

Role of Various Accentuated Parameters in Extenuating Tedious Experimental Analysis for Customized Centrifugal Pumps

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DOI: <https://doi.org/10.34256/irjmt2022>

ABSTRACT

The fluid power industry is engrossed with numerous applications befitting to pumps. Concocting experimental plans for investigations on innovative pumps require meticulous drafting and candor infused veracity. But if we stay to ground reality, contemporary technological advancement must also be taken into for the design of experiments. It is through fending contemporary literature and writings, that any scholar will be able to design an innovative experimental plan. In this article, the experimental findings from an innovative centrifugal pump have been discussed. The camaraderie between the experimental plan and the experimental results has been eviscerated, introducing the concept of accentuated parameters. The camaraderie is ascribed to the accentuated parameter. It is through the selection and utilization of certain accentuated parameters; any experimental finding can be scoured. This article illustrates the use of accentuated parameters and their effect on the findings.

Keywords: *Accentuated parameters, Candor, Concocting, Centrifugal pump, Veracity.*

1. Introduction

Several types of researches [1-5] in the domain of centrifugal pumps are being concocted. Experimental designs make scholars and scribes to look at enigmatic processes with consternation. But with this 'accentuated parameter' concept, even the insurmountable conundrums can be made fathomable. To understand and discern this concept, a customized centrifugal pump has been selected. A 3.3HP annular cased semi-open impeller imbued centrifugal pump was considered for analysis.

Fig.1 provides the scheme of arrangement of the centrifugal pump test rig taken up for analysis [6]. This centrifugal pump is customized [7]. The key objective of conducting a performance analysis in this centrifugal pump is to observe and scour the effect of the tip clearance (distance between the inside of the casing and the tip of the impeller) on the performance of the pump. Before executing the experimental analysis, several pinnacles need to be irrefutably planned.

1. The experimental plan needs to be maneuvered using an assertion/hypothesis. This assertion or hypothesis will have to be concocted adhering to the objective of the research. The assertion should be specific and must be based on technical claims. Despite the situation being a predicament, an experiment must be initiated with an assertion. Assertions and hypothesis shall be allusive. Considering this centrifugal pump, the experiment will have to be planned by

suggesting an assertion, that, there will be a change in the pump performance with changing tip clearance.

2. Secondly, the available resources for experimenting will have to be scoured. Researchers and scribes will often 'hold a short fuse' on reading this. Frankly speaking, the objective of any experimental research work is to lambast (not necessarily to belabour!) any contemporary research finding or even to replace a finding with a better one. Hence, a better use of resources is necessary. For example, the centrifugal pump needs to be supported by instrumentation and stroboscopic resources.
3. The most important pinnacle for experimental planning is to take inventory of the experimental frequency. Careful planning needs to be done on where to record the findings and how many. Sometimes, choosing the wrong experimental frequency might exacerbate the situation. Also, care should be taken such that, to embellish the research document with findings, the experimental frequency should not be planned presumptuous. In the case of this centrifugal pump, the discharge was planned to be adjusted throughout the experiment for each tip clearance.
4. Another most important factor is the accentuated parameters. Accentuated parameters are the key parameters that will have to be carefully recorded. The choice of profligacy also needs to be considered.

2. The Gregory – Accentuated Parameter Approach



Fig. 1 Centrifugal Pump taken for analysis

Fig.1 shows the utilized centrifugal pump test rig. The experimental analysis was performed using the aforementioned approach. Since the accentuated parameters are asserted to play an important role in the experimental findings, it has to be carefully chosen. Let us consider our case, the centrifugal pump. In the centrifugal pump's performance analysis, generally, the following variables will be considered.

1. Delivery head (m of H₂O or kg/cm²) – Direct Instrumentation
2. Suction head (m of H₂O or kg/cm²) – Direct Instrumentation
3. Total head (m of H₂O or kg/cm²) – Calculated variable
4. Wattmeter readings are used to measure input power to the motor (Watts) – Direct Instrumentation.
5. Gross Input Power to the pump(Watts) – Calculated variable.

6. Discharge (kg/s)– Calculated through passive instrumentation.
7. Efficiency (%)–Calculated variable
8. Cavitation – Not quantitative- only visualized through a stroboscope.

