Contents

Modular Gripper Systems
Page 3

TÜNKERS® Round Tube System
Page 5

TÜNKERS® Carbon Tube System
Page 19

TÜNKERS® Square Tube System
Page 25

Euro-Gripper Tooling
Manufacture of components and system supplier
Page 27

Special Solutions
Fixtures, Customised Solutions
Page 31
TÜNKERS® – Specialists in Gripper and Handling Technology

Introduction

Gripper and handling technology form one of the core competences of the wide range of TÜNKE S® products. Our portfolio includes various modular system solutions based on force-closed and form-closed concepts. The main application area of these grippers is in body-in-white, where handling processes and geometry applications are realised. Due to the flexibility of the modular system, gripper operations such as palletisers for crates can be realised in automation technology.

Versatility and Flexibility

Next to standardised modular systems such as the TÜNKE S® circular, carbon or square tube systems and Euro-Gripper tooling, we also offer customised technology in adjusted design. Upon request, we supply niche products, for instance, our Meca-tron system or complete fixtures (see chapter “Special Solutions”).

World-wide Experience and Problem-Solving Competence

The project development of TÜNKE S® gripper systems resorts to a wealth of experience gained in over 10 years and the supply of more than 8 000 units delivered world-wide. Handling systems are used by a large number of OEM in the automotive industry, for instance, by Audi, BMW, Daimler, Ford, GM, Landrover, Renault, Volvo, Volkswagen and Skoda. As a specialist in gripper systems this experience enables us to react flexibly to problems of any kind and offer you timely and competent solutions, for instance, in the case of constructive challenges.

TÜNKERS® as a System Supplier

According to your request, we offer you comprehensive solutions in the development of gripper systems.

This includes
- Design
- Project development and consistent order processing
- Mechanic assembly including the manufacturing of customised parts and the provision of parts
- Installation of pneumatic and electric components
- Verification via 3D measuring and documentation
- Initial operation on site

Subject to technical changes. Data sheets and CAD data upon request.
Modular Gripper Systems
In the conception of gripper systems, the user can choose between modular systems or welded-on grippers. The advantages of the modular design are obvious:

<table>
<thead>
<tr>
<th>Key Factor</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>Use of modular components of aluminium or carbon as opposed to steel in the case of welding grippers</td>
</tr>
<tr>
<td><strong>Flexibility</strong></td>
<td><strong>- Effective Assembly</strong> Modular grippers are easy to install and adjust whereas welding grippers require complex fabrication steps</td>
</tr>
<tr>
<td></td>
<td><strong>- Immediate Adjustment</strong> Changes to components at short notice or constructive adjustments can be integrated into the system in the case of modular grippers whereas this is only possible to a certain limit with welding grippers</td>
</tr>
<tr>
<td></td>
<td><strong>- Retooling / Diversification</strong> Integrated grippers can be replaced with carbon in the event of weight-related problems or in the case of changes to components, for instance, further clamping points can be added. This is not an option with welding grippers</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td><strong>- Replacement Grippers</strong> Our modular systems render the replacement grippers commonly used with welding grippers unnecessary, as the grippers can be timely overhauled in case of a crash by means of standard parts in stock. Modular grippers do not require any further maintenance</td>
</tr>
<tr>
<td><strong>Stock Keeping and Maintenance</strong></td>
<td><strong>- Minimal Stock-Keeping Cost</strong> The maintenance of modular grippers requires only a few standard parts to be kept in stock. This advantage is not given with welding grippers, due to the high degree of specialised manufacture, as this would necessitate the fabrication of bulky and costly replacement grippers</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td><strong>- Simple Design</strong> Due to the standardised components available in 3D CAD formats, the design processes via copy and paste save time and costs. Welding grippers are always customised solutions and subject to an extended design time.</td>
</tr>
</tbody>
</table>

**CONSIDERABLE COST SAVINGS FOR MANUFACTURER AND END CUSTOMER**

- Design
- Assembly and Production
- Purchase and Provision of Parts
- Maintenance and stock-keeping

Subject to technical changes. Data sheets and CAD data upon request.
Round Tube Systems
Subject to technical changes. Data sheets and CAD data upon request.
TÜNKERS® Round Tube System
The force-closed TUNKERS® round tube system utilises, from a technical point of view, the optimal moment of inertia of tubes and achieves an optimal relation between low weight, high rigidity, and minimal vibration as opposed to square-shaped forms.

