

Holroyd

Precision Worm & Helical Gears



RENOLD

Superior Gear Technology

www.renold.com

Introduction

Over 125 Years of Excellence

Over 125 years have elapsed since John Holroyd & Co. Ltd started to produce machine tools and gears and throughout this period the name Holroyd has been associated with the highest quality in both of these fields.

In the production of worm gearing the unique Holroyd gear form is widely respected for its performance and reliability in a wide variety of drives, ranging from the screw down mechanisms in steel mills to the motion actuators of robots used in the construction of microchips.

To improve the performance of wormwheel hobbing machines, Renold developed the Precision Dual Lead Backlash Adjustable Wormgear Form which is now widely used in rotary tables, cutter drives and machine tool positioning mechanisms.

Approvals

Renold Gears is BS EN ISO 9001:2000 approved. All products are designed and manufactured within this Quality Assurance System.

Unrivalled Accuracy

Renold utilise inspection equipment which is unique in its ability to provide our clients with records of Pitch, Profile and Transmission graphs.

Investment in new state-of-the-art gear production equipment has ensured that years of design and manufacturing experience is also backed up by the very latest in CNC machinery and work methods and supported by modern CAD systems for both product and tooling design.

Comparative Accuracy

Standard	DIN 3962 part 2	AGMA 2000 - A88	JIS	BS721 part 2 1983
Country	Germany	North America	Japan	British
Class/Grade	1			
	2	15		
	3	14		
	4	13	0	
	5	12	1	A
	6	11	2	
	7	10	3	B
	8	9	4	
	9	8	5	
	10	7	6	C

Renold precision wormgears although manufactured to BS721 exceed the highest standard class A. They have also been proven to match and surpass DIN 3962 grade 2. This assures that the accuracy and repeatability of these gears are to the highest standards.



Applications



People Movement

High precision worm gears are manufactured with central meshing contact and minimum backlash, both essential features in the Lift and Escalator industry.



Power

Large grinding mills in coal fired power stations use large wormgears for coal pulverisation

Renold has the unique ability to reverse engineer and supply either wormshaft or wormwheel separately or as a complete set.



Machine Tools

Dual lead wormgears are produced with an increasing thread thickness thus allowing the worm to be moved axially to eliminate backlash over the life of the machine. Utilised in machine tools which require repeatable positional accuracy such as rotary tables.



Steel

Large centre pitch wormgear sets with wheel diameters up to 88" (2235mm) and wormshaft thread diameters up to 18" (457mm) are manufactured for use in screw down and wire drawing machines in steel producing factories.

Product Range



Custom made commercial worm gears

Worm gear sets manufactured to customers drawings or reverse engineered from worn samples. Commercial tolerance gearing to high efficiency Holroyd standard or to customer specified particulars.



Dual lead

Dual lead wormgears are constructed with two leads, this has the effect of producing a worm thread which increases in thickness from one end of the worm to the other. This unique design allows the axial position of the wormshaft to be altered thereby reducing the backlash between the wormshaft and wormwheel during the life of the gearset. This design in conjunction with the highest accuracy available makes these gears ideal for positional machine tools.



High precision wormgears

Worm gears manufactured to the highest industry tolerance for concentricity, profile, centre distance and accumulative pitch errors. Special gearing profiles including central contact and reduced backlash can be achieved. Accuracy of manufacture ensures peak performance in efficiency and smoothness of transmission.



High precision helical

Harnessing new grinding technology has allowed Renold to produce custom made high precision helical and spur gears. These small volume, high precision gears are used in aerospace and high performance automotive industries.

Commercial and High Precision Worm Gears

The **Holroyd** tooth form corresponds to British standard 721 recommendations but in addition has an exclusive feature which consists principally of important modifications to the worm thread and wheel tooth, delivering additional valuable properties to gear performance. Authentic independent tests carried out by the UK National Physics laboratory yield efficiencies between 97%-98% on a **Holroyd** gear set. A testament to the **Holroyd** tooth form delivering the smoothest and highest efficiency transmission available.



