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Some Practical Aspects of Reliability in an Industry

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Abstract In this paper a study of theoretical applications in real life situations in an industry have been attempted. On the analysis, it is observed that Preventive maintenance is always better.

Keywords Reliability, Preventive Maintenance, Quality Control, Failure Rate, Survival Rate, Mean Time between Failures

1. Introduction

The growth and development of 'reliability' is closely associated with quality control problems which were vividly discussed in statistical quality control. The importance of reliability and quality control was originated from the demands of modern technology used in world war-II. Complexity and automation of equipment used in the war resulted in several problems of maintenance and repair[1].

Failures in the sophisticated equipments forced to analyse the failure data. Hence the qualitative techniques were introduced for reliability measurement.

Several committees and organisations such as Vacuum Tube Development Committee of USA in 1948, Bell Laboratories and Aeronautical Radio, INC, Advisory group on reliability of electronic Equipment AGREE in 1957. National council for quality and reliability 1961 etc., were formed to promote the concepts of reliability and quality among both manufactures and users. The application of this subject achieved a remarkable progress in the application of reliability principles in industries and government departments in almost all developed and developing countries during the last three decades. Today reliability has become a catch-word in day-to-day life[2].

Reliability is a study of the survival life of a product or a process through probability approach. For improving the quality of any product the machinery should be under good condition where the production should not be stopped an uninterrupted[without failure of the machine] as well as the sub components associated with that machine should be also should survive. So the failure probability of the machine tools an importance place in order to product the qualitative product.

1.1. Mean Time between Failures [MTBF]

Average time of between failures is called mean time between failures starting the failure occurs at time t=0, later first failure occurs at time t_1 and next failure occurs at time t_2 and so on. Here $t_1, t_2, t_3, \ldots..$, are between failures times and it is applicable for repairable items. Here in the situations like the large machinery is dealing with the production of the pistons may have the failures some time to avoid the failures of the machinery we have calculated the data of the breakdown frequency of the machinery.

While in the each line we have collected the data of failures [breakdowns] of the machinery.

1.2. Preventive Maintenance

A system which has life and eventual failure can be achieved to attain longer average life or higher reliability by attending to its service mechanism at equal intervals of time in such a way that by the end of every service the product is brought back to as good as a new one. This procedure is called as preventive maintenance.

In preventive maintenance, parts are replaced lubricants changed or adjustments made before failure occurs. The objective is to increase the reliability of the system over the long terms by staying off the aging effects of wear, fatigue and related phenomena. Failure is postponed or prevented by using maintenance[3].

2. Break Down Analysis

To calculate the mean time between failures for the optimum preventive maintenance,

There are two types of break downs data[4].

1. Mechanical.
2. Electrical.

We have taken the mechanical data for one year in 2011 from the industry. There are 7 types of machines.

OEB ROD SFB CGR OHD RGRFOD

We have seven lines in machine shops each line consists of one OEB, ROD, SFB, CGR, OHD, RGR, and FOD.

We consider all lines machine break downs frequency,

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cumulative frequency and also averages.

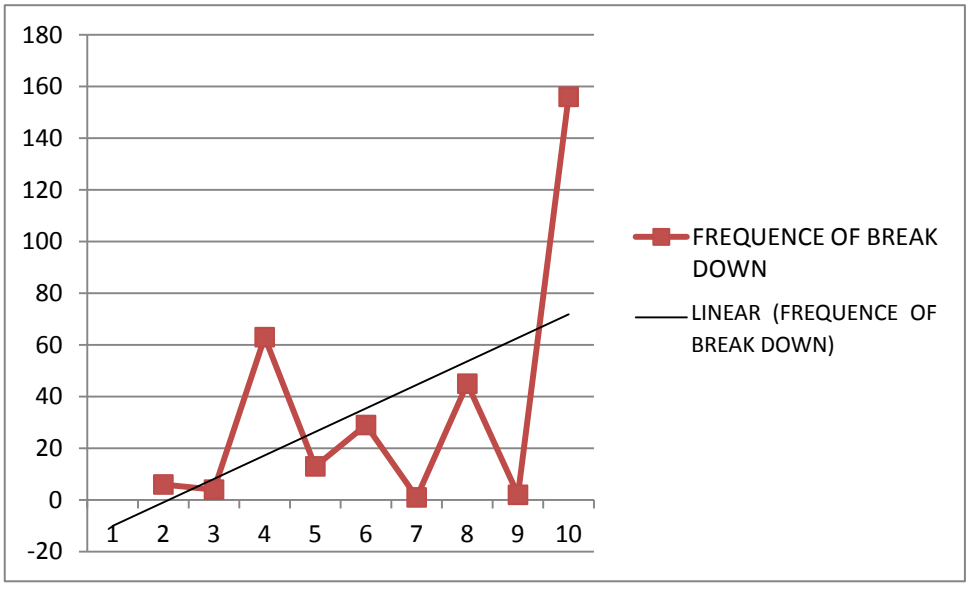
Fit the trend line for each machine among 8 lines we consider serial number on x-axis and frequency Y- axis.

If the trend line is increasing, the failure of the machine break downs is good. Break downs of machines are high, if the trend line is decreasing or fall down. Now calculate the average of the machine among seven lines that is nothing but the mean time between failures [MTBT].

Average time of between failures is called MTBT. Starting the failure occurs at time t=0, later first failure occurs at time t_1 and next failure occurs at time t_2 and so on. Here t_1, t_2, t_3… are between **failures times and it is applicable for repairable items**

Table 1. OEB L_1 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
1	OEBL1		1			
1	OEBL1		2	6	6	
1	OEBL1		3	4	10	
1	OEBL1		4	63	73	
1	OEBL1		5	13	86	35
1	OEBL1		6	29	115	
1	OEBL1		7	1	116	
1	OEBL1		8	45	161	
1	OEBL1		9	2	163	
1	OEBL1		10	156	319	

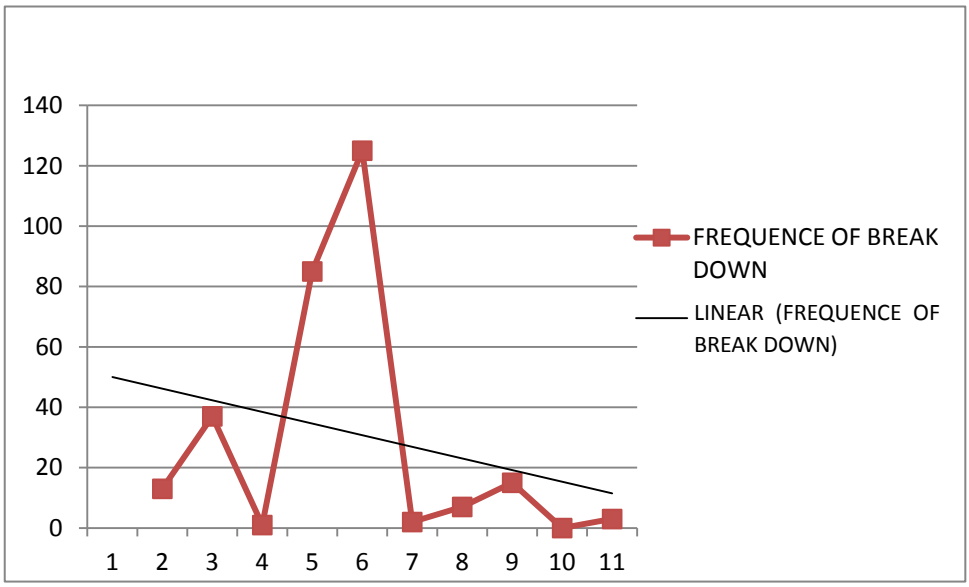


Conclusion: in this manner we conclude that better to go for preventive maintenance for every 35 days.

