

Pumps — Testing — Submersible mixers for wastewater and similar applications

ICS 23.080

National foreword

This British Standard is the UK implementation of ISO 21630:2007.

The UK participation in its preparation was entrusted to Technical Committee MCE/6, Pumps and pump testing.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 September 2007

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ISBN 978 0 580 56041 5

Amendments issued since publication

Amd. No.	Date	Comments

INTERNATIONAL STANDARD

ISO
21630

First edition
2007-08-15

Pumps — Testing — Submersible mixers for wastewater and similar applications

*Pompes — Essais — Mélangeurs immergés pour eaux usées et
applications similaires*



Reference number
ISO 21630:2007(E)
Documents
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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ISO 21630 was prepared by Technical Committee ISO/TC 115, *Pumps*, Subcommittee SC 2, *Methods of measurement and testing*.

Introduction

This International Standard prescribes acceptance test methods for submersible mixers for wastewater and other applications. It is intended for performance measurements relevant to submersible mixers bearing in mind the similarities to, and crucial differences from, submersible pumps. Hence head (pressure) and flow rate measurements are not included. The basic output performance parameter is the thrust. As continuous operation is commonplace, electric power consumption is important for the Life Cycle Cost, and is put forward as an important parameter. It is acknowledged that the present International Standard draws heavily on ISO 9906:1999 in the generalities.

The major objectives of this International Standard are to

- increase uniformity/compatibility in equipment performance characterization, enabling a comparison of mixers,
- simplify communication between customer and supplier and protect customers,
- reduce the need for documentation,
- increase quality and efficiency in both machinery and process.

Pumps — Testing — Submersible mixers for wastewater and similar applications

1 Scope

This International Standard prescribes acceptance test methods for submersible mixers (hereafter “SM” or “mixer”) used for mixing in wastewater and other applications where at least one system component is a liquid.

“Submersible mixer” is taken to mean a fully submersible aggregate consisting of a drive unit and an axial flow type impeller, and optional parts, such as shrouds, supporting the basic functions.

“Liquid” is taken to mean a body without capacity to accommodate shear stresses when at rest. This includes suspensions and dispersions (liquid/solid, gas/liquid and gas/liquid/solid), and non-Newtonian liquids, provided that a possible small yield stress does not prevent the liquid from flowing when agitated.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1

thrust-to-power ratio

ratio of mixer thrust force to mixer power consumption

$$R_{FP} = F / P_1$$

NOTE 1 The ratio of minimum required mixing system power dissipation to mixer power consumption is an (end-user oriented) system efficiency. To understand the importance of the thrust-to-power ratio, consider the case of an SM generating a longitudinal flow velocity u in a recirculation channel such as a wastewater oxidation ditch. This is in fact a common application of the SM, and the following argument is in principle possible to generalize to other applications.

The momentum loss of the flow over one circulation equals the rate of momentum provided by the SM at quasi-steady state. This is given by the mixer thrust F . The power dissipated as a result of this momentum loss is $P = F u$, and this is the minimum required mixing system power to maintain the velocity u . Hence, the system efficiency is $P / P_1 = F u / P_1$.

It is possible to isolate the mixer properties from the system requirement in this expression, and this leads to the thrust-to-power ratio, R_{FP} , as the most relevant efficiency-related parameter of the SM. It should be noted that it is dimensional, and hence it depends on the impeller diameter and speed, not only on the impeller geometry. Other considerations than energetic efficiency of generation of longitudinal flow provide for the multitude of impeller diameters and speeds available in practice.

NOTE 2 An impeller efficiency, defined as the ratio of power of axial motion of the impeller discharge to the electric power uptake of the mixer, can be defined. The definition draws on the assumption that the approaching velocity, u , is small enough to have negligible influence on the mixer impeller characteristics. The hydraulic discharge power $P_h = p Q$ can be expressed in thrust using the relations

$$p = F / A \text{ and } F = 2 \rho Q^2 / A$$

which are approximately valid for the mixer test established herein. The conventional area of the *vena contracta* $A / 2$ is used, as this discharge section best fulfils the flat velocity profile requirement. With $A = \pi D^2 / 4$, one obtains

$$P_h = (F / A) (A F / 2 \rho)^{1/2} = F^{3/2} / [D (\pi \rho / 2)^{1/2}]$$