Now, considering only the quantifiable key variables, it can be observed that discharge can be made to travel along with the other variables. To put to explicit terms, when the discharge is constrained, all other variables can also be driven. This does not imply that all other parameters are immaterial. This approach is only to eliminate the less important variables to be presented in the research findings. Hence, with discharge as the base, other parameters that can be selected as accentuated parameters are,

1. Input Power
2. Output Power
3. Efficiency
4. Total head.

Hence, the experimental analysis was conducted in this centrifugal pump by accentuating the aforementioned parameters as the key findings to explain the phenomenon.

3. Performance of The Centrifugal Pump At 4.5mm Tip Clearance.

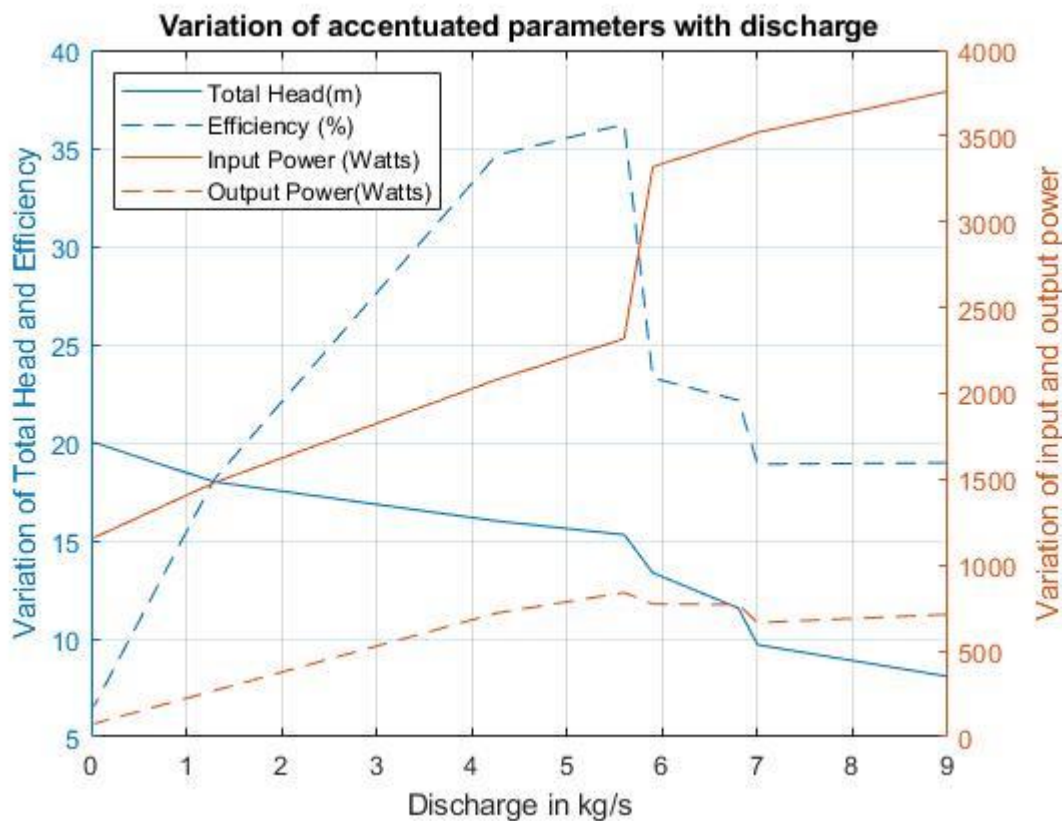


Fig. 1 Pump performance at 4.5mm clearance

Fig.2 provides us edification about the accentuated variables. From the plot, it is evident that there is a fall in the pump efficiency post-discharge of 5.5kg/s. The trend thereafter is comparatively abysmal. But, juxtaposing efficiency and output power, one could observe that despite the fall in the efficiency, output power endures throughout the performance evaluation. This can be ascribed to the rise in the input power.

Also, from the plot, there is a zone that is irrefutably considered to be the threshold zone. The zone between 5.5kg/s to 7kg/s can be deemed threshold. It is incontrovertible that post the threshold zone, the performance turns benighted. It is in the threshold zone, that the efficiency drops repugnantly. This efficiency drop can be ascribed to the catastrophic rise in the input power. But the scenario post threshold cannot be fully deemed umbrage, as this zone witnesses throbbing and restive output power. Hence, it can be concluded from the plot that when the tip clearance is set to be 4.5mm, it is best to operate the centrifugal pump pre-threshold (below 5.5kg/s). This decision can be asserted by prioritizing efficiency over the output power. But, the effect of accentuated parameters can be dealt with only with a comparative model.