Frame Elements
Gripper systems have a standard base plate or a customised bracket which is equipped with a hole pattern for connection to the robot flange. Onto this bracket the tubes are mounted which in turn are connected via cross joints.

Tubes
The high-precision round tubes are available in the diameters 60 mm, 40 mm and 25 mm. Aluminium can be used for nearly all applications, whereas carbon is mostly used for reasons of weight optimisation, and steel tubes are used for applications with extreme demands on rigidity.

Standard aluminium solution
Carbon tube (upon request without core)

Steel tubes for special applications
Cross Joints
The frames are joined by means of GNK or GSK series clamps. The middle part provides for exact alignment of the tubes, while two clamping points each allow for separate assembly and mounting of the tubes. By positioning the gap at clamping points diagonally, a distortion of the tube can be avoided when tightening the clamps. Further characteristics:
- Material: High-strength aluminium alloy (tensile strength 320 N/mm²)
- Integrated measuring drilling processes ø 8 H7 for 3D verification
- High-precision axle tolerance < 0°5’

The GSK series is identical in design to the GNK series but additionally anodized in black and equipped with a lasered angular position measuring scale. In connection with a set collar, it can therefore be visually verified at any given time, if the tube, for instance, after a crash, has moved from its original position. Moreover, flush-mounted screw heads provide for a more compact interference contour and therefore minimise the risk of collision.

Current combinations – GNK/GSK 60-40, 60-25, 40, 40, 40-25
Frames
Depending on the size of the components, three basic frame designs are available which can be adjusted variably.

**Single Traverse**

![Single Traverse Frame Diagram]

**Dual Traverse**

![Dual Traverse Frame Diagram]
The connecting elements of the TÜNkers® round tube system can be combined with TÜNkers® clamps and locating pin cylinders. Due to the dimensions and the weight it is recommendable to integrate size 40 products and in special cases size 50. Three model connection variant types for clamps are shown in the following.

**Pneumatic Clamps**
- TÜNkers® GK series
- TÜNkers® Alpha series
- TÜNkers® K series
- TÜNkers® V series

**Underbody Clamps**
- TÜNkers® UZ series

**Retractable Locating Pins**
- TÜNkers® SZK series
- TÜNkers® SZKD series

**Special Cases**
- TÜNkers® PG series

Further information on the above-mentioned types is available in separate brochures and upon request.
Three options of clamp connections
Subject to technical changes. Data sheets and CAD data upon request.
Round Tube Systems

Overview of different clamp adaptors

Subject to technical changes. Data sheets and CAD data upon request.
Fixed Centring

For positioning components at the gripper via centring pin

Suction Units

For locating components via vacuum technology

Component Sensing

For component sensing
Locator NC block

Aiding the positioning of components

GAW

Subject to technical changes. Data sheets and CAD data upon request.
GNXK Cross joints for GR 25

Valve Plate / Module Plate

For the integration of valves, modules, valve terminals, vacuum units

Adjustment Plates

The variant types shown give a brief survey of basic assembly groups which are known in usual gripper systems. We would be pleased to present you with our catalogue of all components, data sheets and CAD data upon request.

Subject to technical changes. Data sheets and CAD data upon request.
Handling / Process / Geometry Grippers

*Handling Task* – e.g. transfer of component from fixture A to fixture B
Robust base frame – Combination with K40.1 clamps, SZK40 retractable locating pin cylinders, component sensors

*Process Task* – e.g. welding gun operation
Integration of locator NC block and pins for precise alignment of components

*Gripper Geometry Production Task* - e.g. welding of two loose components in the gripper unit
High precision due to solid design and a large number of locator NC block safeguarding precision

Subject to technical changes. Data sheets and CAD data upon request.
Example of a geometry gripper on round tube basis

Design and production at TÜNKERS® / Project Daimler W203 Sindelfingen
Subject to technical changes. Data sheets and CAD data upon request.
Carbon Tube Systems
An elitist material which was reserved for the aerospace and racing industry until a few years ago, carbon or CFRP established itself as the material for light-weight applications. Due to increasing weight problems of robotic applications, the TÜNKERS® carbon tube system is a serious alternative to aluminium systems.

**Reasons for the use of carbon in connection with robotic cells**

**Key Factor Weight**

- No distortion
- Low investment as to robots
- No maintenance
- High precision
- Short cycle time
- No vibration

The weight of a gripper is the key to the functionality and performance of gripper systems and robotic cells.