Efficient manufacturing

The accuracy of wormgears depends largely on the accuracy of the tooling producing the wormgears. These high precision custom made wormwheel cutting tools are uniquely manufactured and maintained in our in house cutter manufacturing department. This also allows us to produce special tooling for customers' particular requirements.

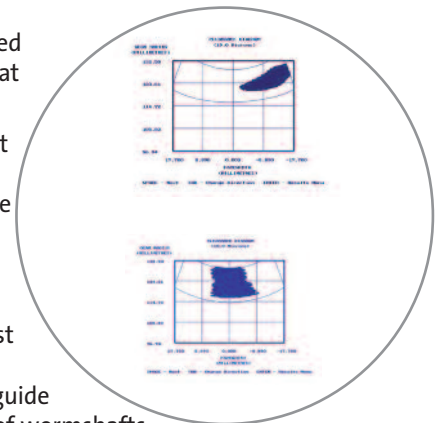
Renold over its 125 years history of producing wormgears has amassed a huge number of high precision manufacturing tools. Each of these tools can be selected to produce a number of different sizes and ratio of wormgears. Our unique tool selection software enables our design engineers to select the right tool to meet the customers particular requirements. Wormgears produced with high precision hobs are high accuracy, produced much faster and are correct first time, reducing the cost to produce.

Special profiles

All gears, bearings and gear housings deflect and distort to some extent when running under load. This deflection from theoretically true running conditions causes faulty running and can result in comparatively rapid wear and low efficiency unless some correction is applied during manufacture of the gears. Renold has devised a means of correction which ensures that our gears will run correctly under loaded and distorted conditions.

Renold **Holroyd** wormgears are produced to have the optimum contact by taking into account this deflection. Contact prediction software developed by Renold ensures the correct contact position required for the application is achieved electronically, prior to manufacture, to ensure the wormgears are again produced much faster and are correct first time thereby reducing the cost to produce.

Special profiles and gear shapes can be produced based upon the customers requirements. Our knowledge and experience of gearing applications will also be applied to suggest the best shape and contact for any custom made wormgear set. To help the designer with the correct selection of gearing particulars, Renold has produced the **Holroyd** Design Guide, the design guide contains the dimensional and selection criteria required for the correct selection and design of wormshafts and wormwheels based on the **Holroyd** gear profiles.



Capacity and standards

Wormgears can be produced in both Metric and Imperial gearing centres from 1 1/8" (28mm) to 48" (1219mm). Wormshaft diameters up to 18" (457mm) and wormwheel outside diameters up to 88" (2235mm). Wormshafts are manufactured from gas carburised case hardened steel ground on worm threads. Wormwheels are manufactured from centrifugally cast phosphor bronze. Other alloy bronzes can be utilised dependant upon the requirements of the application

The wormwheel can be supplied with a mounting centre in either steel or cast iron and on certain sizes can be electron beam welded to the centre to give added security through strength.

Renold also has a range of wormshafts and wormwheels called versatile gears. These are part finished gears in centre distances from to 3" and 20" with standard **Holroyd** ratios from 5/1 to 70/1 . The gearing on the versatile wormshafts is complete. The wormwheels are produced to allow a special customer centre to be manufactured, thus allowing conventional engineering machinery to complete the production of the gear set whilst still utilising the **Holroyd** gearing form.

Dual Lead Gears

Dual lead wormgears are constructed with two leads. One flank of the thread and its mating sides of the wheel teeth are manufactured with one lead, and the other flank and its mating wheel teeth are manufactured to a slightly different lead.

As far as the worm is concerned this has the effect of producing a worm thread which increases in thickness from one end of the worm to the other.

If the worm is therefore moved in an axial direction when in mesh with the wormwheel, backlash between the pair can be adjusted to the required amount.

In practice the gears are manufactured so that the initial backlash is achieved at a certain distance relative to a datum plane on the worm. The worm can then be adjusted from this point as and when necessary during the life of the gears.

