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Rushton J H, Costich E W & Everett H J. Power characteristics of mixing impellers. *Chem. Eng. Progr.* **46**:395-404, 1950; 46:467-79, 1950. [Mixing Equipment Co., Rochester, NY, and Illinois Inst. Technology, Chicago, IL]

This write-up is a brief account of what was thought to be necessary at that time to know about the power required to turn a mixing impeller to move liquid. The impeller itself can only move liquid and does not do any mixing itself. It is the moving liquid which does the mixing, and there was nothing in the literature to determine the energy necessary to move the liquid by an impeller which was not in a casing like a pump. [The *SCI*® indicates that this paper has been cited over 300 times since 1961.]

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"This article was based on experimental work done at the Mixing Equipment Company, Rochester, New York by Costich and Everett, who were research and application engineers for the company, under my direction. It was necessary to know how much power was required to turn various types of mixing impellers in order to apply them successfully to industrial operations. Until that date, about the only power data in the literature on mixing had to do with specific mixing operations, and it was difficult to use the information for a variety of operations. Not only that, but we knew that different size impellers using the same amount of power often gave different results with chemical reaction and other physical mixing problems. For example, for geometrically similar impellers it was found that when they ran at such speeds as to require the same power, different chemical results would be achieved. This was because the power in a flowing fluid is the product of the amount of flow multiplied by the head or turbulence against which the flow takes place. Accordingly, some chemical reactions are best performed using a large flow and a small turbulence for the same power than using another geometrically similar impeller which would give small flow and a large amount of turbulence. Therefore, it was recognized that the best way to do experimental work for an industrial application, whether it be the suspension of solids or the mixing of two immiscible or reacting liquids, was to do experiments with one type of impeller, but to use different diameters and to run them at such speed that they would draw the same amount of power. Therefore, if it could be shown that the larger impeller at lower speed but the same power could give a better result than a smaller impeller running at higher speed and therefore producing more turbulence (which would show that the system would work best with a large flow and a small amount of turbulence at the same power input and larger diameter and give a larger flow than a small diameter, but the high speed for smaller diameters would result in more turbulence). Then it could be decided whether the application required a lot of flow or a lot of turbulence. Thus, the size of an impeller could be established for an application and the speed of the impeller correlated and the power to drive the impeller could be determined. This article provided the amount of power and geometrically similar impellers of various sizes, and thus the application to the requirement of flow and head could be determined to size the mixing device.

"It is still true that the best experimental technique for application of mixers is to experiment with different sizes of impellers using the same amount of power so that it can be determined whether the application is best accomplished by large flow and small turbulence or the reverse. The power correlations in the article have been checked many times and by many other experiments and the data still are very reliable."