

## -Content-

- ◆ Company profile and general information
- ◆ Customer & honor
- ◆ Introduction of engineering & technology
- ◆ Products & Technical advantage
- ◆ Capability of design validation

## -Company profile & general information-

- Name: Zhejiang Ruideli automobile components Co., LTD
- Regtime: Y 2004, Company property: Joint-equity enterprise
- Address: No. 258 Linxi Street. Deqin District, Zhejiang, China
- Scale: Occupied area 35,000m<sup>2</sup>, Employee 180+
- Qualifications: 2008 ISO/TS 16949:2002 quality system certification  
2018 IATF16949:2016 quality system certification  
2021 ISO14001:2015 EHS system certification
- Developing course:
  - Jun. 2004 Company established;
  - Nov.2006 Had been system supplier of WeiChai Powertrain;
  - Aug.2008 Had been system supplier of Xincheng powertrain
  - Oct. 2011 Had been system supplier of Yangzhou diesel engine company
  - May. 2013 Had been system supplier of Yuchai machine;
  - Oct. 2014 Had been system supplier of XCEC (Xi'an Commins);
  - Jun. 2019 Had been system supplier of Yunnei powertrain;
  - Jul. 2020 Had been system supplier of DFLE (Dongfeng Light duty engine)
  - Sept.2020 Had been system supplier of FOTON Commins
  - Oct. 2021 Had been system supplier of JAC company;
  - Jul. 2022 Had been system supplier of DCEC (Dongfeng Commins)

## ■ Products & application field:



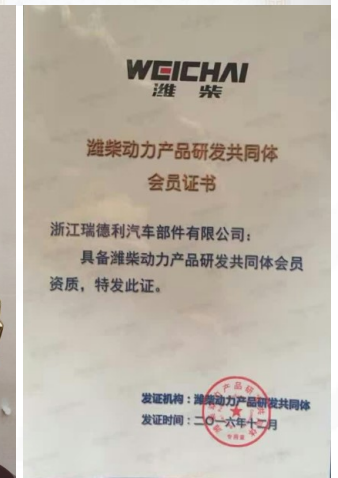
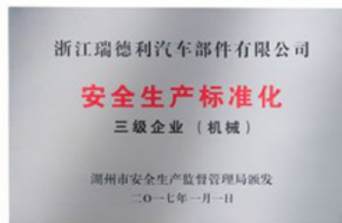
-Customer groups: OE-



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So on.....

## -Our Honors-

Ruideli's good performance achieved high endorse and appreciate from customers. Had been awarded times as "Excellent Supplier", "Best Quality Award", "Synchronously Develop Award" from WeiChai. Awarded as "New Product Develop Award", "Excellent Improvement Award" from XCEC in 2021 & 2022. And other certificates by local government sectors.



# -Manufacturing capacity-

| Facilities    |                                    | Qty. | Comments   |
|---------------|------------------------------------|------|--|
| Machine Shop  | Digital Lathe                      | 36   | <ul style="list-style-type: none"> <li>- Key components achieve accuracy meet: 0.005mm</li> <li>- Quicky action for prototypes</li> <li>- Capacity: 600 k pcs per month</li> </ul>   |
|               | CNC                                | 3    |  |
|               | Drilling machine                   | 4    |  |
| Assembly Shop | Tensioner line                     | 10   | <ul style="list-style-type: none"> <li>- Tensioner: Major characteristic online inspection;</li> <li>- Idler: Automatic assembly, flexibility 100% check.</li> <li>- Capacity: tensioner 200k pcs and idler 500k pcs per month.</li> </ul> |
|               | Idler line                         | 5    |  |
| Proto Shop    | Lathe/Grinder /Milling machine/... | /    | <ul style="list-style-type: none"> <li>- Provide various of tools and fixture for production facilities;</li> </ul>  |

■ Advantage:

1. Product traceability: 2D code or date code print on assemblies.
2. Pulley bore diameter on 100% inspection by air gauge .
3. Major characteristic (torque, damping, centerline height, etc) online check.
4. Poka-yake measures for automatic assembly line.



