

Center-Less Gear Lapping Machine “KSL25”

(An Innovative Gear Finishing Machine allows Highly Accurate and Efficient Lapping of both Tooth Flanks Simultaneously.)

1. The KSL25 Center-less Gear Lapping Machine Process

A gear (part) is loaded between two MC (Monocast) Nylon Lapping Gears. A small amount of lapping oil containing a fine grained abrasive material is supplied to the meshing area of the part and lapping gears while the lapping gears are rotating at a high speed. The KSL25 is a Gear Finisher that delivers simultaneous lapping of both tooth flanks and produces a smooth mirror-like surface with a roughness of RZ 0.3 ~ 1 μm in a short time as shown in photo 1. Photo 2 shows the appearance of the KSL25, and diagram 1 shows the machine layout.

Photo 1: Mirror-Like Flanks after the Gear Lapping Process



Photo 2: Exterior View of the KSL25

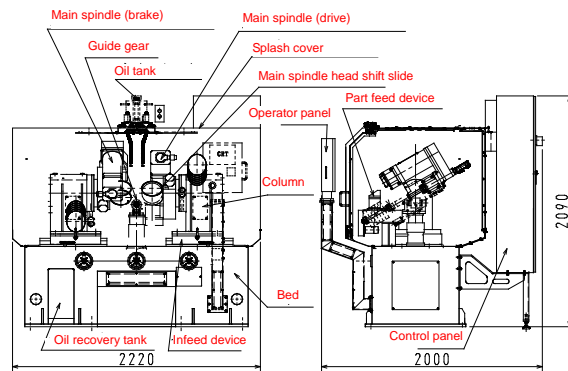


Diagram 1: Machine Layout of the KSL25

2. Specs of KSL25

- Max. Workpiece Diameter 250 mm
- Machine Length x Width 2220 x 2000 mm
- RPM of lapping gear Max. 3000 rpm

3. Machining Principal of Center-Less Gear Lapping Machine

As shown in diagram 2, the crossed axis (meshing angle) of lapping gears and part is set to as much as 30 degrees. By rotating the right drive lapping gear, the meshed part and brake lapping gear begin rotating. The drive lapping gear contacts the right flank of the part, and the brake lapping gear contacts the left flank of the teeth on the part creating the lapping process due to the crossed axis action of the meshing slide. The part is traversed between the nylon lapping gears several times, with a stroke slightly larger than the part face width. Photo 3 shows the machining area.

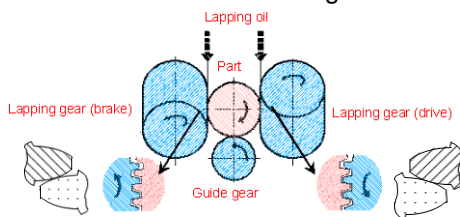


Diagram 2: Principal of the Center-Less Gear Lapping Machine

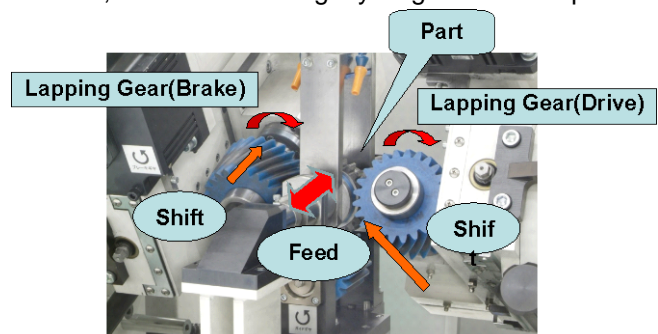


Photo 3: Machining area of the KSL25

4. Purpose of Development

Typically, an expensive gear grinding machine or, a gear honing machine is used in the gear finishing process. The main purpose of these machines is to reduce the vibration and noise created during uneven motion transfer, and with the focus not on improvement of gear life or transmission efficiency. With this in mind, since 2005, Kashifuji has entered into collaborative research with SASEBO National College of Technology with the development of a prototype machine to decrease flank roughness. Kashifuji has developed a practical and reasonable center-less gear lapping machine, the “KSL25” for gear production factories. Table 1 shows the comparison of finished flank roughness by various finishing processes.

Machine	Tool	Roughness of Tooth Flanks Rz μm																
			0	1	2	3	4	5	6	7	8	9	10					
Shaving Machine	Shaving Cutter	3. 2~8																
Grinding Machine	Threaded Grinding Wheel	2~5																
Honing Machine	Grinding Wheel Shaped in Internal Gear	2. 5~5																
Center-Less Gear Lapping Machine	Cylindrical Nylon Gear	0. 3~1																

Table 1: Roughness of the Tooth Flanks - Various Finish Processes

5. Features

1. A lapping gear is made of commercially available / inexpensive MC Nylon. The wear of MC Nylon is very low due to the self lubricating nature of the Nylon, which produces long tool life.
2. A part can be loaded between two lapping gears from above, and is automatically meshed by rotating the lapping gears.
3. Simultaneous lapping on both flanks produces an efficient, fast cycle.

6. Machining Example

Diagram 3 shows the roughness of lapped tooth flanks on a ground gear. Before the lapping process, the roughness is about Rz 2 μm . A smooth mirror-like surface with a roughness of about Rz 0.5 μm is produced after the lapping process.

- Part: Module 2.5, Number of teeth: 75, Helix angle: 30 degrees RH, Face width: 26 mm, Material: SCM415, Carburized hardness: HRC60
- Lapping gear: Module 2.5, Number of teeth: 38, Spur gear, Face width: 70 mm, MC Nylon
- Lapping oil: A 25 grams of WA alundum granules #1000 mixed with a 1000 cc of oil, Dropping speed: 20 cc/min
- Lapping conditions: Rotation speed: 3000 rpm
- Feed rate: 600 mm/min, Feed stroke: 32 mm

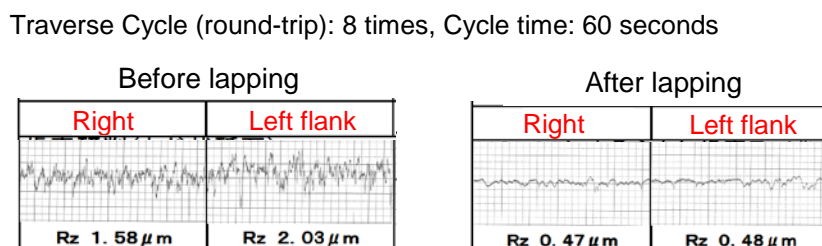


Diagram 3: Measured Roughness Before / After Lapping

7. Sales Records

3 machines (KSL25) have been sold to our valued customers as of 2012. Our market share is 100% as no other makers manufacture this type of machine domestically or overseas.

8. Conclusions

Improved roughness of tooth flanks increases the basic function of a gear. The increased life and transmission efficiency during motion transfer contributes to the reduction of CO2 levels. We will continue to make a concerted effort to improve the gear lapping process and to reduce the machine cost.