Figure 1. Frequency of Break-Down of OLE L1, Machine

Table 2. OEB L_2 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
2	OEBL2		1			
2	OEBL2		2	13	13	
2	OEBL2		3	37	50	
2	OEBL2		4	1	51	
2	OEBL2		5	85	136	
2	OEBL2		6	125	261	29
2	OEBL2		7	2	263	
2	OEBL2		8	7	270	
2	OEBL2		9	15	285	
2	OEBL2		10	0	285	
2	OEBL2		11	3	288	

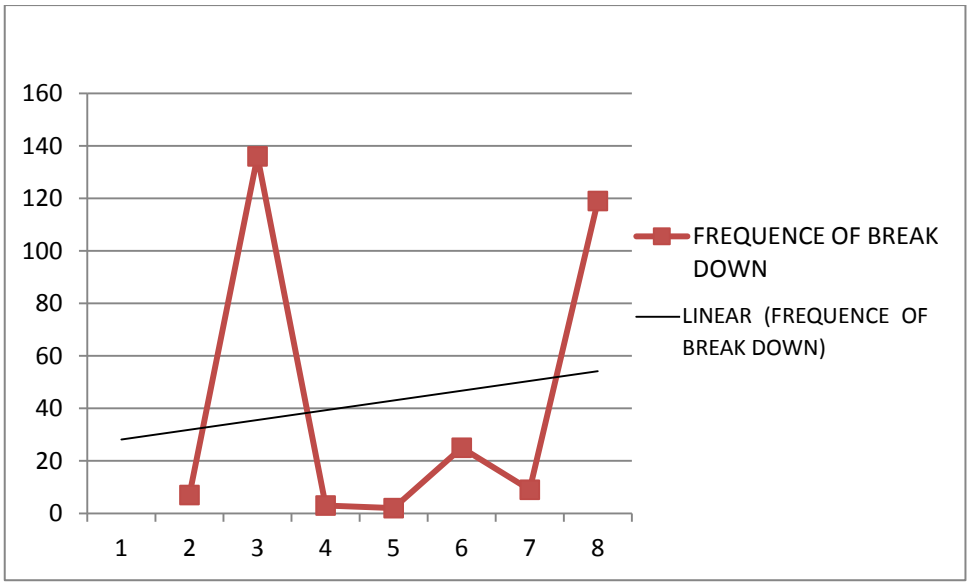


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 29 days.

Figure 2. Frequency of Break-Down of OEB L2 Machine

Table 3. OEB L_3 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
3	OEBL3		1			
3	OEBL3		2	7	7	
3	OEBL3		3	136	143	
3	OEBL3		4	3	146	43
3	OEBL3		5	2	148	
3	OEBL3		6	25	173	
3	OEBL3		7	9	182	
3	OEBL3		8	119	301	

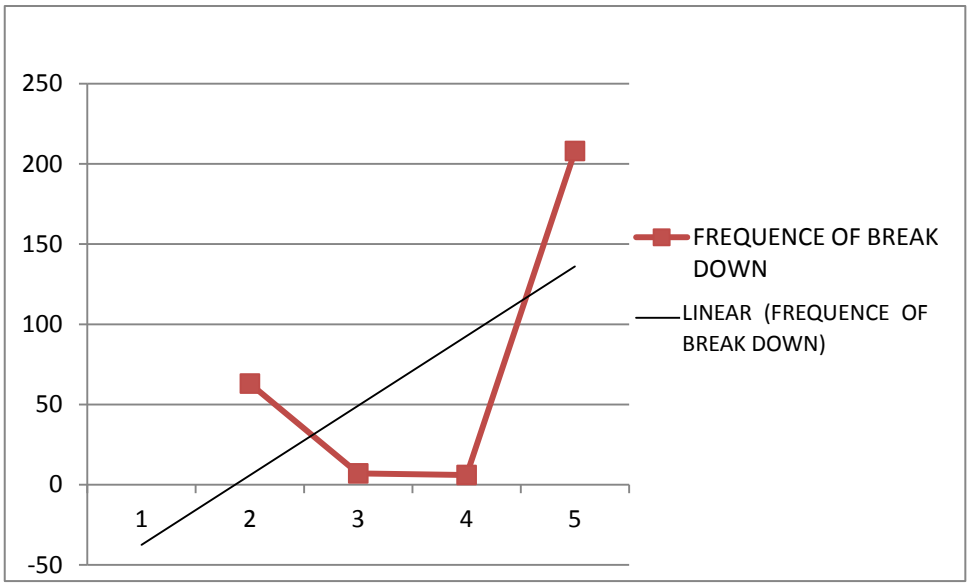


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 43 days.

Figure 3. Frequency of Break-Down of OEB L3 Machine

Table 4. OEB L_4 MACHINE- MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
4	OEBL4		1			
4	OEBL4		2	63	63	
4	OEBL4		3	7	70	71
4	OEBL4		4	6	76	
4	OEBL4		5	208	284	

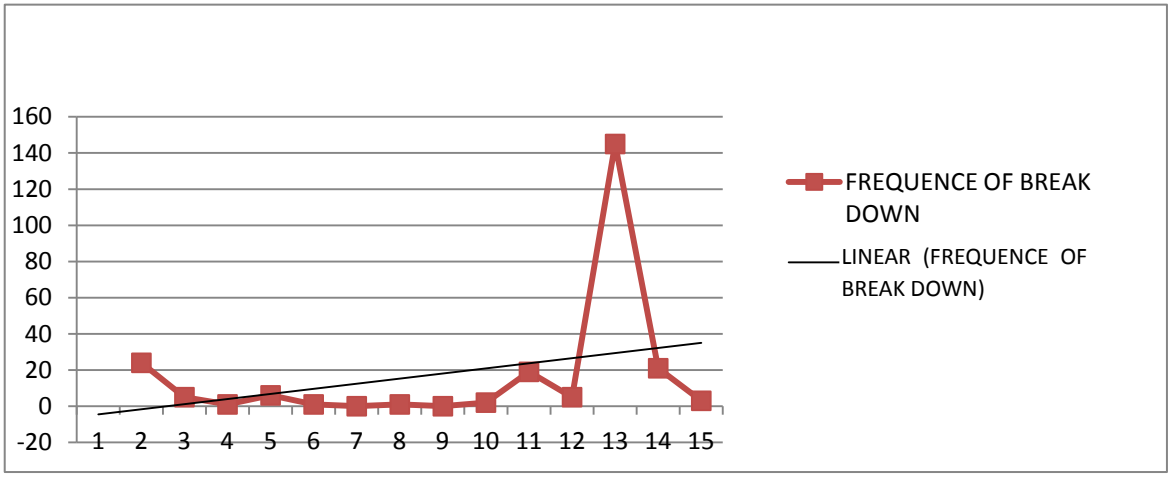


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 71 days.