## -Technical capacity-

### ■ Staffing & Patent:

- 20 engineers in total, 50% has experience of system & tensioner design more than 10 years. 6 of them be able to undertake system dynamic test and system simulation at ADT develop.
- 60+ patent about our products.

### ■ Facilities for Research & Develop :

| Facility type              | Qty. | Function                            |
|----------------------------|------|-------------------------------------|
| ROTEC test system          | 1    | Accessory system dynamic test       |
| 3D SIMDRIVE calculation    | 1    | System simulation                   |
| Material analyzer          | 1    | Metallographic analysis             |
| Tensioner test cabinet     | 9    | Tensioner durability test           |
| Spray and mud test machine | 1    | Tension & Idler environmental test  |
| Idler test cabinet         | 5    | Idler/bearing durability test       |
| Torque & damping test      | 2    | Tensioner torque & damping test     |
| Bearing noise test room    | 1    | Bearing noise test                  |
| Movable CMM                | 1    | Accessory system misalignment check |

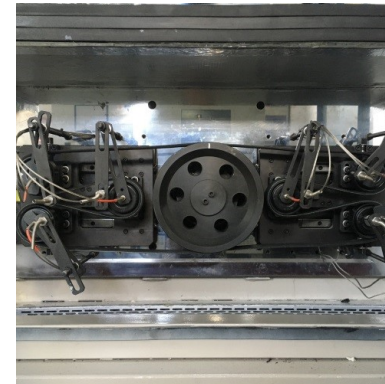
### ■ Experience :

- Full ability of engine accessory drive system static calculation , dynamic simulation, and dynamic validations.
- As a partnership of accessory drive system synchronously develop for Weichai powertrain, Yuchai machine, XCEC, etc...
- Products applied successfully on Weichai engines like WP3, WP4, WP5, WP6,WP7,WP8, WP9, WP10,WP12,WP13,Yuchai machine 6J, 6L, 4W,6G, DKA, 4DK, K5/K8,K9/K11,K13/K15,etc...

