

LOTUS CHEMMIXERS

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BEST DESIGN - BEST MIXERS

Reduce Maintenance

Extend the life of your seal and Gearbox

Article 1.0 - Structure and Bearings

When a mixer drive or shaft seal fails prematurely how much does it cost you? What is lost in terms of production, time to organize and address the issue, how many man hours does the repair require and what is the cost for replacement parts? Could this have been prevented and is there a better solution?

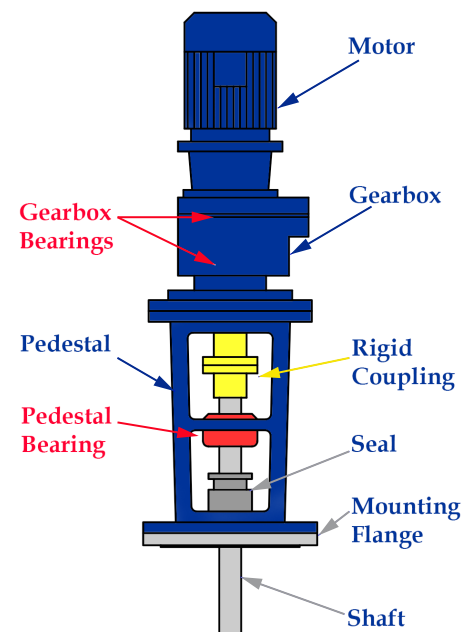
The answer is YES.

In this series of articles, LOTUS MIXERS is going to examine what makes a better mixer.

We will breakdown our articles into two categories. The first subject is the overall reliability in regard to the longevity of the mixer, maintenance requirements over the lifespan of the agitator and ease of maintenance.

The other consideration is the performance which deals with the application of the right impeller(s) to provide the correct flow, tank turnover, solids suspension, mass transfer, heat transfer, gas flow rate and mixing intensity. This will be discussed in future articles.

For this article, we will cover key points in design and the proper selection of components for the mixer pedestal. This is commonly overlooked but plays a pivotal role in overall reliability and maintenance requirements for agitators.



Points to consider in a mixer design:

- What is the distance between the first bearing and the mechanical seal/stuffing box?
- What is the distance between the gearbox bearings? Is the first bearing located in the gearbox?
- Is there a bearing in the mechanical seal?
- What is the L10 or B10 life on all bearings - not just the output bearing?

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PEDESTAL DESIGN

There are basically two different approaches to mixer pedestals - one with a bearing or one without a middle bearing.

A way to increase the longevity of your gearbox and seal is a pedestal bearing or independent bearing housing.

Going back more than 50 years ago, nearly all mixers were supplied with an integrated pedestal bearing.

Then one of the major mixer manufacturers at the time included the spread bearing design in their primary gearbox. This was a marketing success in the United States and resulted in other mixer manufacturers developing competitive units. It saved a few dollars initially but the overall cost of real world operation became a lot higher.

Over time, bearing quality improved and to cut cost most manufacturers removed the pedestal bearing from their mixers. Even the spread bearing/hollow quill gearbox has been discontinued to be more cost competitive.

Today, most mixers supplied in the US only have gearboxes with two output bearings and the entire shaft load is carried by these. In contrast, the pedestal bearing design is the European standard and is a widely accepted concept through the world excluding North America.