Figure 4. Frequency of Break-Down of OEB L4 Machine

Table 5. OEB L_5 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
5	OEBL5		1			
5	OEBL5		2	24	24	
5	OEBL5		3	5	29	
5	OEBL5		4	1	0	
5	OEBL5		5	6	36	
5	OEBL5		6	1	37	
5	OEBL5		7	0	37	
5	OEBL5		8	1	38	17
5	OEBL5		9	0	38	
5	OEBL5		10	2	40	
5	OEBL5		11	19	59	
5	OEBL5		12	5	64	
5	OEBL5		13	145	209	
5	OEBL5		14	21	230	
5	OEBL5		15	3	233	

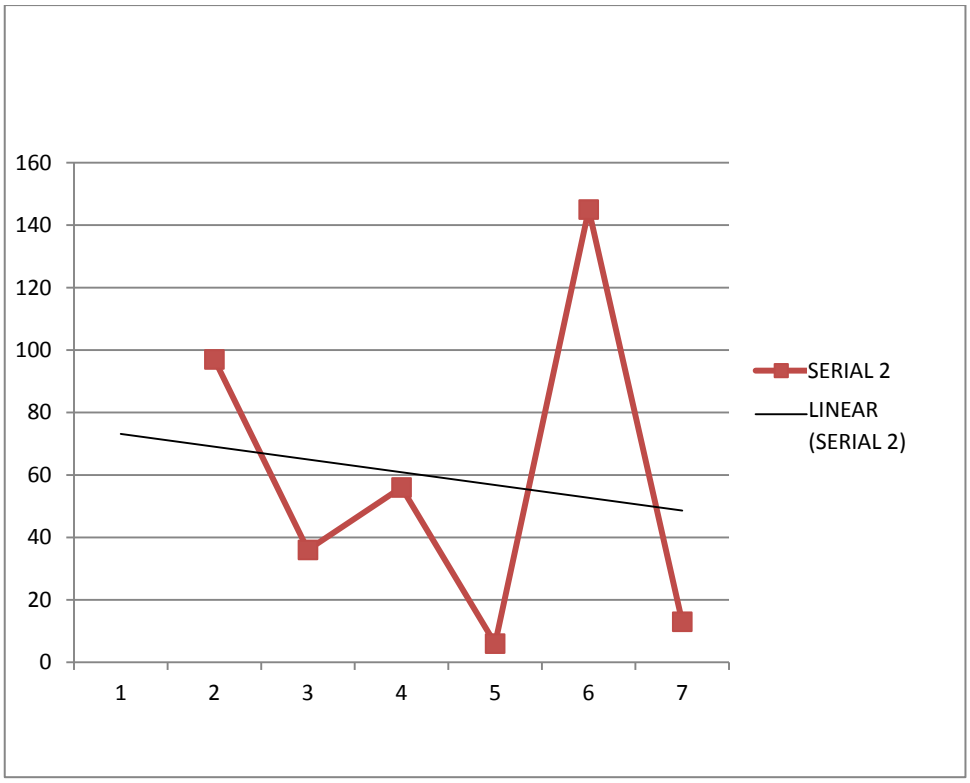


Conclusion: in this manner we conclude that better to go for preventive maintenance for every 17 days.

Figure 5. Frequency of Break-Down of OEB L5 Machine

Table 6. OEB-L_6 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
6	OEBL6		1			
6	OEBL6		2	97	97	
6	OEBL6		3	36	133	
6	OEBL6		4	56	187	59
6	OEBL6		5	6	193	
6	OEBL6		6	145	338	
6	OEBL6		7	13	351	

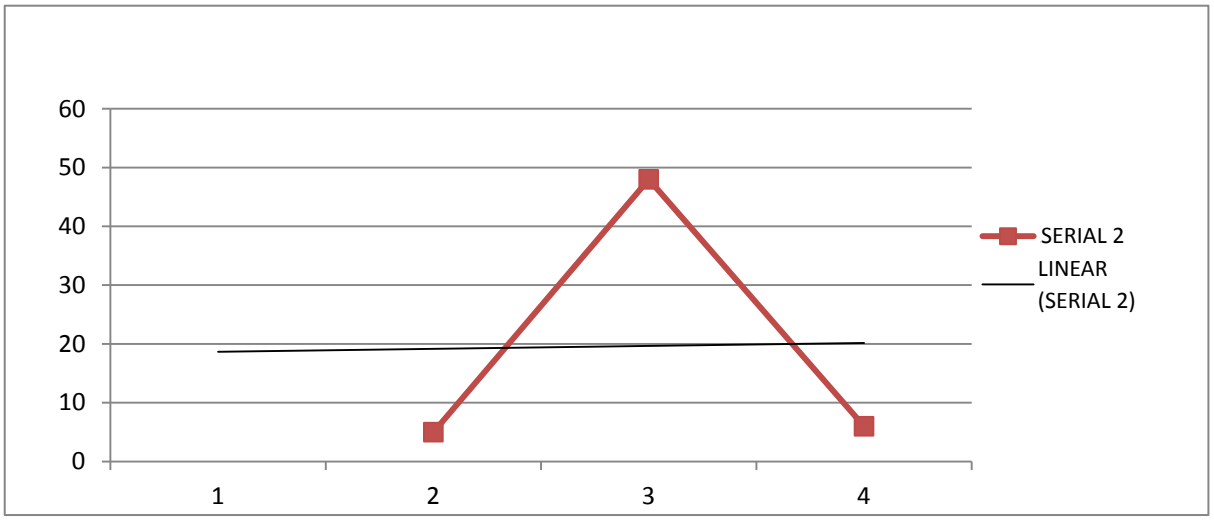


Conclusion: In this manner we conclude that better go to for preventive maintenance for every 59 days.

Figure 6. Frequency of Break-Down of OEB L6 Machine

Table 7. OEB L_7 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
7	OEBL7		1			
7	OEBL7		2	5	5	20
7	OEBL7		3	48	53	
7	OEBL7		4	6	59	

