**Description of duplex worm gears**

The usual method of adjusting the backlash of a worm gear assembly is to modify the center distance. Once assembled, such adjustment requires a major rework of the gearbox housing. The use of duplex worm gears allows the backlash adjustment to be made by axially shifting the worm. This simplifies greatly the assembly and maintenance operations. Because of the unique characteristics of the product, please take time to study its construction and proper use.

**Backlash adjustment mechanism and method of adjustment**

The dual lead worm is formed to give a difference between the right tooth surface and left tooth surface so that it provides a unique tooth profile in which the tooth thickness varies continuously, corresponding with the lead difference. (Fig 1)

The worm gear is also formed in its right and left tooth surface. When such a worm and worm gear are set up at a constant assembly distance and the worm is moved in the axial direction, the tooth thickness of the worm in mesh with the worm gear changes making backlash adjustment possible.

![Diagram showing backlash adjustment mechanism](image)

An arrow marking on the outer circumference of the hub of the HKH duplex worm indicates the direction of assembly as well as acts as a guide for the backlash adjustment.

When the worm is held with arrow mark pointing right, the tooth thickness is thinner on the right and thicker on the left. Therefore, moving the worm to the right causes the thicker teeth to come into actual engagement with the worm gear, thereby reducing the backlash. (Fig 2)

![Diagram showing backlash adjustment](image)

**Application Examples**

Adjustment by using Screws *

Adjustment by using Shims *

* The illustration above is a design example, not a design for machinery or a device in actual use.

**Point of caution during assembly**

HKH duplex worm gears differs in module between the right and left tooth surface and, therefore, you must orient the worm and worm wheel properly. Please carefully verify the following two aspects before proceeding with assembly.

1. **Verifying the orientation of assembly**
   
   An arrow indicating the orientation of assembly is stamped on both the duplex worm and worm wheel. When assembling the worm and worm wheel, check the worm wheel of the arrow mark on the front such that the direction of arrow mark on the worm coincides with that on the worm wheel. Should the assembly be incorrect, the center distance "a" will become larger than the normal distance, resulting in difficulty of assembly and improper gear engagement. (Fig 3)

![Diagram showing orientation of assembly](image)

2. **Verifying the reference position**

   A Y-groove (60°, 0.3 mm deep line) on tip peripheral of the duplex worm tooth marks the reference tooth. The gear set is designated to have a backlash of nearly zero (±0.045) when the reference position is positioned in alignment with the center of rotation of the worm wheel with the center distance set at the value "a". (Fig 4)

![Diagram showing reference position](image)
**AGDL2-20R1 AGDL2-30R1 AGDL2-36R1 AGDL2-40R1 AGDL2-50R1 AGDL2-60R1**

| Module | 1.5 | 2 |

**Duplex Worms**

| Catalog No. | Module | 1.5 | 2 |

**Specifications**

- Precision grade: AGDL
- Gear teeth: Standard full depth
- Pitch angle: 17° 30’
- Material: G20M40
- Heat treatment: Torsionally hardened, tooth surface induction hardened
- Tooth hardness: 50 ~ 60 HRc

For products not categorized in our KHK Stock Gear series, custom gear production services with short lead times is available. For details see page 8.

**AGDL Duplex Worm Wheels**

| Catalog No. | Module | 1.5 | 2 |

**Specifications**

- Precision grade: AGDL
- Gear teeth: Standard full depth
- Pitch angle: 17° 30’
- Material: C450 (formerly JIS A 1101)
- Heat treatment: Torsionally hardened

For products not categorized in our KHK Stock Gear series, custom gear production services with short lead times is available. For details see page 8.

**For products not categorized in our KHK Stock Gear series, custom gear production services with short lead times is available. For details see page 8.**
AGDL - KWGDLS

Duplex Worms

**Module 2.5, 3**

**Specifications**

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Nominal module</th>
<th>Number of starts</th>
<th>Number of teeth</th>
<th>Helix angle</th>
<th>Shape</th>
<th>Pressure angle</th>
<th>Reducer</th>
<th>Gear teeth</th>
<th>Module</th>
<th>Reducer Width</th>
<th>Root radius</th>
<th>Modul. O.D.</th>
<th>Allowable total length</th>
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**AGMA Standard Grade**

- AGDL2.5-20R1: Grade 1
- AGDL2.5-30R1: Grade 1
- AGDL2.5-36R1: Grade 1
- AGDL2.5-40R1: Grade 1
- AGDL2.5-50R1: Grade 1
- AGDL2.5-60R1: Grade 1

**Allowable total length**

- AGDL2.5-20R1: 171
- AGDL2.5-30R1: 289
- AGDL2.5-36R1: 397
- AGDL2.5-40R1: 515
- AGDL2.5-50R1: 623
- AGDL2.5-60R1: 731

**Allowable torque**

- AGDL2.5-20R1: 0.0045 N·m
- AGDL2.5-30R1: 0.0045 N·m
- AGDL2.5-36R1: 0.0045 N·m
- AGDL2.5-40R1: 0.0045 N·m
- AGDL2.5-50R1: 0.0045 N·m
- AGDL2.5-60R1: 0.0045 N·m

**Duplex Worms**

- AGDL2.5-20R1: 6°48'3°48'3°48'3°48'3°48'3°48'
- AGDL2.5-30R1: 10°54'10°54'10°54'10°54'10°54'10°54'
- AGDL2.5-36R1: 14°10'14°10'14°10'14°10'14°10'14°10'
- AGDL2.5-40R1: 17°30'17°30'17°30'17°30'17°30'17°30'
- AGDL2.5-50R1: 20°30'20°30'20°30'20°30'20°30'20°30'
- AGDL2.5-60R1: 23°42'23°42'23°42'23°42'23°42'23°42'

**For products not categorized in our KHK Stock Gear series, custom gear production services with short lead times is available.** For details see page 8.
**KWGDL - KWGDLS**

**Duplex Worms**

**Specifications**

- **Precision grade:** HSK W 001 grade 1
- **Modulus:** 3.5
- **Material:** SCM440
- **Heat treatment:** Normalized and quenched and tempered to HRC 40-45

**Catalog No.**

<table>
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**Finite values**

- **Helix angle:** 3°47’
- **Pressure angle:** 17°30’
- **Normal pressure angle:** 17°30’
- **Precision gear:** HSK W 001 grade 1
- **Material:** SCM440
- **Heat treatment:** Normalized and quenched and tempered to HRC 40-45

**For products not categorized in our KHK Stock Gear series, custom gear production services with short lead times is available. For details see page 8.**

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**KWGDL3.5-R1**

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**Module 3.5, 4**

**AGDL**

**Duplex Worm Wheels**

**Specifications**

- **Precision grade:** HSK W 002 grade 1
- **Modulus:** 3.5
- **Material:** SCM440
- **Heat treatment:** Normalized and quenched and tempered to HRC 40-45

**Catalog No.**

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**Other Products**

- **Bevel Gearboxes**
- **Single-Stage Gearboxes**
- **Helical Gearboxes**
- **Rack Gearboxes**
- **Internal Gearboxes**
- **Spur Gearboxes**
- **Helical Bevel Gearboxes**
- **Bevel Helical Gearboxes**
- **Internal Racks"