### ■ Validation:



Durability test cabinet



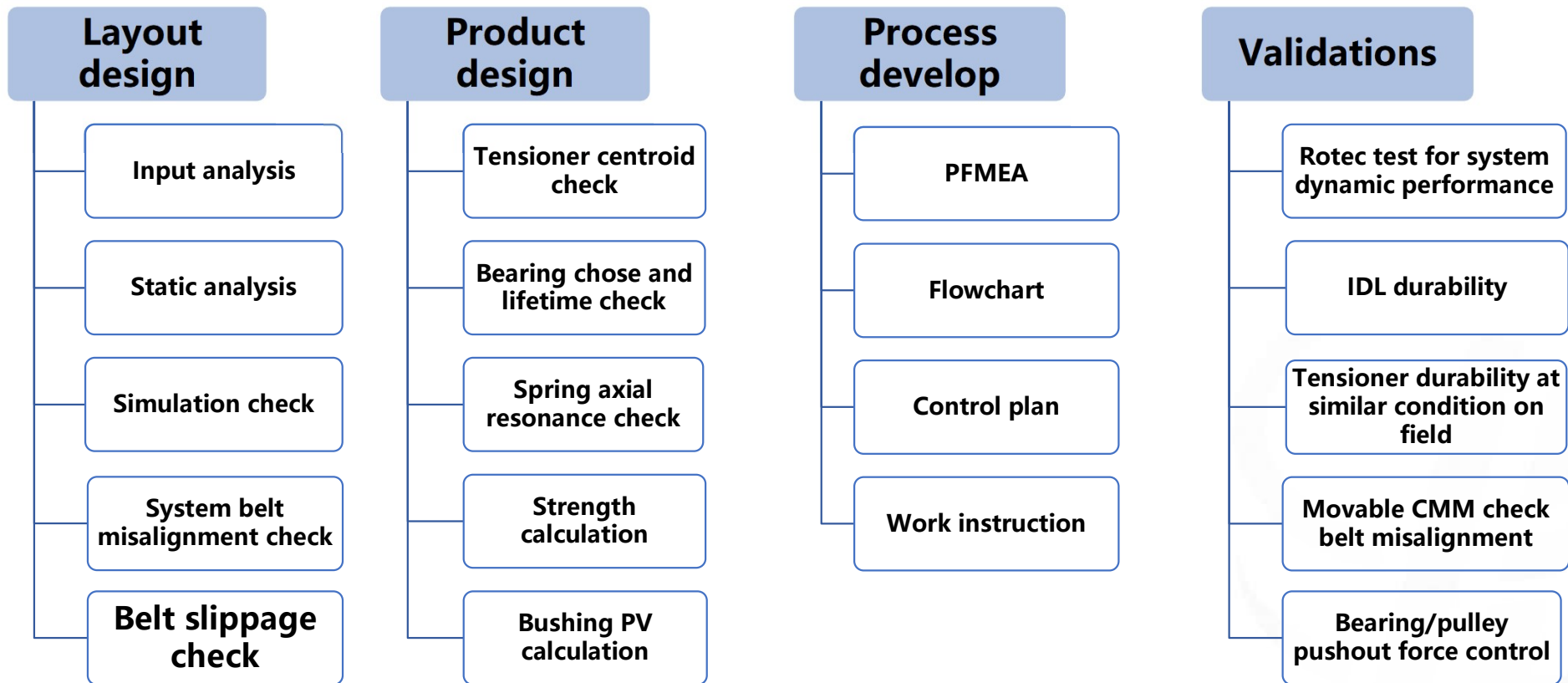
Bearing test cabinet



Bearing noise test facility

# -Technical Advantage-

➤ Top-down develop



# -Technical Advantage-

## ➤ Static layout method

**(Input) Layout Data**

| Pulley | X Coordinate | Y Coordinate | Diameter | Pulley Type |
|--------|--------------|--------------|----------|-------------|
| 1      | 0            | 0            | 137      | Grooved     |
| 2      | 0            | 175          | 123      | Flat        |
| 3      | 180          | 200          | 87       | Grooved     |
| 4      | -80          | 298          | 65       | Flat        |
| 5      | -215         | 375          | 60       | Grooved     |
| 6      | -105         | 212          | 65       | Flat        |
| 7      | -215         | 210          | 99.2     | Grooved     |
| 8      | -243.5       | 40           | 119      | Grooved     |
| 9      | -116.1       | 105.5        | 70       | Flat        |

**(Input) Belt Data**

Belt Name: Multi-V Belt    Geometric Type: Gates  
 Belt rib type: PK / EPDM    Belt Height: 4.4 [mm]  
 No of Ribs Cord type: 8 / Aramid    Flat to Pitch: 1 [mm]  
 Stretch and Wear Allow: 0 % of Length    Pitch to Effective: 1.2 [mm]  
 Eff. Drive Length (of ISO 9981): 2566.2920 [mm]    Length to lence: 12 [mm]

**(Input) Tensioner Data**

Tensioner Type: Automatic    Tensioner Arm Length [mm]: 53  
 Pivot Point (x,y): -162    132    Tensioner Arm Angle [deg]: 330  
 Design Tension [N]: 375    Spring Rate Factor [N/m deg]: 0.3

