PERPETUAL INDUSTRIES INC.

Please direct all inquiries to:

#110, 5 - 8720 Macleod Trail South

Calgary, Alberta, Canada T2H 0M4

P: 403-214-4321

F: 403-770-8122

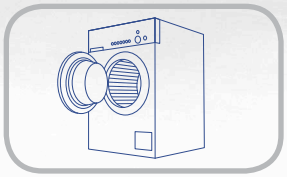
E: info@perpetualindustries.com

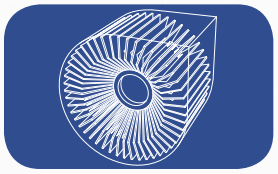
www.perpetualindustries.com

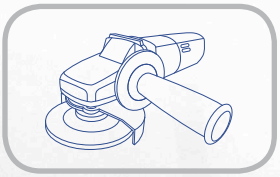
CURRENT STATE AND OPPORTUNITY

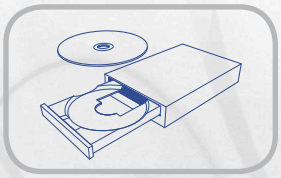
The XYO technology shows significant improvements in industrial fan performance during independent studies. Perpetual Industries wants to work with innovative fan manufacturers to optimize and implement the XYO balancer in their product.

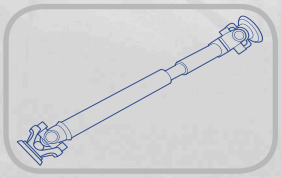
Contact us to see how your product can beat the competition using XYO

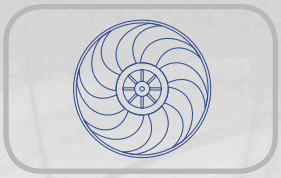


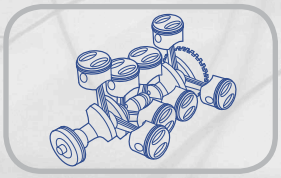


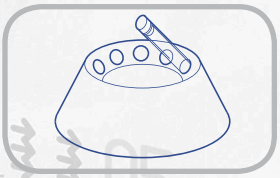












XYO PROTOTYPE BALANCER AS APPLIED TO INDUSTRIAL FANS

Summary Report

RESULT HIGHLIGHTS

The XYO technology reduces vibration by compensating for variable mass imbalance during the operation of industrial fans. Tests showed that a **prototype XYO balancer** had a significant impact on reducing vibration levels of these fans. Benefits of reduced vibration using XYO include:

- Lower power consumption
- Reduce noise emissions
- Increased efficiency and performance