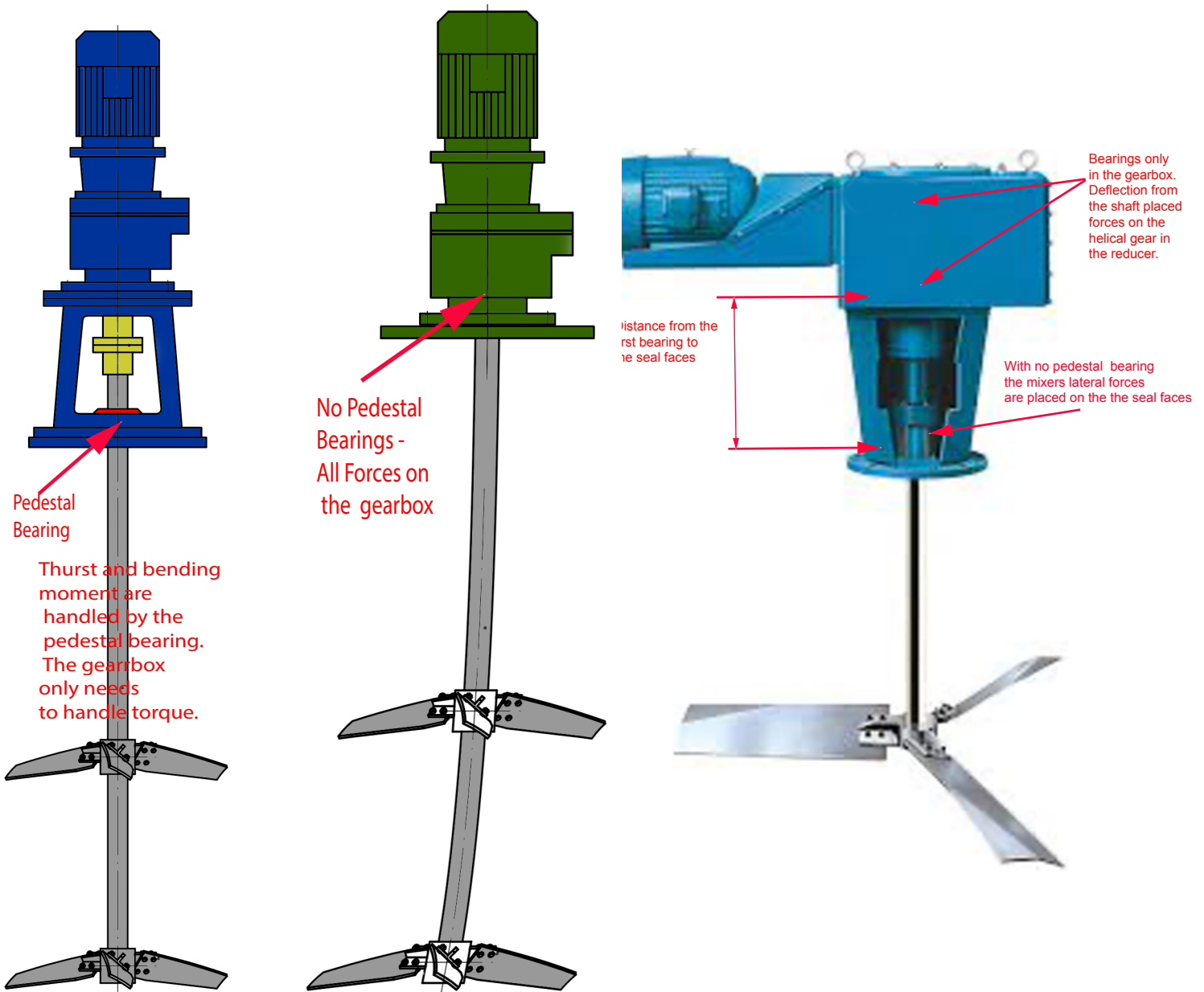
Top entry mixer with pedestal bearing and double mechanical seal. This pedestal includes a special jacket that allows for the seal to be removed without requiring external rigging - no lifting crane nor forklift required.



The idea of the pedestal bearing is to remove all of the forces from the gearbox except torque (which is easily handled by a quality gear reducer) and minimize deflection of the shaft through the mechanical seal.

It is important to note for double reduction right angle gearboxes (typically 45 rpm or greater), any shaft deflection tends to separate the gear teeth. With the large overhung load from the rotation of the impeller and shaft, bending moments are high on the shaft end. This separation results in premature failure and excessive wear. Try holding a pencil strictly by the end.





BEARING LIFE

Bearings are critical to the operation of an agitator.

For mixers without a pedestal bearing, every mixer gearbox has at least four bearings (two on the input shaft and two on the output shaft). Pedestal bearings add one or two additional bearings to the design.

For this reason it is critical to make sure the selection of the bearings are correct. Every bearing in the unit should be no less than L_{10} -100,000 hours.

What does L_{10} -100,000 hours mean.

The American Bearing Manufacturers Association (ABMA) defines the Basic Rating Life, L_{10} as the bearing life associated with a 90% reliability when operating under conventional conditions, i.e., after a stated amount of time 90% of a group of identical bearings will not yet have developed metal fatigue. L_{10} life is also referred to by manufacturers as the 'minimum expected life'.

L_{50} life: Or average life.

Although the L_{10} life is the proper method of specifying fatigue life per the ABMA, another term is often used in the industry. The L_{50} or average life is accepted as the bearing life associated with a 50% reliability, i.e., after a stated amount of time, only 50% of a group of identical bearings will not yet have

Required L_{10} Life Hours	Equivalent L_{50} (avg) Life Hours
20,000	100,000
40,000	200,000
80,000	400,000
100,000	500,000

ADDITIONAL NOTES ON THE PEDESTAL

A good pedestal is designed to be rigid and to handle no less than 3 times the maximum loads from the mixer (dead load, thrust, bending moment and torque).

The construction of the pedestal should include through testing including dye penetrant testing of all welds and 100% material traceability.

In terms of maintenance and service, there are several options to make it quicker and easier.

One innovation has been the development of a special pedestal with a jack which allows for the mechanical seal, bearing housing, gearbox and motor to be removed without requirement for additional lifting equipment (no crane or hoist required).

Also with the pedestal bearing design, you can remove/disconnect the gearbox and motor without having to support the shaft. The design utilizes a sleeve through the bearing housing which has a lock collar to hold the shaft in place.

Other options include single and double split seal. These are quick and easy to remove and require minimum training for a proper replacement.

CONCLUSION

Like a building where the foundation is critical to the structure, the proper mixer pedestal provides a solid base for a reliable mixer.

When looking to improve upon your mixers' longevity and to reduce overall maintenance cost, an integrated pedestal bearing with the proper bearing life should do the job.