**FEAD-System Layout**

**Belt Tension Control**

Tensioner Position: Automatic

| Tensioner Position | X        | Y       | Arm Position [deg] | Effective Belt Length [mm] | Tensioner Torque [Nm] | Belt Design Tension [N] |
|--------------------|----------|---------|--------------------|----------------------------|-----------------------|-------------------------|
| Instal 9/TCN       | -126.371 | 92.763  | 312.2410           | 2539.8173                  | 41.13                 | 565.38                  |
| Min Belt           | -119.944 | 99.747  | 322.5149           | 2554.2920                  | 38.04                 | 433.28                  |
| Nominal Belt       | -116.101 | 105.500 | 330.0000           | 2566.2920                  | 35.80                 | 375.00                  |
| Max Belt           | -113.209 | 111.301 | 337.0118           | 2578.2920                  | 33.69                 | 335.96                  |
| Stretch & wear     | -113.209 | 111.301 | 337.0118           | 2578.2920                  | 33.69                 | 335.96                  |
| Free Arm           | -109.000 | 132.000 | 360.0000           | 2619.6777                  | 26.80                 | 260.10                  |

### Input:

- Coordinator of engine;
- Accessory loads;
- Belt type and parameters;
- Tensioner parameters;
- Boundary

### Output:

- Slippage ratio;
- Bearing loads;
- Hubload and direction;
- Belt lifetime;
- Resonance frequency;

## ➤ Dynamic simulation

**Simulation Task**

Name of Project: NOMINAL POSITION  
 User Name: GULANXI YUCHAI  
 Remark: 2018.06.07  
 Simulation Task: NOMINAL POSITION

Mode of Calculation: Time Domain

Initial Rotary Speed <math>\omega\_{min}</math>: 500.0  
 Reference Element: Crk-Mass [10]  
 Direction of Rotation: Clockwise  
 Temperature <math>T\_c</math>: 45.0  
 Start Time <math>t\_s</math>: 0.0  
 End Time <math>t\_e</math>: 0.0  
 Minimum Time Step <math>\Delta t\_s</math>: 1.0E-8  
 Maximum Time Step <math>\Delta t\_e</math>: 1.0E-4  
 Max. Frequency Detachable <math>\omega\_{max}</math>: 1.00E+6  
 Maximum Error: 1.5E-6  
 Integration Method: Adams-Bashforth

Number of Load-Intervals: 0  
 Simulated Interval: 1.0  
 Interval Unit: seconds  
 Crossfade Duration <math>\tau\_c</math>: 1.0  
 Rotary Speed Gradient for Crossfade: 0.00E+0  
 Transient Oscillation Control: Active

Relevant Portion in Evaluation: 0.0  
 Edit Load-Intervals

Multi-Threading: Active

Type of Output: Dynamic Sample Rate  
 Value: 50  
 Steps in Progress Output: 50

### Input:

- Crank torsion vibration;
- Accessory loads curve;
- Belt type and parameters;
- Tensioner torque and damping parameters;

### Output:

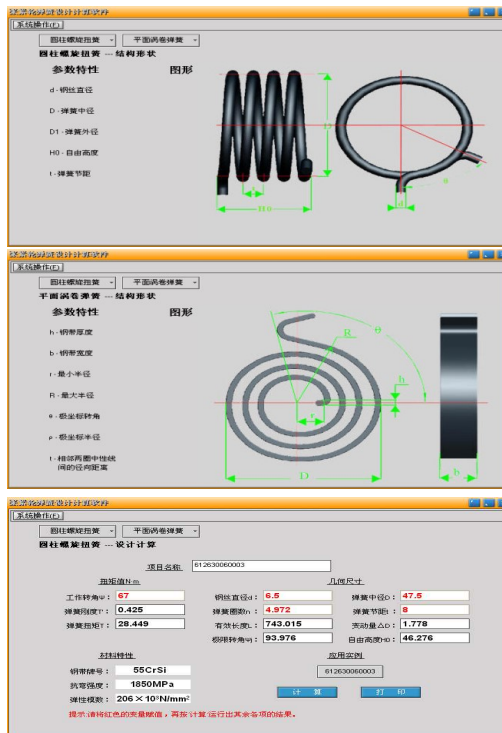
- Belt dynamic tension;
- Slippage risk;
- Belt fluctuation of spans;
- Bearing hubloads;
- Arm movement;