4. Performance of The Centrifugal Pump At 3mm Tip Clearance

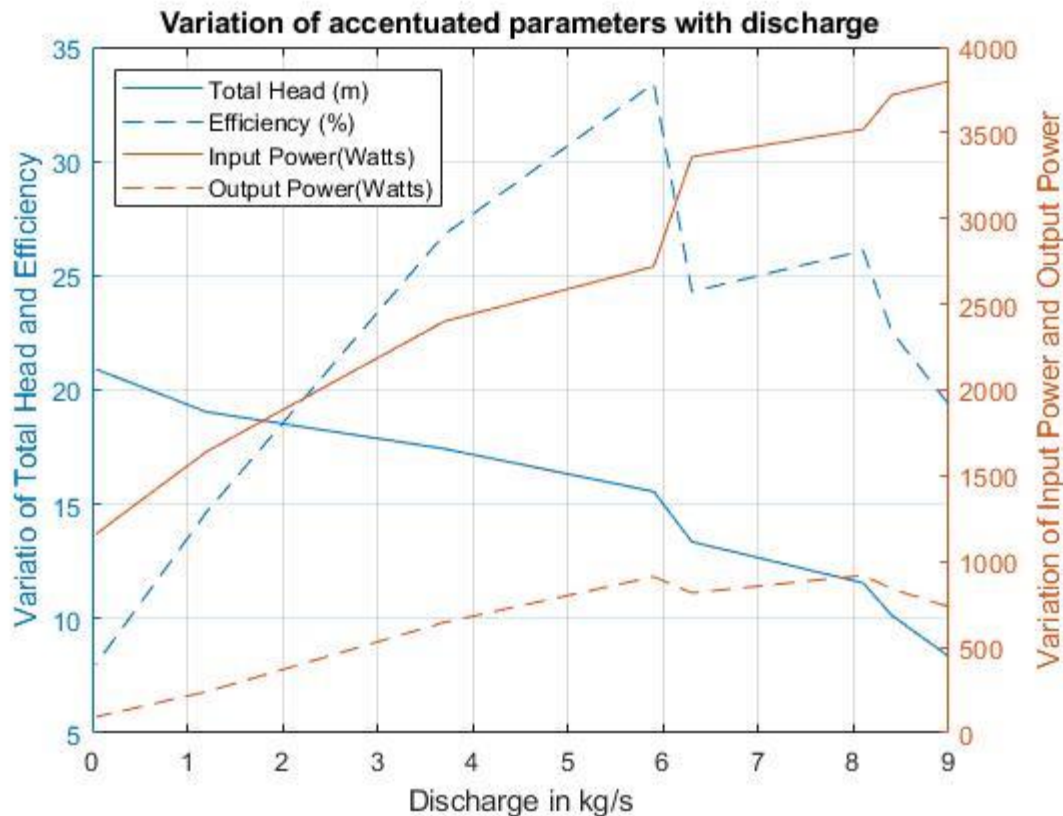


Fig. 2 Pump performance at 3mm clearance

Fig.3 provides us an edification about the accentuated variables for 3mm tip clearance. From the plot, it is evident that there is a precedent threshold zone, but here, the threshold zone is wider. Fig.2 and Fig.3 share some common armada. The pattern of efficiency, input power, output power, and the total head remains the same. Hence, it can be discerned that the choice of accentuated parameters will have to be impaled with decisions such as they act as a purveyor of critical parameters.

In this plot, the threshold zone can be categorized as the zone between 5.8kg/s and 8.5kg/s. Since the threshold zone has a shift, it can be asserted that the centrifugal pump with 3mm tip clearance is suitable for operation up to 5.8kg/s. Comparing quantitatively, the 4.5mm case had hit a higher efficiency than the 3mm case. This experimental finding leads to a pragmatic hypothesis, that, lesser the tip clearance, the lesser will be the maximum efficiency. But this hypothesis can be validated only when compared with the 1.5mm case. Except for efficiency, the trend of accentuated parameters remains the same. But, this does not conclude that the other accentuated

parameters need to be disbarred, but it rather means that the efficiency factors needs to be projected as a regimen.