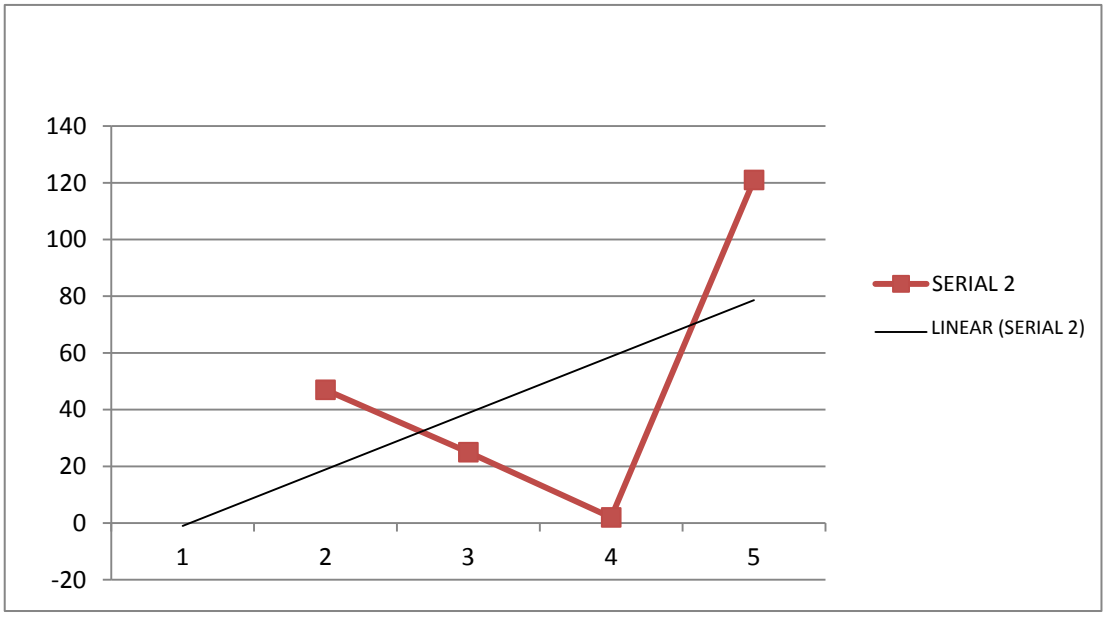


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 20 days.

Figure 7. Frequency of Break-Down of OEB L7 Machine

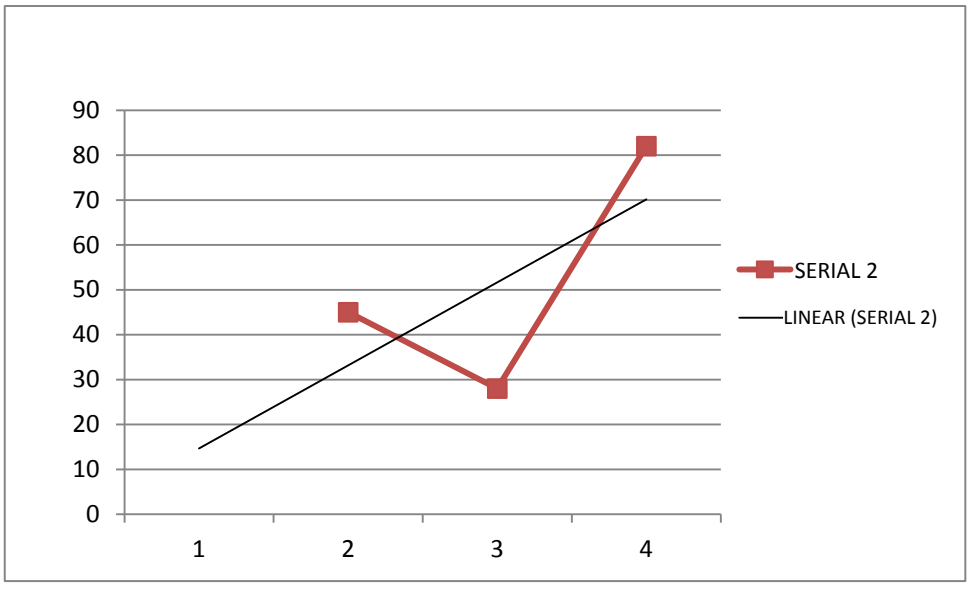
Table 8. ROD L_2 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
2	RODL2		1			
2	RODL2		2	47	47	
2	RODL2		3	25	72	49
2	RODL2		4	2	74	
2	RODL2		5	121	195	



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 49 days.

Figure 8. Frequency of Break-Down of ROD L2 Machine



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 52 days.

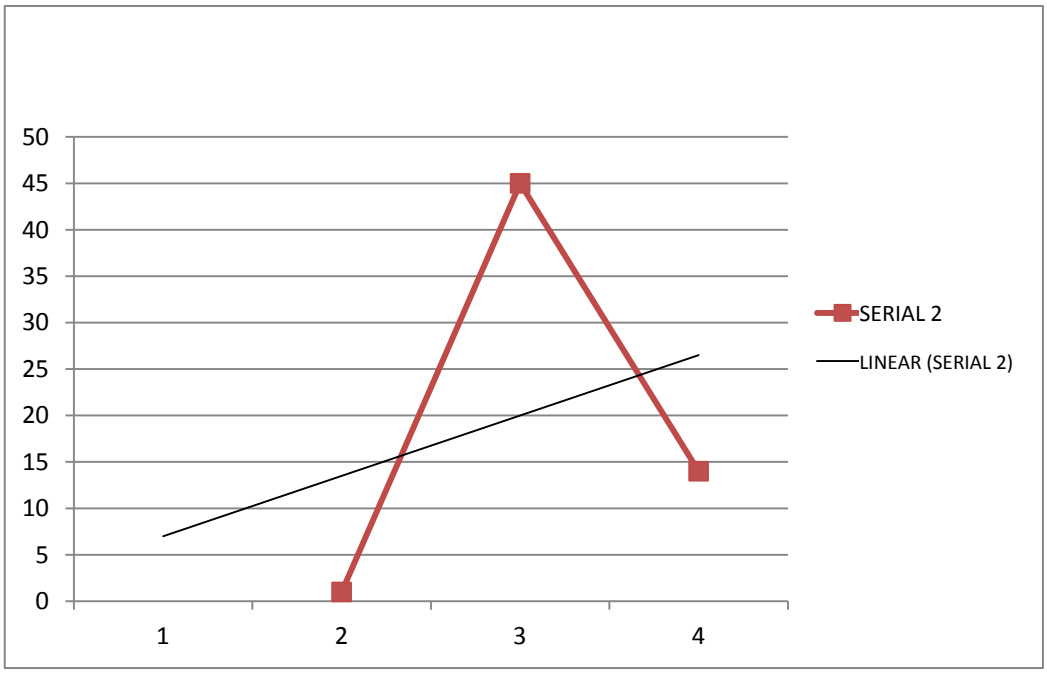
Figure 9. Frequency of Break-Down of ROD L7 Machine

Table 9. OD L_7 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
7	RODL7		1			
7	RODL7		2	45	45	
7	RODL7		3	28	73	52
7	RODL7		4	82	155	

Table 10. ROD L_8 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
8	ROLD8		1			
8	ROLD8		2	1	1	
8	ROLD8		3	45	46	20
8	ROLD8		4	14	60	

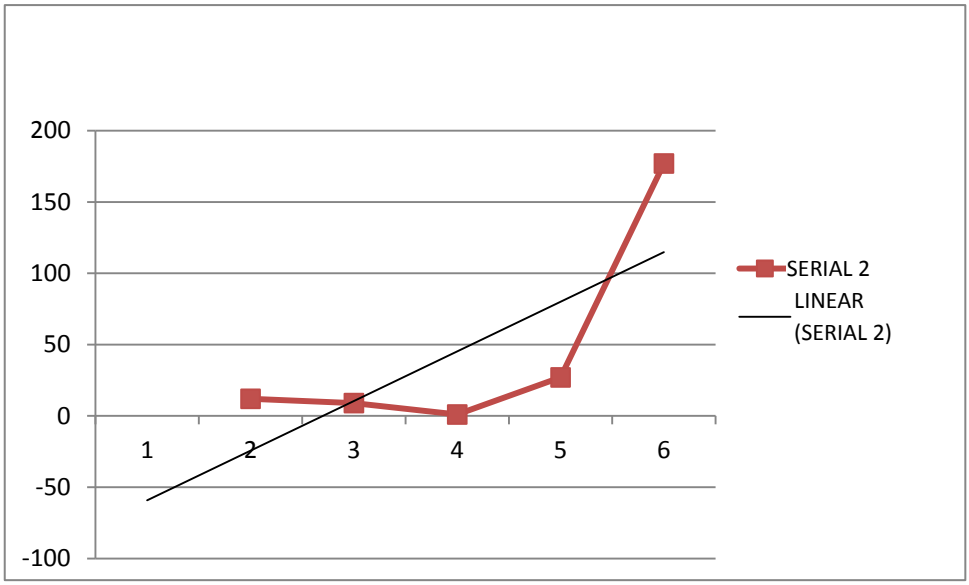


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 20 days.