Industrial Fan
Vibration Decreased by 83%

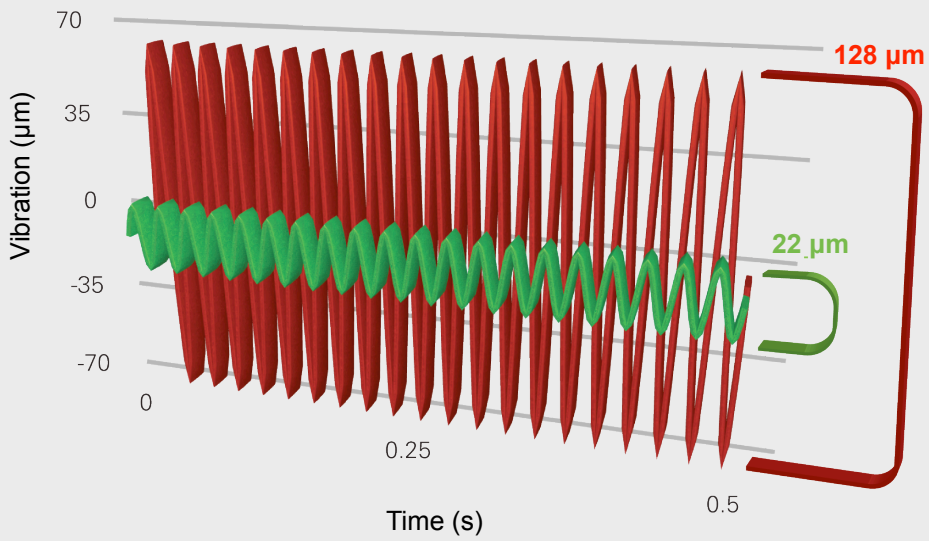


Figure 1. Impact of XYO on vibration of industrial fans operating with 925 g.mm imbalance at 2400 RPM

WITHOUT XYO **WITH XYO**

Note:

- **The results in this report are based upon prototype XYO balancer design.While the results shown are significantly positive, it is possible to exceed and improve upon these results with optimization.**
- **Fans were tested with mass imbalances up to 2165 g.mm; however, the XYO balancer can compensate for larger mass imbalances if desired.**
- **Perpetual Industries is looking for a capable partner that needs the competitive advantage that XYO can provide.**

INTRODUCTION

Industrial fans, shown in Figure 2, have to be balanced due to imperfections during manufacturing; however the balancing process cannot compensate for mass imbalances that occur due to build-up of debris or erosion of the fan blades during operation. Improperly balanced, or damaged fans, and those with debris on the blades experience severe vibration issues which increase power consumption and noise emissions, and decrease product efficiency.

The XYO balancer can overcome deficiencies in the manufacturing process and compensate for imbalance changes while fans are operational.

TEST OBJECTIVE

The objective of the testing was to quantify the benefits of reduced vibration for fans operating with a prototype XYO balancer.

TEST OVERVIEW

The testing was performed on three fans:

- A factory-balanced fan
- An unbalanced fan without XYO
- An unbalanced fan with XYO installed

Vibration was measured with two velocity transducers mounted to the fan housing as shown in Figure 3.

Mass imbalances ranging from 0 to 21.65 grams were imposed at a radius of 100mm, giving a maximum imbalance of 2165g.mm. Six different mass imbalances were tested with and without the prototype XYO balancer: 0.00g, 7.25g, 9.25g, 11.25g, 16.45g and 21.65g.

Small screws were placed at a radius of 100mm from the geometric center of the impeller to simulate the mass imbalance. The prototype XYO balancer was fitted to the unbalanced fan by removing the existing hub of the impeller, as shown in Figure 4. The fan assembly was supported on resilient mounts, secured in normal locations. The prototype XYO balancer was designed to compensate for a maximum of 2700g.mm of mass imbalance.

Note: the XYO balancer can be designed to compensate for larger mass imbalances if desired.

Figure 2. Example of an industrial fan

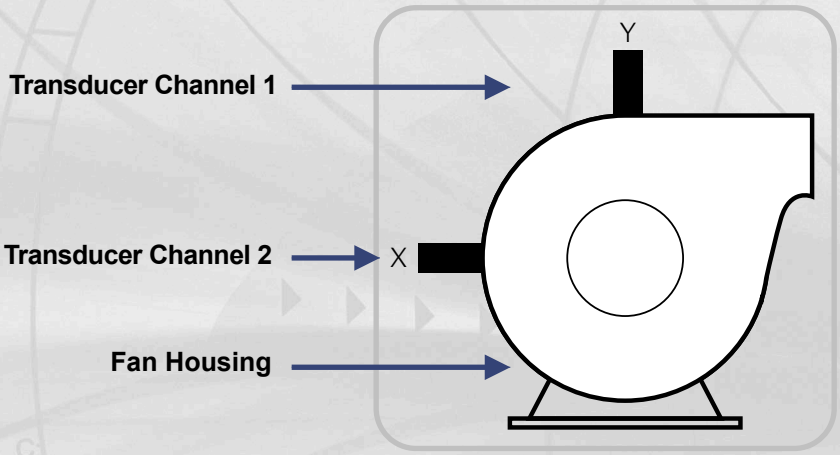
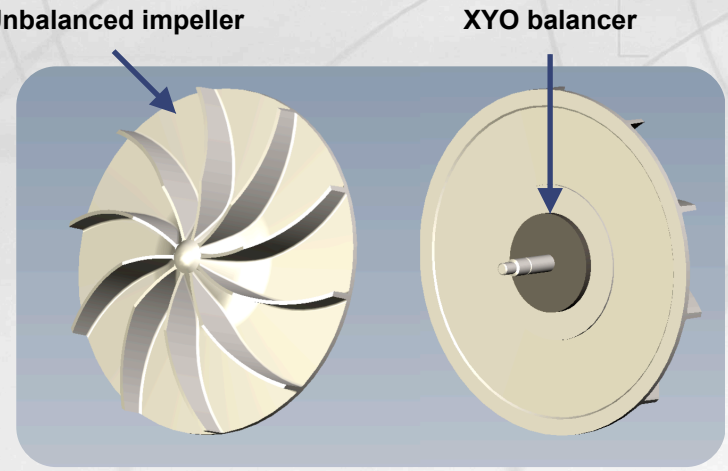