5. Performance of The Centrifugal Pump At 1.5mm Tip Clearance

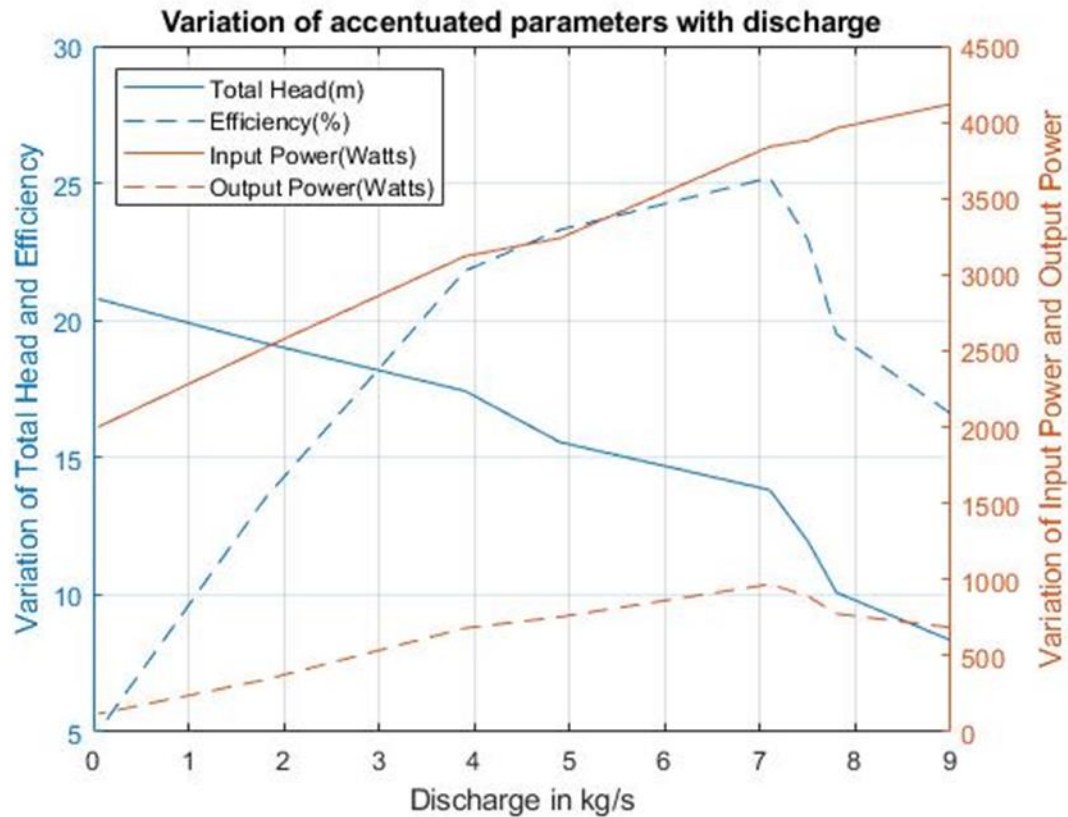


Fig. 4 Pump performance at 1.5 mm clearance

From Fig.4, it is evident that, in this case, the threshold zone further widens. In this case of 1.5mm tip clearance, the threshold zone can be determined to be between 4.5kg/s and 8.5kg/s. Hence, an assertion can be made that this pump can be utilized well by up to only 4.5 kg/s. Also, as seen from the previous cases, there is a drop in the maximum efficiency. The maximum efficiency in the case is around 25%. This is a factor that discombobulates researchers in selecting the best clearance. But still, comparing Fig.4 with Fig.2 and 3, it evident that all the accentuated parameters follow a similar pattern. Hence, the choice of accentuated parameters is validated. However, there are several conundrums and impasses, which can be discerned and solved only under a comparative model.

But giving a generic notion for all types of pumps might of out of line. Let us consider an exemplification. Contemporary research [8] asserts that the lower the tip clearance, the better is the efficiency. But our current research concludes the other way. This does not mean that one should do a formal aspersion on all contemporary research works that do not infer that same way. Deciphering such contemporary literature with a general notion would end up in enigmatic baloney and enthralls a controversy. Instead, one needs to interpret contemporary findings with a certain degree of discernment. In the aforementioned research, the pump architecture is completely different from the architecture of our current research. Researchers must be accultured to respect every literature and formally put out opinions.

