



# Motor speed reduction methods

## Shaft mounted gear reducers are most commonly used in the grain industry

by Fred Fairchild

A.C. motors usually come in standard output speeds of 3600, 1800, 1200 or 900 revolutions per minute (rpms), but the machines they power generally require different input speeds. In order to get to the required input speed for a particular piece of machinery, some type of speed reduction method is required. These reductions in speed are accomplished by using gear reducers, v-belt and sheaves, chain drives with sprockets or combinations of each.

In this article, we will focus on gear reducers.

### GEAR REDUCERS

Gear reducers are available in several types depending on the speed required for the machine they are driving and the mounting method. These include in-line reducers also called parallel shaft reducers, right-angle reducers (usually worm type) and shaft-mount styles.

When used with standard speed motors, they can be complete with a C-frame standard motor mounted directly to the gearbox forming what is known as a gearmotor unit.

In other cases, a standard frame motor may be connected directly to the reducer using a coupler between the motor shaft and the reducer input shaft. And in yet other cases, the motor speed is transmitted to the reducer through a belt or chain drive.

### SHAFT MOUNTED GEAR REDUCERS

In the grain industry, the most commonly used speed reducers are the shaft mounted type. These reducers are chosen based on the class of service, horsepower of the motor, the output speed required (input shaft speed of the machine they are driving) and the amount of speed reduction required.

These shaft mounted reducers are normally classified by their gearing sizes and the difference between the input speed and output speed of the reducer. This difference between the input and

output speeds is referred as the speed ratio of the reducer. The ratio is nominally called out as the number of revolutions the input shaft turns to provide one revolution of the output shaft. As an example, a 25:1 ratio means for every 25 revolutions the input shaft turns, the output shaft turns one revolution.

The speed ratio is determined by the gearing setup in the reducer housing. If the reducer has only one pair of gears, it is known as a single reduction reducer. If there are two pairs of gears, a double reduction reducer, and one with three pairs



# Similago **Inox**

Alapala's new generation roller mill...

- All product contact parts in stainless steel
- Easy-to-remove assembly
- Single high and double high models
- Accurate roll positioning
- Optional roll adjustment automation
- Special software solutions, graphical and touch-screen
- Roll replacement within 20 minutes



**Alapala Machine Industry and Trade Inc.**

World Trade Center, A1 Block, No:15 / 453, 34149 Yesilkoy - Istanbul / TURKEY  
e-mail: [info@alapala.com](mailto:info@alapala.com) Tel: +90 212 465 60 40 pbx Fax: +90 212 465 60 42

Project Design & Management - Superstructure - Machinery - Installation - Commissioning

[www.alapala.com](http://www.alapala.com)

For more information, see Page 90.

Reducer Size	Ratio Symbols				
	05	09	15	25	35
107	5.0586	8.8205	14.8276	24.7250	34.8778
115	4.7000	8.8125	14.7759	24.8558	34.9487
203	5.1053	8.8732	14.9231	24.7409	34.6429
207	5.1579	8.8308	14.7870	24.7094	35.0000
215	5.1687		14.8187	24.8502	34.8154
307	5.1111	8.7925	14.9704	24.7692	34.8791
315	4.8824	8.8620	14.5744	24.4118	34.0513
407	5.0000		13.6842	25.0000	
415	5.0833		13.9792	25.8403	
507			13.6842	25.3846	
608			13.9118	25.6555	

of gears is a triple reduction reducer.

The greater the speed reduction of a gear reducer, the greater the number of gear pairs required. Nominal speed ratios for most shaft mounted gear reducers are: 5:1, 7:1, 9:1, 15:1 and 25:1. The actual ratio for a given reducer may vary slightly depending on the brand and size of a reducer. The exact ratio table shown above is from the Browning Torque Taper Plus gear reducer catalog.

The selection of the proper shaft mount reducer for each piece of equip-

allowable during 10 hours a day.

- Class III Moderate shock loads for over 10 hours a day. Heavy shock loads are allowable during 10 hours a day.

These classifications are based on standards published by the American Gear Manufacturers Association (AGMA). The AGMA also publishes an application table for different types of machinery operating under different degrees of severity. As an example, a bucket elevator requires a reducer rated for Class II conditions regardless of the number of hours operated. On the other

the selection portion of most manufacturers of shaft mount gear reducer catalogs. Once the class of service has been determined and the motor horsepower and reducer output speed are known, the correct size shaft mount reducer may be chosen from selection tables for the class required.