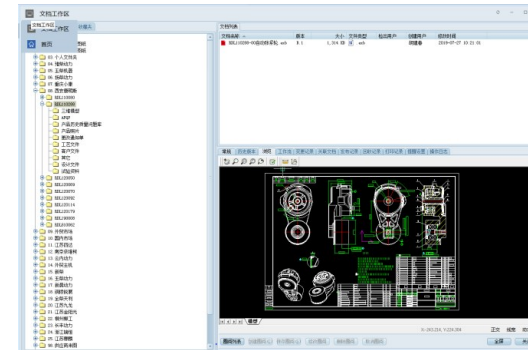
# -Technical Advantage-

➤ Software for components design

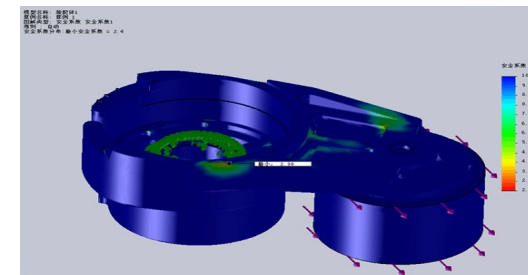
## Spring design



## EDM system for design management



## CAE analysis for strength

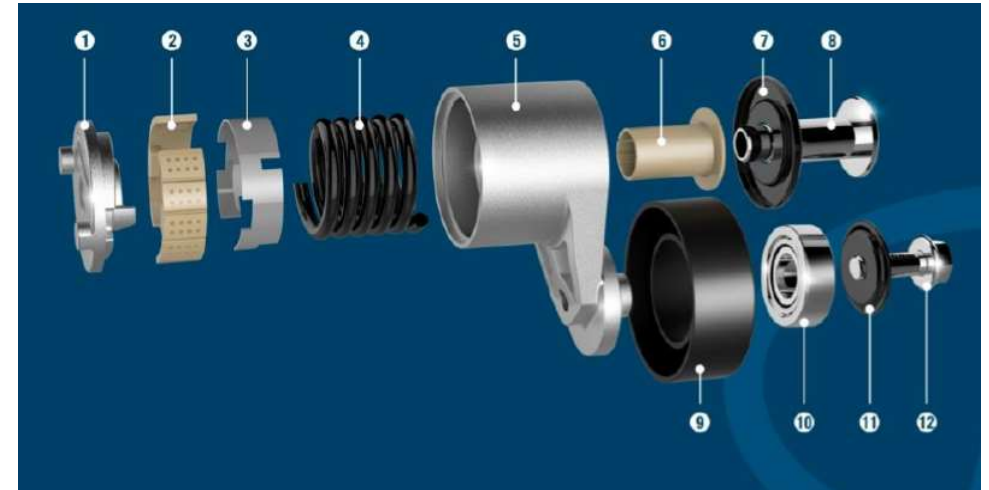




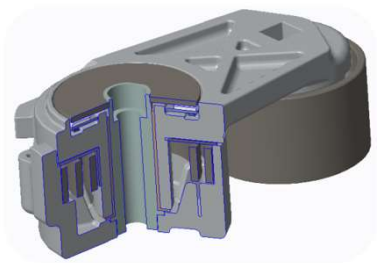
## -Products -

### ➤ Products variety

- Tensioners with different sharps("Z" sharp or "U" sharp);
- Helical and Spiraling spring provide different tensioner characteristic;
- Diversified damping element provide different tensioner response characteristic.;
- Various type of idlers applied on various field, AV belt drive system, PK belt system, etc...