For applications that require:

- Extreme accuracy
- Minimum backlash
- Backlash adjustable from 0-300 microns
- Adjustment without disassembly

Comparable accuracy of Holroyd Dual lead against split type Split Wormshaft Type

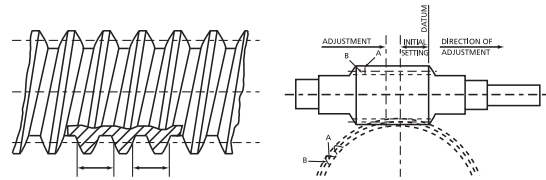
With this arrangement the worm is produced as a two-piece item, the design being split at the gearing centreline. One worm may be integral with the shaft, the other keyed or splined to the shaft but axially adjustable, the position being fixed by a spacer positioned at the centreline between the two components.

There are a number of disadvantages with this method. Firstly, the gap required by the spacer can cause an interruption of the line of contact. Secondly there will be increased friction and therefore reduction in efficiency due to the applied pressure to both sides of the wormwheel teeth.

Dual Lead Wormgear

The Dual Lead wormgear does not suffer from any of the above disadvantages. It provides a kinematically correct gear, which can run in either direction of rotation and on which the backlash is infinitely adjustable from an acceptable maximum to zero. In addition, the dual lead wormshaft is a one-piece unit that is less expensive and more accurate than split worms, including Class 1 types.

The graph shows test results comparing two split type worm shafts to a Holroyd Dual Lead type worm gear, it shows that both split designs are microns less accurate. In one case half as accurate.

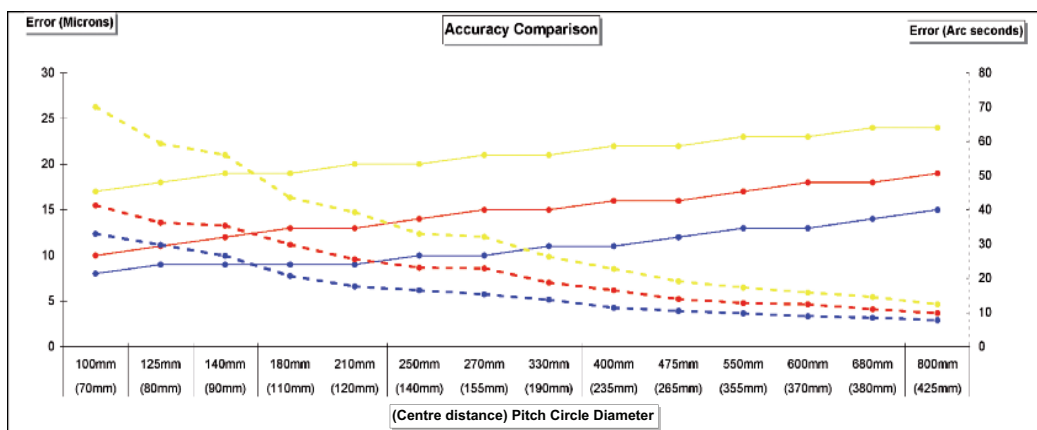


Accuracy Checking of Dual Lead & Precision Wormgears

The accuracy of a set of gears takes account of the tolerances of concentricity, profile, adjustment, accumulative pitch errors and centre distance. When assessing a requirement for a dual lead worm gear it is necessary to confirm that the distance of the supporting case can be held within plus 0.05 mm (0.002”) and minus 0.00 mm.

There are various national standards covering the accuracy and classification of wormgear sets which stipulate maximum allowable errors of adjacent and cumulative pitch and profile. Holroyd have the manufacturing capability to achieve closer tolerances than are stated in the majority of these standards with the necessary equipment for their checking and verification.

In addition, Holroyd have unique equipment for carrying out single flank or transmission testing. This comprises a continuous measurement of the angular position of the driven wormwheel relative to where it should be with a perfect gear set as the driving worm rotates at a uniform rate. The test both measures and records actual pitch and eccentricity, and also the profile.



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