Figure 10. Frequency of Break-Down of ROD L8 Machine

Table 11. SFB L_1 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
1	SFBL1		1			
1	SFBL1		2	12	12	
1	SFBL1		3	9	21	45
1	SFBL1		4	1	22	
1	SFBL1		5	27	49	
1	SFBL1		6	177	226	

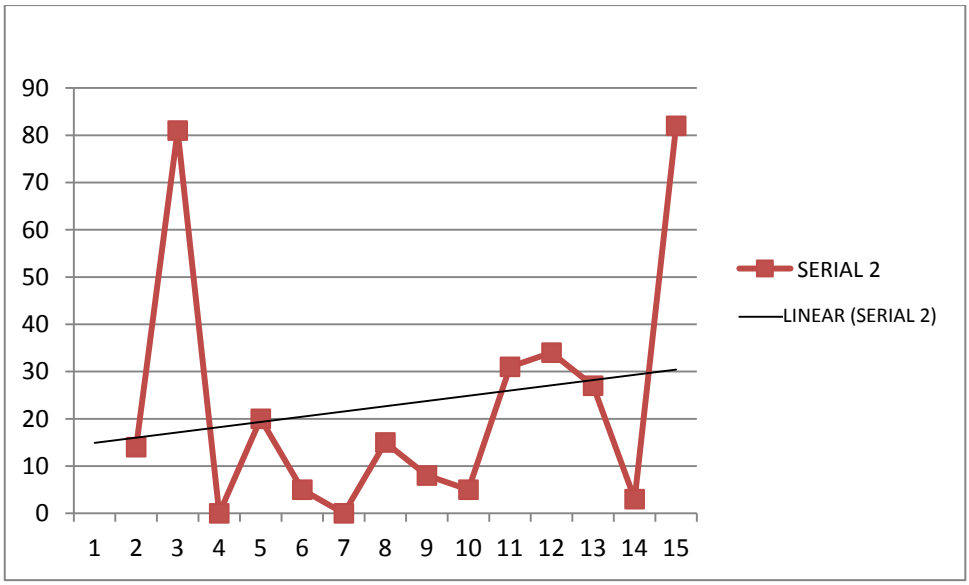


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 45 days.

Figure 11. Frequency of Break-Down of SFB L1 Machine

Table 12. SFB L_4 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
4	SFBL4		1			
4	SFBL4		2	14	14	
4	SFBL4		3	81	95	
4	SFBL4		4	0	95	
4	SFBL4		5	20	115	
4	SFBL4		6	5	120	
4	SFBL4		7	0	120	
4	SFBL4		8	15	135	25
4	SFBL4		9	8	143	
4	SFBL4		10	5	148	
4	SFBL4		11	31	179	
4	SFBL4		12	34	213	
4	SFBL4		13	27	240	
4	SFBL4		14	3	243	
4	SFBL4		15	82	325	

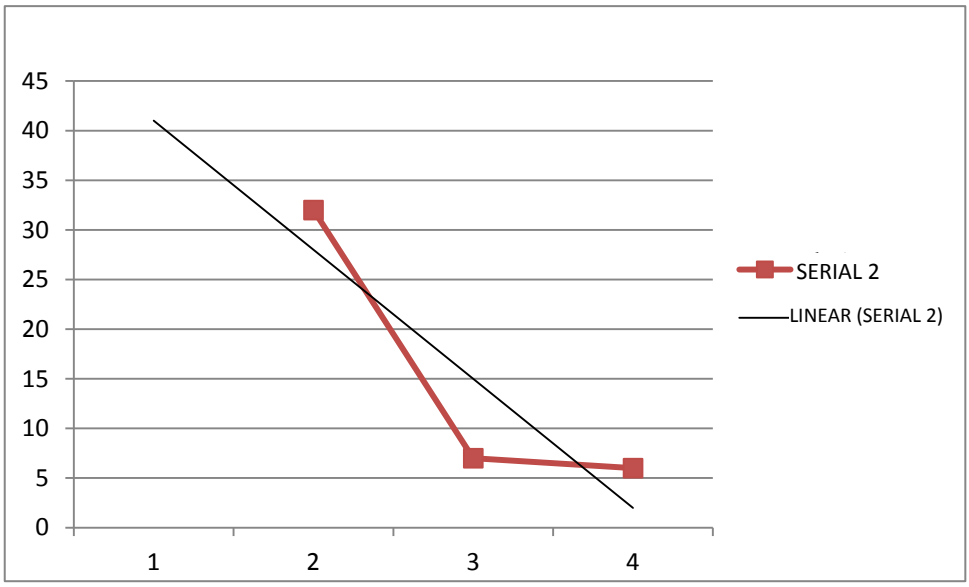


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 25 days

Figure 12. Frequency of Break-Down of SFB L4 Machine

Table 13. CGR L_1 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
1	CGRL1		1			
1	CGRL1		2	32	32	
1	CGRL1		3	7	39	15
1	CGRL1		4	6	45	

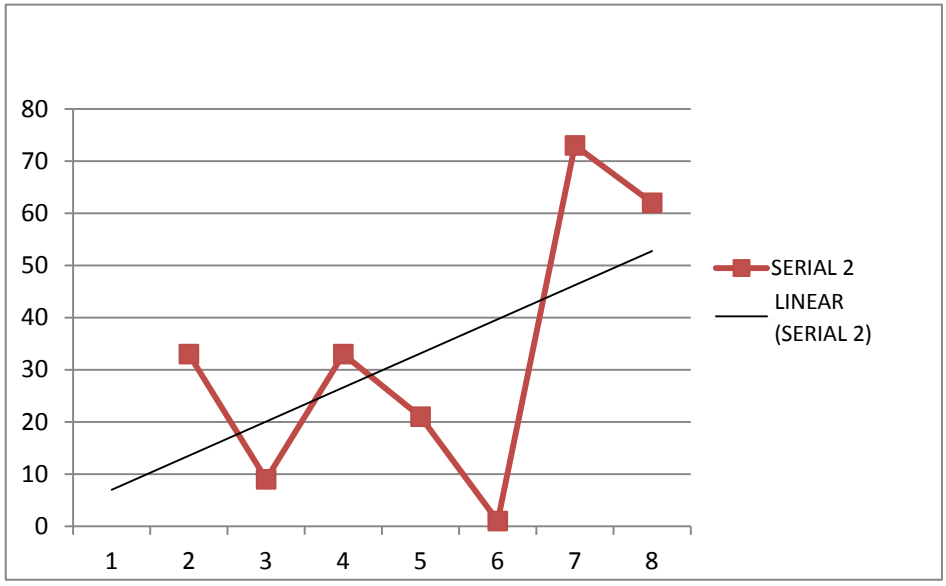


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 15 days.