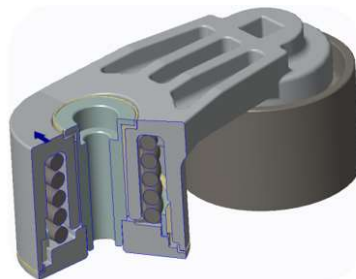


## -Various type in mass production –



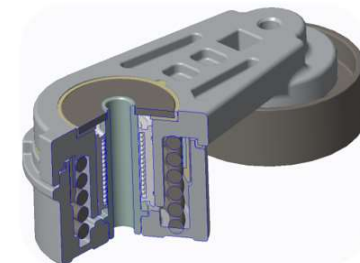
- **Scroll spring type:**

Revolute Pair: Thin self-lubricating bushing  
Lifetime Expectation: 300,000-600,000 Km



- **Screw spring type:**

Revolute Pair: PA46 or self-lubricating bushing  
Lifetime Expectation: 300,000-600,000 Km

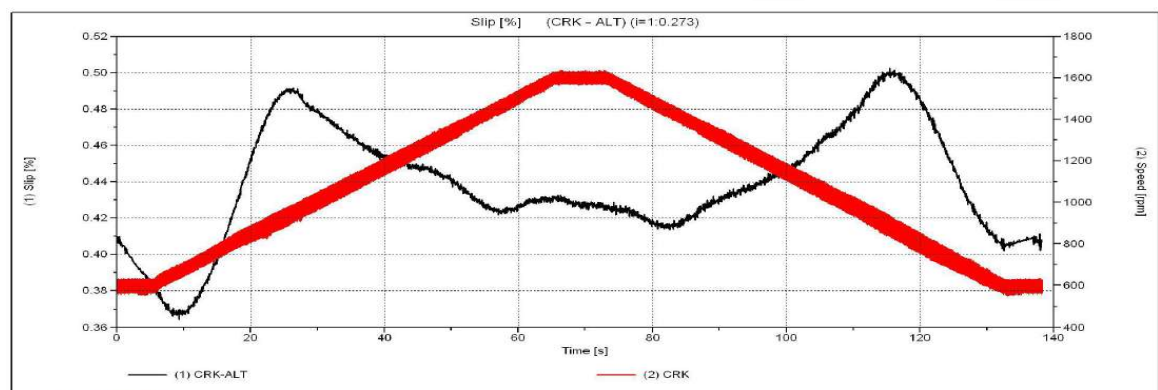
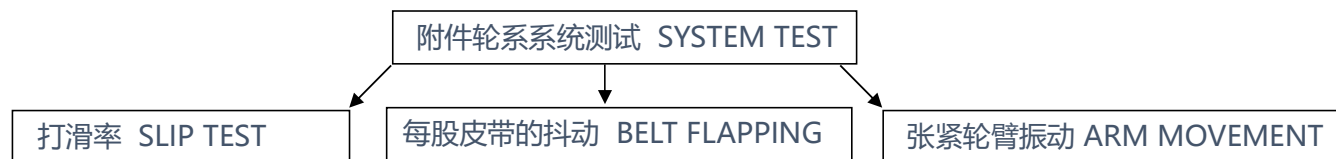
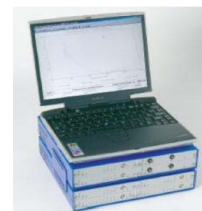


- **Screw spring type:**

Revolute Pair: Needle bearing  
Lifetime Expectation: 500,000-800,000 Km

# -Design validations capability-

系统测试及发动机台架试验-Rotec测试设备  
system test and engine shelves experiment



|   |                             |   |
|---|-----------------------------|---|
| <b>RuiDeLi</b><br>NO.258, Linxi Street, DeQing County, Zhejiang China |                             | Measurement: NO: 750 5/14/2020 7:44:30 PM 5.5<br>© Zhejiang RuiDeLi Power Equipment Co., Ltd. |
| Customer:<br><b>WeiChai Power</b>                                     | Operator:<br><b>HUBOFAN</b> | Test Specimen:<br>80s structural mantle (No. 618 corrected, C31)                              |