If a screw conveyor is operated under heavy duty conditions requiring a Class II reducer, the required motor horsepower and reducer output speed are found in the Class II selection table. Reading across the selection table, the proper size gear reducer may be selected. If the screw conveyor has a 10-hp 1800-rpm motor with a required reducer output speed of 80 rpm, the Class II selection table in the 2010 Dodge Gearing Engineering Catalog, Table 10, for screw conveyor shaft mount speed reducers shows that there are two choices: an SCXT415 or an SCXT425. Either may be used, but a v-belt drive must be used between the motor and the reducer input shaft as neither reducer reduces the 1800 rpm directly to 80 rpm. (Note: A standard shaft mount gear reducer may be used on screw conveyor drives using a special mounting adapter.)

Most gear reducer manufacturers catalogs provide output speeds, ratio and horsepower ratings for each size shaft mount gear reducer they manufacture.

Before finalizing and purchasing a reducer, there are additional factors to consider. These include the initial cost of the reducer selected versus the cost of maintenance and the expected useful operating life. For example, a 30% increase in initial cost by specifying a gear reducer one size larger than required might represent as much as a 240% greater bearing life and 10 times greater gear life. However, it is difficult to determine what the actual operating life will be. This life is based on not only choosing the correct reducer for the application and operating conditions, but also properly maintaining it. Choosing the next size larger reducer than required for an application may be

***If the lubricant indicates it is not in the proper condition, chances are your reducer will fail earlier than expected, causing system downtime.***

ment is determined by the horsepower of the driving motor, the number of hours it is operated per day, and the severity of the application. The latter two are divided into three classes:

- Class I Steady load not exceeding Motor HP rating and light shock loads during 10 hours a day. Moderate shock loads are allowable if operation is intermittent.

- Class II Steady load not exceeding Motor HP rating for over 10 hours a day. Moderate shock loads are

hand, a gear reducer on a screw conveyor uniformly loaded or fed requires a Class I reducer if operated 10 hours or less per day, and a Class II reducer if operated over 10 hours per day.

If the same screw conveyor handles tough or difficult loads that require it to be of heavy duty construction, a Class II reducer is required regardless of how many hours per day it is operated. This application classification and class table is based on AGMA Standard 6021-G89 and is found in



a wise choice if the piece of machinery it is driving is critical to keeping a system operating.

Maintenance for a shaft mount gear reducer must be done on a regular schedule. Items to be checked are the tightness of the reducer on the shaft it is powering, the tension on the v-belt drive system from the motor to the reducer input shaft, if required, the cleanness of the reducer housing, and the temperature of the reducer housing surface when it is in operation. If the surface temperature is higher than that recommended for the reducer, severe damage may be done to the gearing in the reducer.

The level and condition of the lubrication in the reducer is also very important. It lubricates the surfaces of the gears in the reducer, but it also keeps the gears from becoming overheated. Using lubrication with proper

## Resources

Dodge 2010 Gearing Engineering Catalog

Browning Torque Taper Plus gear reducer catalog

Falk (Rexnord) "How to Specify & Select Gear Drives" Website

flowability characteristics (viscosity) for every operating condition is essential. Different weight lubricant may be necessary if the reducer is mounted in areas with extreme temperature changes, or lubricant that remains fluid under varying operating temperatures should be used.

Testing the lubricant on a scheduled basis will reveal any changes in the liquid and its performance ability. If the lubricant indicates it is not in the proper condition, chances are your reducer will fail earlier than expect-

ed, causing system downtime. Take a lubricant sample and have it tested periodically. If you notice contamination or metal particles, your reducer is not getting the proper lubrication and is setting up for a failure. The lubricant is an excellent indicator of the condition of the gears in the reducer. Preventing failure is a priority in any operating system.

In my next article, I will discuss v-belt and chain drives. **WG**

Fred Fairchild is a professor in the Department of Grain Science and Industry at Kansas State University. Prior to coming to Kansas State in 1994, he worked in the industry designing, construction and commissioning of numerous mill facilities. He is a licensed professional engineer. He can be reached by e-mail at [fjf@k-state.edu](mailto:fjf@k-state.edu).

We want to hear from you — Send comments and inquiries to [worldgrain@sosland.com](mailto:worldgrain@sosland.com). For reprints of WG articles, e-mail [reprints@sosland.com](mailto:reprints@sosland.com).

# Processing grains aiming for excellence!

## ZACCARIA

86 years of tradition in cereals equipment



**DHZ-1**  
Horizontal  
Maize Degermer

**LOOKING FOR COMMERCIAL  
AGENTS WORLDWIDE**



**DVZ-1** Vertical  
Maize Degermer  
(with Conditioning SCCZ-3)

**Equipment Solutions for Rice, Beans, Maize and Other Cereals**

Check our website: [www.zaccaria.com.br](http://www.zaccaria.com.br), for further details.

• E-mail: [info@zaccaria.com.br](mailto:info@zaccaria.com.br)  
 • Phone: (+55.19) 3404-5721 / (+55.19) 3404-5712



For more information, see Page 90.