Figure 13. Frequency of Break-Down of CGR L1 Machine

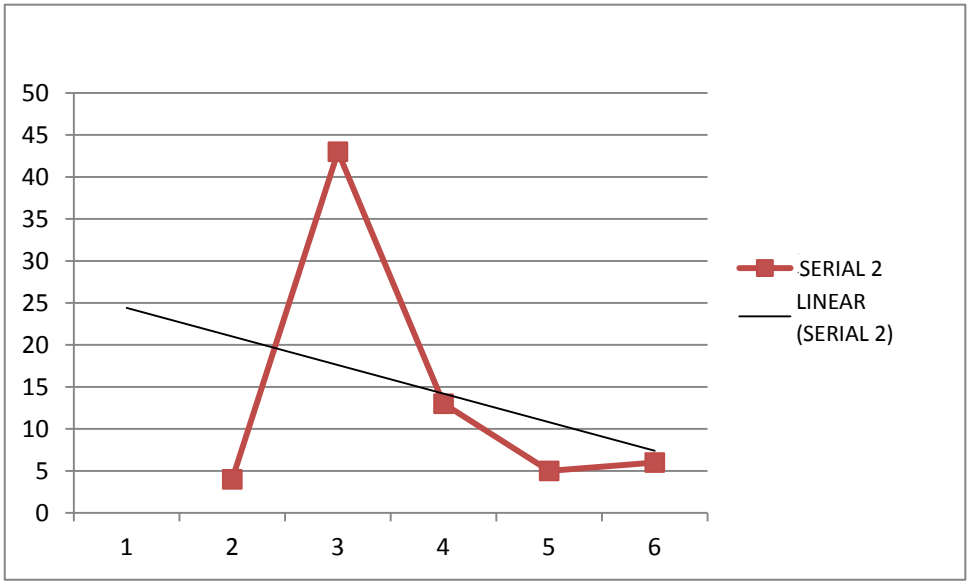
Table 14. CGR L_4 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
4	CGRL4		1			
4	CGRL4		2	33	33	
4	CGRL4		3	9	42	
4	CGRL4		4	33	75	33
4	CGRL4		5	21	96	
4	CGRL4		6	1	97	
4	CGRL4		7	73	170	
4	CGRL4		8	62	252	



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 33 days.

Figure 14. Frequency of Break-Down of CGR L4 Machine



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 14 days.

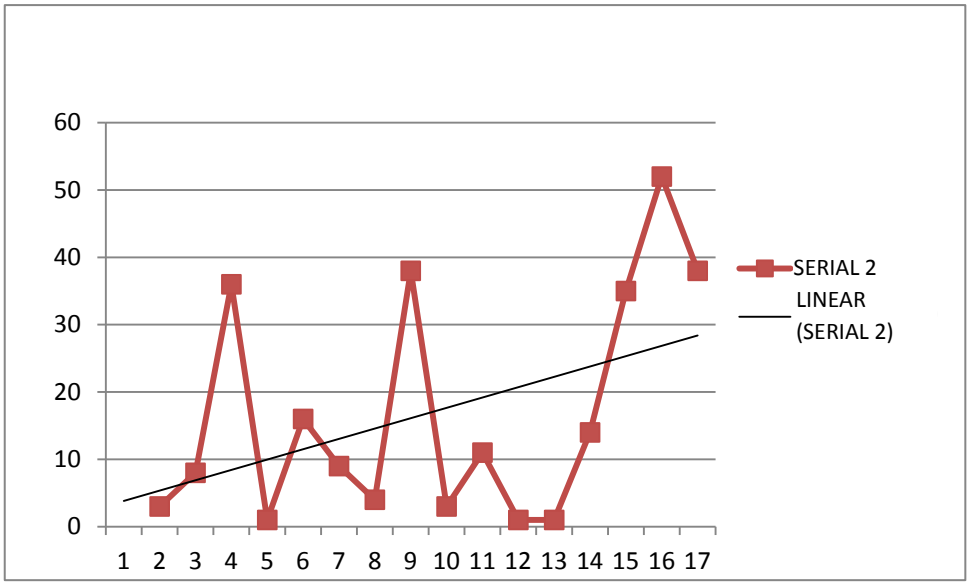
Figure 15. Frequency of Break-Down of CGR L6 Machine

Table 15. CGR L_6 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
6	CGRL6		1			
6	CGRL6		2	4	4	
6	CGRL6		3	43	47	14
6	CGRL6		4	13	60	
6	CGRL6		5	5	65	
6	CGRL6		6	6	71	

Table 16. OHD L_1 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
1	OHDL1		1			
1	OHDL1		2	3	3	
1	OHDL1		3	8	11	
1	OHDL1		4	36	47	
1	OHDL1		5	1	48	
1	OHDL1		6	16	64	
1	OHDL1		7	9	73	
1	OHDL1		8	4	77	
1	OHDL1		9	38	105	17
1	OHDL1		10	3	108	
1	OHDL1		11	11	119	
1	OHDL1		12	1	120	
1	OHDL1		13	1	121	
1	OHDL1		14	14	135	
1	OHDL1		15	35	170	
1	OHDL1		16	52	222	
1	OHDL1		17	38	250	

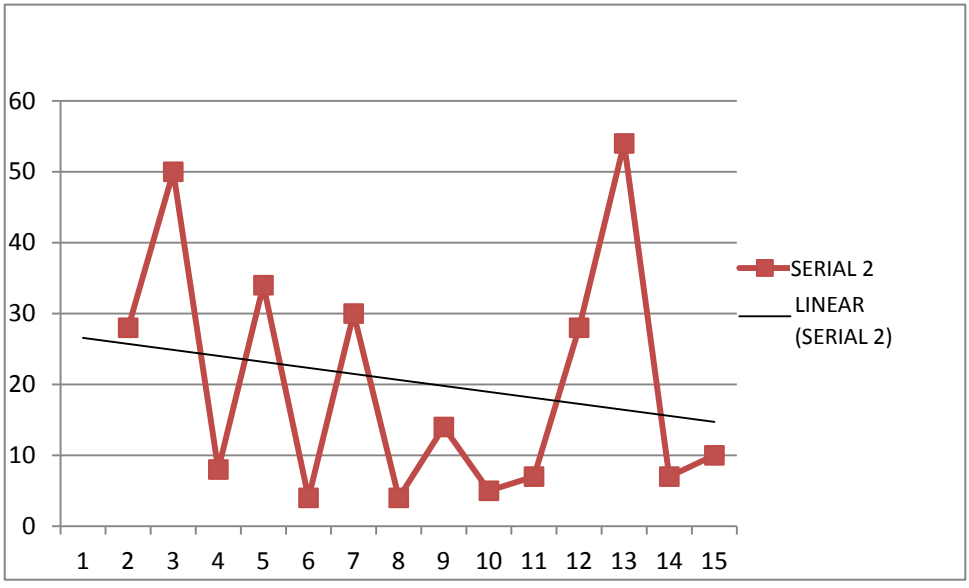


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 17 days.