## -Product validations capability-

### ■ Moveable CMM

Accurately measure pulley position of belt drive system



### ■ Bearing noise test

Test bearing sound decibel value in soundproof



### ■ Laser alignment

Measure alignment condition on engine



### ■ Hand-hold vibration test unit

More flexible compared with Rotec on measuring arm movement



### ■ Mechanical electronic stethoscope

Used to determine the noise source when checking abnormal noise on engine or vehicle



### ■ Sonic tension meter

Measure belt tension on engine or vehicle



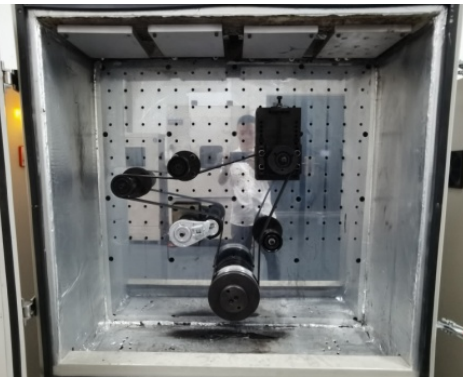
## -Product validations capability-



- Ruideli currently owns the most Qty. of test equipment compared with domestic competitors.
- Implement high temperature, salt spray, mud, dust, durability, etc. for tensioner & Idler according to SAE standard.



Tensioner multistation test cabinet



Individual test cabinet



Bushing wear test machine



Salt spray cabinet

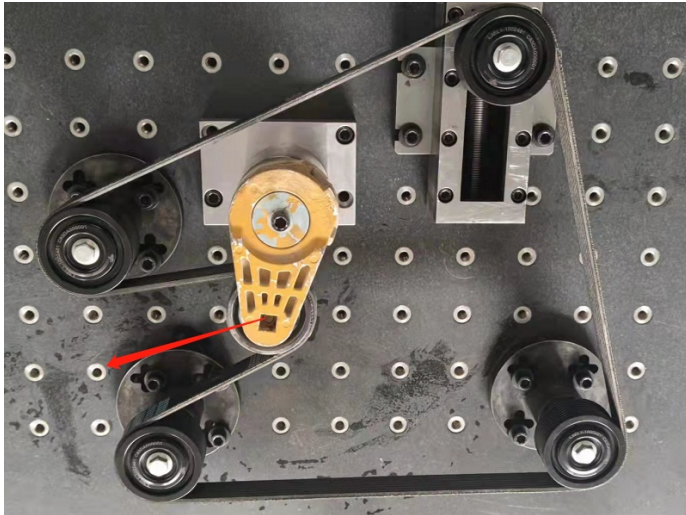


Bearing test machine

## -Product validations capability-

### ■ Parallelism measurement at nominal position

- To reflect the real tilt condition after tensioner wear.
- To evaluate the influence between HTA and belt alignment.



### ■ Durability test at nominal with similar HTA and belt wrap angle

- Eccentric arm of drive pulley generate system vibration excitation leads arm





## -Experiment and test ability- -

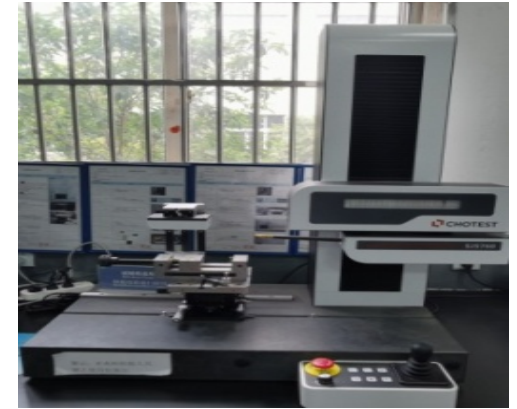
### Torsion Tester

Accurately measure the output torque and damping of tensioner;



### Surface roughness profiler

Measure the part surface roughness and belt pulley groove angle;



### Spectrum Analyzer

The metallographic analysis of metal material;



### Tensile Testing Machine

The strength test for components or products;