Figure 3. Mounting points for the velocity transducers during testing



XYO balancer installation shown from the front (left) and back (right), on an unbalanced impeller

TEST RESULTS

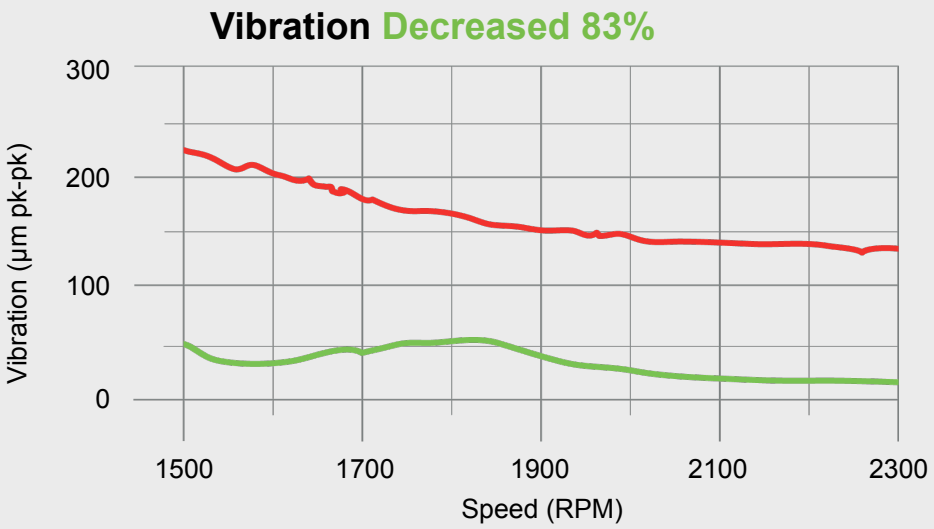


Figure 5. Vibration of an industrial fan over a range of speeds, with and without an XYO balancer, and with a 925 g.mm imbalance