Figure 16. Frequency of Break-Down of OHD L1 Machine

Table 17. OHD L_7 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
7	OHDL7		1			
7	OHDL7		2	28	28	
7	OHDL7		3	50	78	
7	OHDL7		4	8	86	
7	OHDL7		5	34	120	
7	OHDL7		6	4	124	
7	OHDL7		7	30	154	
7	OHDL7		8	4	158	
7	OHDL7		9	14	172	20
7	OHDL7		10	5	177	
7	OHDL7		11	7	184	
7	OHDL7		12	28	212	
7	OHDL7		13	54	266	
7	OHDL7		14	7	273	
7	OHDL7		15	10	283	

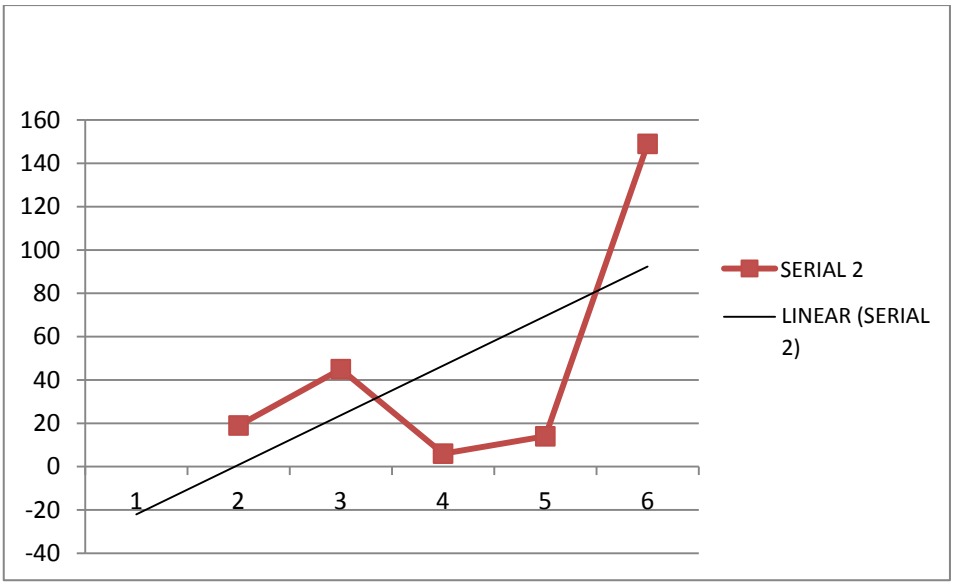


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 20 days.

Figure 17. Frequency of Break-Down of OHD L7 Machine

Table 18. OHD L_8 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
8	OHDL8		1			
8	OHDL8		2	19	19	
8	OHDL8		3	45	64	47
8	OHDL8		4	6	70	
8	OHDL8		5	14	84	
8	OHDL8		6	149	233	

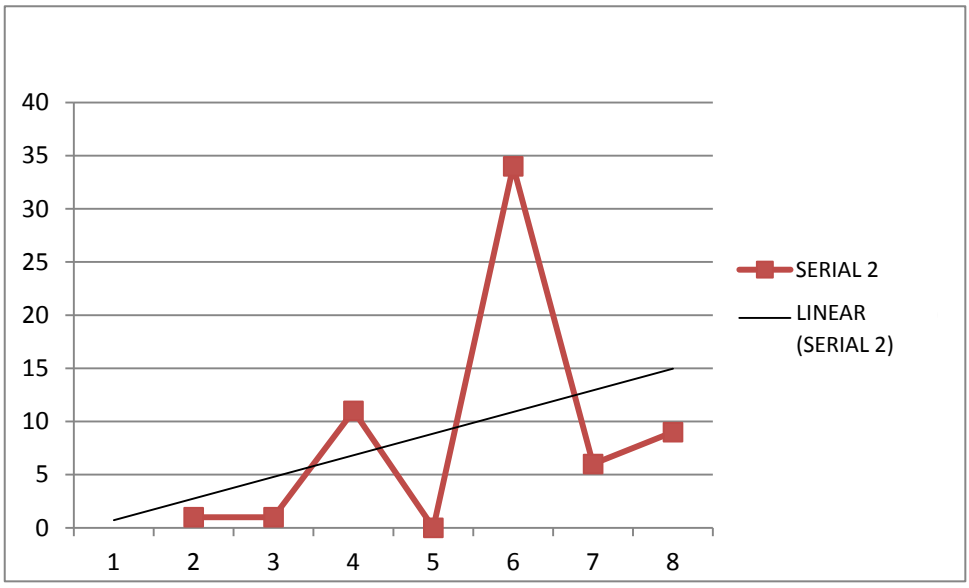


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 47 days.

Figure 18. Frequency of Break-Down of OHD L8 Machine

Table 19. R.GR L_2 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
2	R.GRL2		1			
2	R.GRL2		2	1	1	
2	R.GRL2		3	1	2	
2	R.GRL2		4	11	13	
2	R.GRL2		5	0	13	9
2	R.GRL2		6	34	47	
2	R.GRL2		7	6	53	
2	R.GRL2		8	9	62	

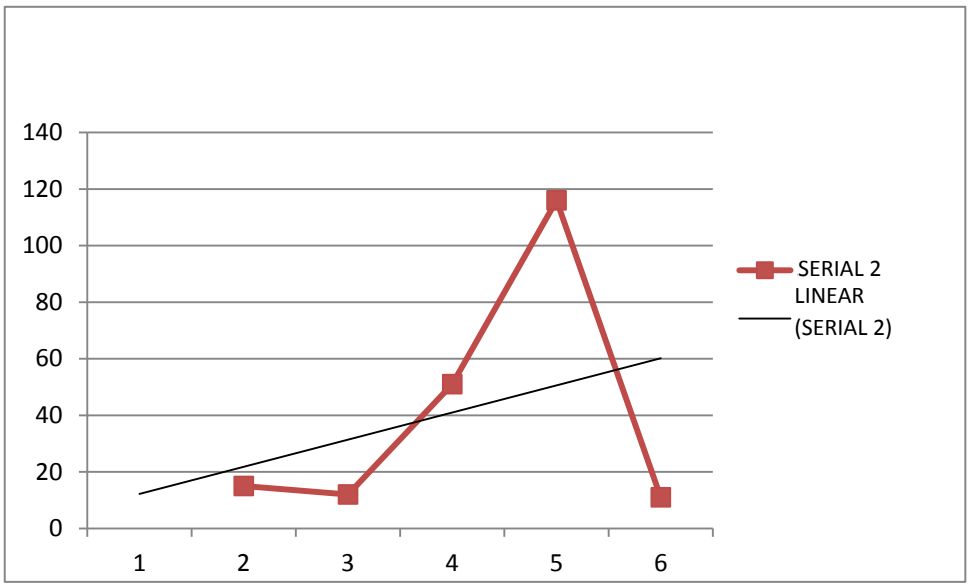


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 9 days.