Table 1. Comparison of various key parameters

Tip clearance	Maximum Efficiency	Threshold Zone	Threshold zone magnitude
4.5mm	38%	5.5 – 7kg/s	1.5 kg/s
3mm	33%	5.8 – 8.5 kg/s	2.7 kg/s
1.5mm	25%	4.5-8.5 kg/s	4 kg/s

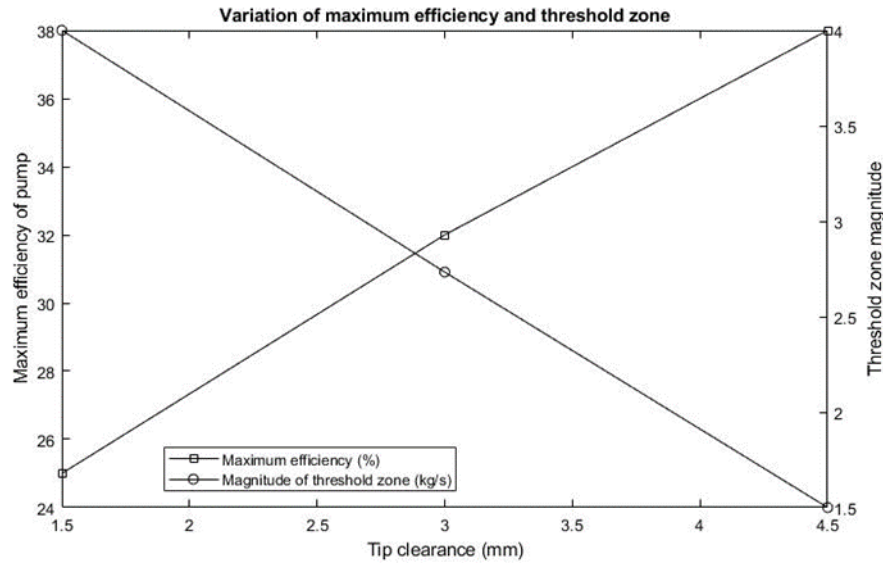


Fig. 5 Effect of Tip Clearance on threshold magnitude and efficiency

Table.1 and Fig.5 provides a comparison of the variation in the threshold zone and maximum efficiency. This will help us choose the best clearance value.

6. Conclusion

1. From the graphical plots, it is evident that the choice of accentuated parameters holds powerful and this approach can be applied to all other experimental planning. Any decision needs to be concocted using a prioritizing technique. Comparing the trends of various accentuated parameters, to decide which clearance is the optimum one, one accentuated parameter needs to be comparatively prioritized over the other.
2. Comparing the threshold zone, it is evident that, lower the tip clearance, the wider is the threshold zone. The pump can be operated only up to 4.5kg/s. Also, when a 1.5mm clearance case is chosen, the maximum efficiency is around only 25%. Efficiency, as a key factor is also inevitable.
3. Hence, comparing all the plots, and considering efficiency as the key prioritized parameter, it is evident that 4.5mm is best suitable. Despite a diminutive drawback of the operating range, the choice of 4.5mm will be the best suited, as it gives maximum efficiency.
4. Hence, in general, the higher the tip clearance, the better will be the performance.
5. This conclusion is for this customized type of pump with an annular casing and semi-open impellers. Finally, the article gives a little ‘pep-talk’ for researchers, research writers, and technology journalists that they should compare contemporary literature with respect and must not treat any result differing from theirs to be hostile. This will obliterate trepidatious balonies, prattle, and bickering.

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Acknowledgement

The authors thank the Almighty for his blessing to compose this research article. The authors would also like to thank their parents for their support and motivation. The comments and opinions in this research article reflect the personal views of the authors and do not necessarily reflect the opinion of the affiliated institutions.

Funding

This study was not funded by any grant

Conflict of interest

None of the authors have any conflicts of interest to declare.

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Cite this Article

Role of Various Accentuated Parameters in Extenuating Tedious Experimental Analysis for Customized Centrifugal Pumps, *International Research Journal of Multidisciplinary Technovation*, Vol 2, Iss 2(2020) 9-15.

DOI: <https://doi.org/10.34256/irjmt2022>