UNBALANCED FAN WITHOUT XYO
BALANCED FAN WITHOUT XYO
UNBALANCED FAN WITH XYO

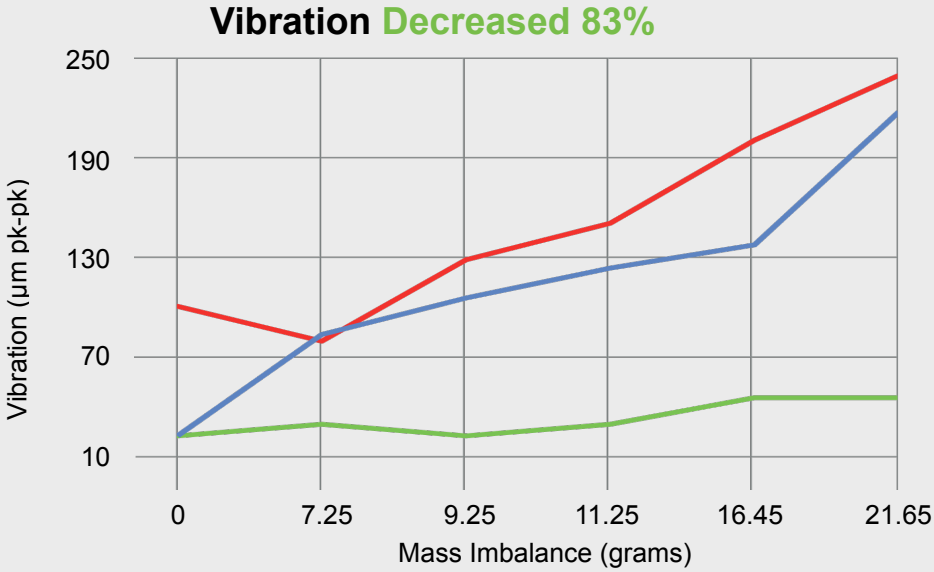


Figure 6. Vibration of industrial fans with and without an XYO balancer, for imbalances located 100 mm from the centerline

TEST RESULTS (continued)

Vibration was reduced by **83%** when the unbalanced fan was fitted with an XYO balancer. Even with the largest mass imbalance used for testing, vibration was reduced by **81%**.

The XYO technology shows immense capabilities when applied to industrial fans. Performance values are based on a prototype XYO balancer, and can be optimized further by working with a capable and innovative industrial fan manufacturer who seeks a strong competitive advantage in the market.

Table 1. Summary of vibration results for factory-balanced fan and an unbalanced fan **with** XYO

MASS IMBALANCE AT 100 mm (g)	VIBRATION		IMPROVEMENT (µm pk-pk)
	WITHOUT XYO (µm)	WITH XYO (µm)	
0	22	22	0 (0%)
7.25	83	29	54 (65%)
9.25	105	22	83 (79%)
11.25	123	29	94 (76%)
16.45	137	45	92 (67%)
21.65	217	45	172 (79%)

Table 2. Summary of vibration results for unbalanced fan **with** and **without** an XYO balancer

MASS IMBALANCE AT 100 mm (g)	VIBRATION		IMPROVEMENT (µm pk-pk)
	WITHOUT XYO (µm)	WITH XYO (µm)	
0.00	100	22	78 (78%)
7.25	79	29	50 (63%)
9.25	128	22	106 (83%)
11.25	150	29	121 (81%)
16.45	200	45	155 (78%)
21.65	239	45	194 (81%)

FINDINGS AND CONCLUSIONS

The XYO balancer showed significant improvements in vibration when applied to an unbalanced fan, up to **83%**. Lower vibration levels can also provide other benefits for industrial fans, including:

- Increasing product life because of reduced mechanical wear on the fan assembly
- Decreasing power consumption due to smoother operation of the fan
- Lowering noise emissions and allowing fans to operate a quieter environments
- Overall performance efficiency of the fan will increase by lowering vibration levels, which are a primary source of energy loss
- Lowering manufacturing costs by eliminating balancing of the impeller, or by avoiding fine-balancing
- Cheaper and lighter components can be used in the fan assembly because they are not subjected to high vibration levels with an XYO balancer installed
- Downtime losses can be prevented because the XYO balancer automatically compensates for variations in the mass imbalance caused by debris build-up on the fan or erosion of its blades

Perpetual Industries wants to work with capable and innovative industrial fan manufacturers to optimize and implement the XYO technology and provide a strong competitive advantage in the market.

Impact of XYO:

- **Reduced** mechanical wear
- **Decreased** maintenance
- **Lower** noise emissions
- **Increased** energy efficiency
- **Reduced** manufacturing costs