Figure 19. Frequency of Break-Down of R.GR L2 Machine

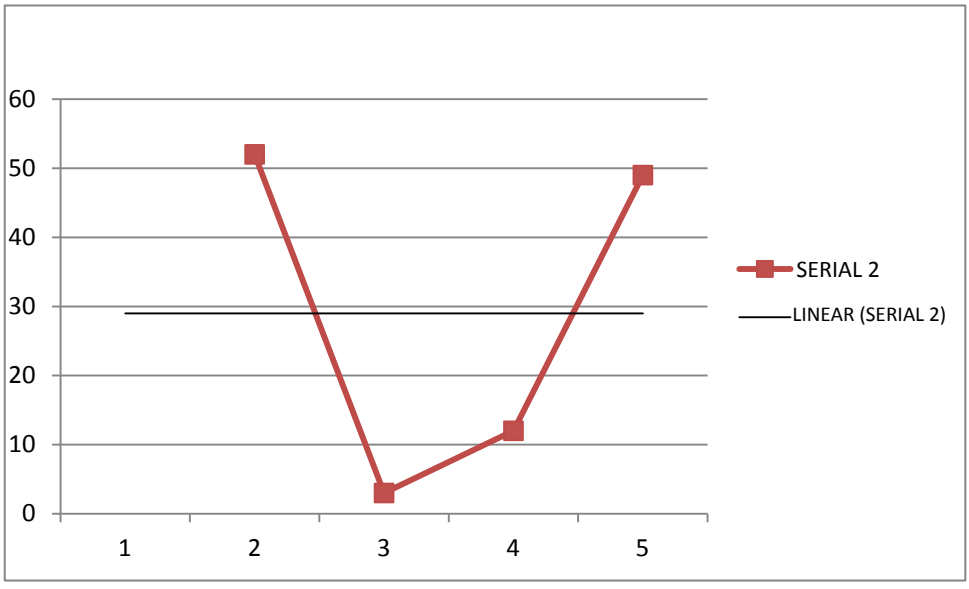
Table 20. R.GR L_6 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
6	R.GRL6		1			
6	R.GRL6		2	15	15	
6	R.GRL6		3	12	27	41
6	R.GRL6		4	51	88	
6	R.GRL6		5	116	204	
6	R.GRL6		6	11	215	



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 41 days.

Figure 20. Frequency of Break-Down of R.GR L6 Machine



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 29 days.

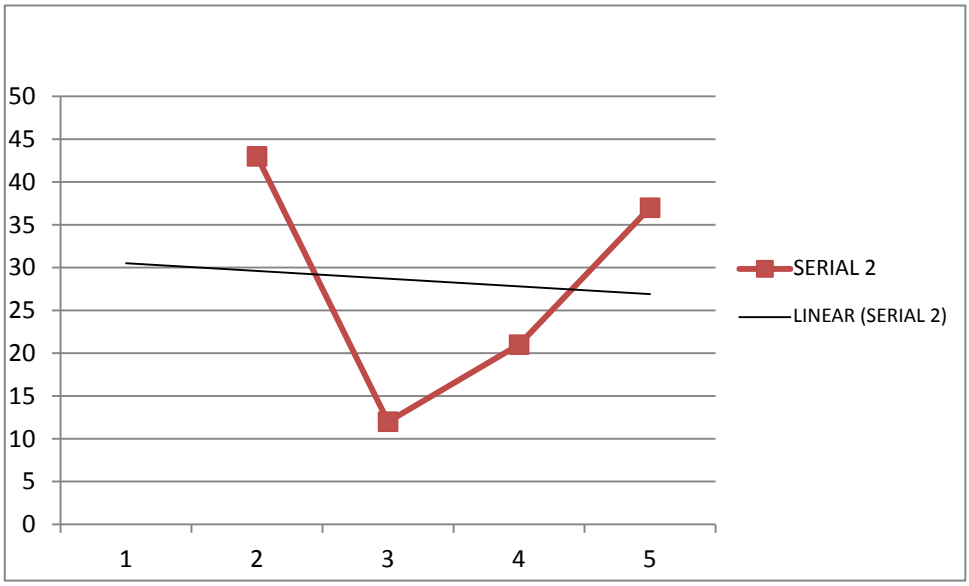
Figure 21. Frequency of Break-Down of FOD L3 Machine

Table 21. FOD L_3 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
3	FODL3		1			
3	FODL3		2	52	52	
3	FODL3		3	3	55	29
3	FODL3		4	12	77	
3	FODL3		5	49	126	

Table 22. FOD L_5 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
5	FODL5		1			
5	FODL5		2	43	43	
5	FODL5		3	12	55	28
5	FODL5		4	21	76	
5	FODL5		5	37	113	

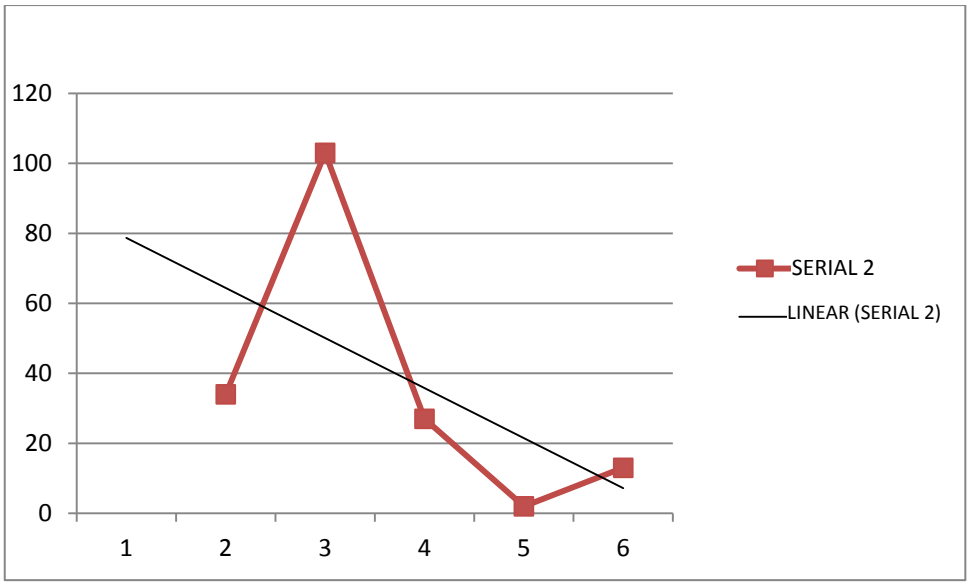


Conclusion: In this manner we conclude that better to go for preventive maintenance for every 28 days.

Figure 22. Frequency of Break-Down of FOD L5 Machine

Table 23. FOD L_6 MACHINE-MTBF

LINE NO	MACHINE NAME	DATE OF BREAK DOWN	FAILURE NUMBER	FREQUENCE OF BREAK DOWN	CUMULATIVE FREQUENCE	MTBF
6	FODL6		1			
6	FODL6		2	34	34	
6	FODL6		3	103	137	
6	FODL6		4	27	164	36
6	FODL6		5	2	168	
6	FODL6		6	13	181	



Conclusion: In this manner we conclude that better to go for preventive maintenance for every 36 days.

Figure 23. Frequency of Break-Down of FOD L6 Machine

3. Conclusions

From the above data and analysis it is concluded that the preventive maintenance is always essential for better machine functioning. Various conclusions drawn for each tools are given at the end of each table and graph. It is always better to prevent the eventuality rather than repair it .

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