DOJ Compact High-Angle Constant Velocity Joint

Lightweight and compact with a maximum operating angle of 30° DOJ

**Features**
- External dimensions: one size more compact (approximately 4%) compared to the current 30° DOJ
- Weight: approximately 6% lighter
- Strength and durability: improved actual strength and durability through optimization of track contact angle/contact ratio, and cage offset

**Applications**
- SUVs and other vehicles that require greater operating angles

**Structure**

Typical application

One size more compact

Previous product → New product
PTJ High-Angle Low-Vibration Constant Velocity Joint

The PTJ low-vibration constant velocity joint boasts the world’s highest level of NVH performance and achieves a maximum operating angle of 30° for the first time in the world.

Features

- Extended operating angle range that ensures low vibration
  From 15° to 17°
  • Operation in low-vibration range
    The roller cassette is maintained parallel to the outer ring axis to ensure low vibration.
    - Improved product: approximately 17°
    - Previous product: approximately 15°

- Enlarged operating angle range
  Operation possible up to 30°
  • Operation at maximum angle
    - Improved product: approximately 30°
    - Previous product: approximately 26°

Structure

- Outer ring
- Trunnion
- Lower cassette
- Outside diameter: same as the current PTJ

Applications

- Crossover SUVs and other vehicle types that require greater operating angle and lower vibration
  Example of application

Examples of application

\[ \text{Average of current PTJ} \]
\[ \text{30° PTJ,95} \]
Super-Wide Operating Angle (54°) Fixed CVJ (TUJ)

The world’s first fixed CVJ capable of a super-wide operating angle (θ max. = 54°)

Results of a case study that assumes a 4° increase in the operating angle with a fixed joint on an ordinary medium-sized FF vehicle

Approximately 70 cm (13%) decrease in the minimum turning radius of the vehicle
(when the wheelbase is the same as a conventional CVJ)

Approximately 40 cm (15%) increase in the wheelbase
(when the minimum turning radius is the same as a conventional CVJ)

Example of use

Features

- Maximum operating angle (θ max): 54° (current UJ: 50°)
- Outer ring outside dia.: Same as with UJ
- Mechanical strength, durability: Equivalent to those with UJ

Applications

- Large-sized and medium-sized FF and 4WD vehicles boasting smaller minimum turning radius
Ultra-Low Torque Tapered Roller Bearing

Significantly lower running torque
(1/2 that of previous tapered roller bearing in the same class),
without loss in bearing life and rigidity

Features

- Realization of lower torque: 1/2 that of previous bearing
- Compact bearing size: 10% or greater reduction of outside bearing diameter (same life and rigidity compared to previous bearing)

Performance

- Torque measurement result
  - Running torque (Nm)
  - Bearing speed (r/min)
  - Previous product
  - New product

- Bearing rigidity calculation result
  - Axial load (kN)
  - Axial displacement (μm)
  - Previous product
  - New product

Engineering challenges and solutions

Challenge 1: Realization of lower torque
Means for realization: Implementation of optimization in design
Adoption of a new cage form with reduced oil stirring resistance

Challenge 2: Maintain bearing life comparable to that of the previous bearing
Means for realization: Adoption of FA heat treatment
When lubricated with clean oil, the new product boasts a bearing life 2.8 times as long as that of the 4T product.

Challenge 3: Maintain rigidity comparable to that of the previous bearing
Means for realization: Adoption of a high load capacity design
The cage is situated near the outer ring and a maximum possible number of rollers are incorporated.
High Load Capacity Tapered Hub Bearing for SUVs

Realization of 20% longer bearing life and 7% higher rigidity in the same amount of space

Structure

Features

- 20% increase in bearing life (calculated life)
- 7% increase in bearing rigidity

Features

- Wheel bearings for SUVs
Hub Bearing with Built-In Low-Torque Hermetic Seal

Twice the sealing performance and a 15% reduction in running torque in the same seal space through optimization of structure, form and rubber material.