## -Experiment and test ability-

### CMM

Accurately measure for components and products;



### Bearing Vibration Measuring Instrument

Vibration measure for bearing and belt pulley;



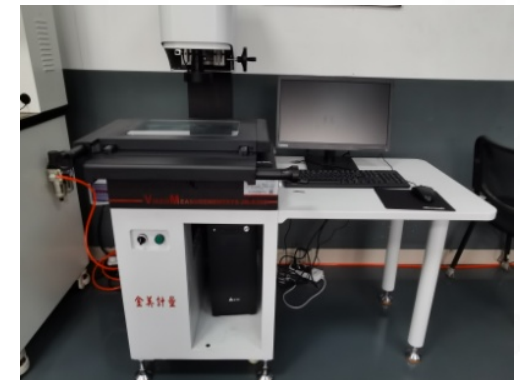
### Metallographic Polishing Machine

The metallographic analysis of metal material;



### Digital Optical Projector

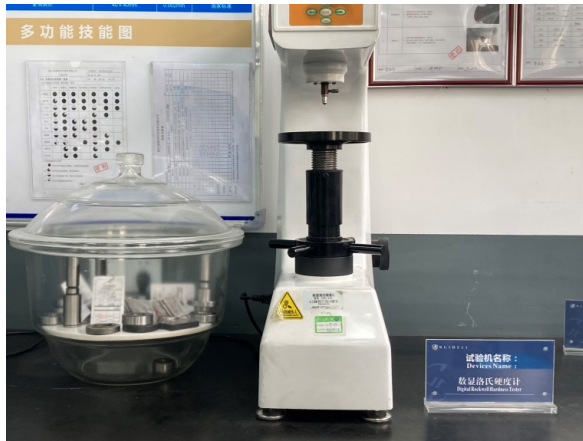
Measure the outline dimension of parts or products with complex shapes;



# -Experiment and test ability- -

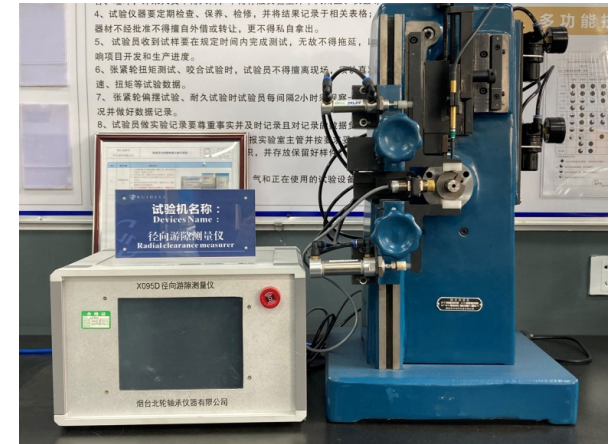
## Digital Rockwell Hardness Tester

Hardness test for metal;



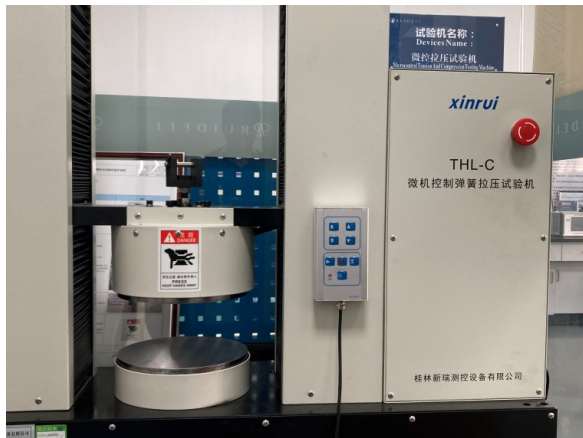
## Radial clearance measurer

The clearance measure for bearing and belt pulley;



## Micro-control tension and compression testing machine

Stiffness test of spring and other elastic elements;



## Digital Vickers Hardness Tester

The surface hardness test for metallic part;

