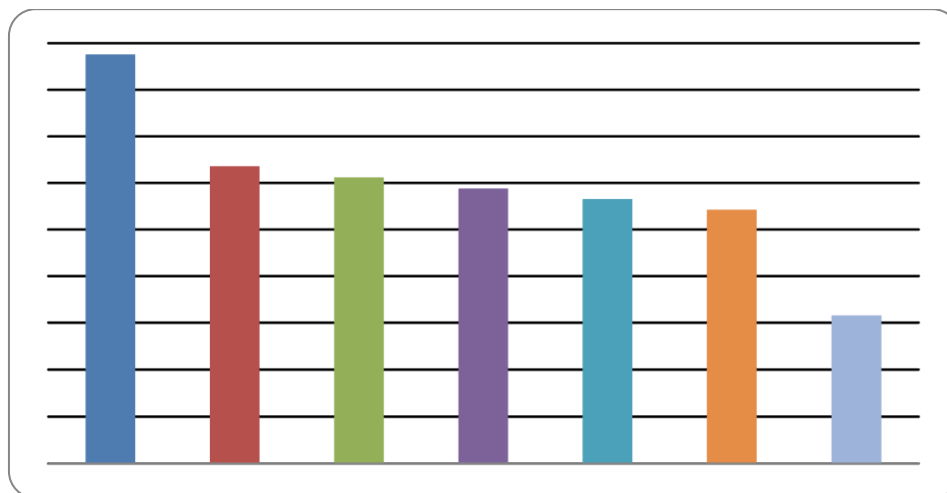


Figure 3: Magnitude of Mean Reliability at component level.

IV. CONCLUSION

Reliability evaluation of an engineering system or component or element is very important in order to predict its availability or unavailability and other important indices. In this paper reliability evaluation of a Hose Reel system installed at an educational institution is done and different reliability parameters are obtained. A large sample size of the failure rate of each and every component of the hose reel system was taken into account for evaluating different reliability parameters. Mean Reliability of each and every component is calculated and provided in the result section. Component level mean reliability is also evaluated and provided in result.

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