Features

- Sealing performance: twice the resistance to muddy water
- Lower torque: 15% decrease in running torque (30% decrease with seal alone)

Structure

Applications

- Wheel bearings for passenger cars
Hub Bearing with Built-In Active Sensor

No need for adjustment of sensor air gap or machining of knuckle

Features

- No need for adjustment of sensor air gap
- No need for machining work or assembly to secure the sensor to the knuckle
- Protection against flying rocks and prevention of jamming by foreign objects

Means for realization

- Sensor is built into the hub bearing
- Sensing face is surrounded by a metal core
Low-Emission Capable Laminated Conrod Module

- Shell-type needle roller bearing that can operate under minimal lubrication conditions to help comply with emission control
- Realization of compact size with NTN’s unique laminated conrod
- Proposal of total VA/VE with modular design involving conrod that incorporates the shell-type needle roller bearings described above

Features

- Through optimized design of the cage used on shell-type needle roller bearings and the higher precision of the outer ring, this conrod boasts excellent anti-seizure performance even under a severely reduced lubrication condition that is four times as demanding as conventional lubrication conditions (75% reduction in the amount of mixed oil).
- This conrod product features a unique laminated construction prepared by pressing thin sheets. As a result, it is very compact, with a minimum width that is 17% (6% in terms of outside dimensions) more compact than conventional conrod products formed by fine blanking techniques.
- NTN offers a modular conrod product that is capable of operation with minimal lubrication. This is prepared by press-fitting shell-type needle roller bearings into its unique laminated conrod component. Being highly functional and compact, this product also serves for VA/VE applications.

Applications

- 2-cycle engines for agricultural machinery (pruning machines, spraying machines, chainsaws, etc.)
High-Speed, High-Quality Color Filter Repair System

Capable of coping with large-sized substrates, the system features multi-functionality and advanced functions.

Features

1) Realization of quick repair
- A dedicated high-speed drive mechanism is provided for repair fluid application
- A combination of a dedicated applicator needle and a repair fluid container is provided for each repair fluid
- No need to rinse the applicator needle; simpler color switching
- The tip of the applicator needle is refilled by repair fluid during application
- No need for separate repair fluid filling
- 70% reduction in repair time compared to previous repair systems

2) Realization of high-quality repair
- Each applicator needle has a specially treated tip. The amount of the repair fluid applied is adjusted precisely based on the time of contact between the color filter substrate and the applicator needle
- Prevention of overflow of repair fluid to defect-free areas
- Improvement in repair quality

Example of repair

Coating is removed by lasers
Repair fluid is applied

Advantages of the NTN's unique applicator mechanism

1. High-speed mechanism specialized for application (for X1, X2, Y, and Z axes)
   The time needed for repair is reduced by the high-speed, high-precision drive motion of ultracompact linear motors.

2. Provision of four applicator needles
   Color switching without rinsing and reduced repair time are realized.

3. Unified support structure for applicator needles and repair fluid containers
   Filling of applicator needles with repair fluid is not necessary.

4. Filler-applicator needle
   The amount of liquid applied is adjusted in a range from a few picoliters (one trillionth of liter) to tens of picoliters. Repair quality is improved because any defect can be filled with a very small amount of the repair fluid.
Advanced Functionality Controller for Parts Feeder

Power consumption by parts feeders can be reduced by 30% compared with previous controllers.

Features

1) Optimal vibration frequency automatic adjustment function
   - Automatic adjustment to the most efficient frequency
     - Approximately 30% energy conservation

2) Constant amplitude function allows parts to be transported in an optimal state.
   - Amplitude regulation: within 3% (under conditions that result in amplitude variation of 10% or greater with previous controllers)

3) No need for a vibration sensor
   - No problems such as broken vibration sensor leads
   - The new controller can be easily installed to replace an older controller

Means for realization

1) The drive signal (voltage, current) to the vibrator electromagnet is accurately measured [drive signal measuring device]

2) Based on the measured values, (i) deviation from the optimal vibration frequency and (ii) the amount of transportation (vibration amplitude) are estimated [CPU]

3) The electromagnet is energized based on the vibration frequency and amplitude ordered by the CPU [inverter]
   - Automatic adjustment of optimal frequency and constant amplitude functions are realized without use of an external vibration sensor

Controller block diagram

- Drive signal measuring device
- CPU
- Inverter circuit