**Increased demands on robotic applications**

**Performance**

- short cycle time
- wider depth of throat
- higher output

*Increased demands on the robot*

**Process**

- extended range of functions
- new processes
- Processing of several component variant types
- additional underbody assembly groups and components in gripper systems

*More weight*
TÜNKERS® Carbon – The Solution for Weight Optimisation and Cost Saving

As early as at the start of the project phase, the maximal admissible weight class is defined through determination of the robot type without knowledge of the weight of the relevant component or gripper.

If this weight class is exceeded by the gripper solution conceived for the actual application case, design engineers can, next to punctual measures for weight optimisation, only resort to larger robots with negative consequences as to investment, space requirements and cycle time.

With actual potentials for weight reduction of up to 50 % TÜNKERS® carbon grippers offer a real alternative and create new constructive scope in the form of complete systems and hybrid solutions where carbon components can be integrated with aluminium in composite design.

This is possible due to the universal TÜNKERS® round tube concept which allows for aluminium, steel and carbon components to be combined with each other flexibly owing to standardised dimensions.

<table>
<thead>
<tr>
<th>Heavy grippers</th>
<th>Light grippers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large, expensive robots</td>
<td>Small, favourably priced robots</td>
</tr>
<tr>
<td>Long cycle time</td>
<td>Short cycle time</td>
</tr>
<tr>
<td>Lower output</td>
<td>Higher output</td>
</tr>
<tr>
<td>High robotic workload</td>
<td>Low robotic workload</td>
</tr>
</tbody>
</table>

Increased demands on process and performance

Ideal material for weight reduction  

Carbon

Smaller investment

Lower process cost

Lower maintenance cost

Generation of higher quantities
General Material Properties of Carbon

<table>
<thead>
<tr>
<th>Material</th>
<th>Ultimate tensile strength (GPa)</th>
<th>Modulus of elasticity (GPa)</th>
<th>Density (g/ccm)</th>
<th>Specific rigidity (GPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard carbon</td>
<td>0.5</td>
<td>220</td>
<td>1.7</td>
<td>2</td>
</tr>
<tr>
<td>High-strength steel</td>
<td>1.3</td>
<td>210</td>
<td>7.6</td>
<td>0.17</td>
</tr>
<tr>
<td>Aluminium</td>
<td>0.1</td>
<td>70</td>
<td>2.7</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Exact values are subject to relevant alloy.

Standard carbon is 3x more resilient and 4x lighter than steel.

Additional characteristics in comparison with steel or aluminium

- First-rate relation of rigidity and weight (low weight, high tensile strength)
- High E modulus, high resistance, rigidity and dynamic load-bearing capacity
- Good vibration absorption and dimensional accuracy
- Heat and corrosion resistant (minimal thermal expansion)
- Minimal thermal expansion
- High breaking limit in case of collapse, high degree of dependability
Comprehensive tests have shown that standard CFRP semi-finished parts are absolutely unsuitable for the design of modular gripper systems. As to texture, winding and supporting material, the patented Tünkers® carbon modules take the forces generated by robotic grippers with high dynamic loads into account.

**Carbon Tubes**

**GRC 25 / GRC 40 / GRC 60**

<table>
<thead>
<tr>
<th>Tube (mm)</th>
<th>Steel (kg/m)</th>
<th>Aluminium (kg/m)</th>
<th>Carbon (kg/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>1.63</td>
<td>1.40</td>
<td>0.27</td>
</tr>
<tr>
<td>40</td>
<td>2.31</td>
<td>1.65</td>
<td>0.40</td>
</tr>
<tr>
<td>60</td>
<td>4.87</td>
<td>2.97</td>
<td>0.76</td>
</tr>
</tbody>
</table>

*Weight comparison of steel tube – aluminium tube – carbon tube*

**Carbon Joints**

*Exploded view GKC 40-40_1 Aluminium Carbon*
### Carbon Joints

#### Aluminium

- Design with optimised rigidity
- Smaller outer dimensions – less risk of collision
- Identical micrometric measurements for easy exchange

#### Carbon

- 56%

#### Weight Comparison Aluminium Joint

<table>
<thead>
<tr>
<th>Aluminium</th>
<th>Carbon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1270 g</td>
<td>560 g</td>
</tr>
</tbody>
</table>

### Application examples

- Various complex mechanical systems showcasing the benefits of carbon joints over aluminium joints.

Subject to technical changes. Data sheets and CAD data upon request.
Square Tube Systems
Derived from the concept of automotive bodies with rigid occupant cells and flexible crumple zones, the idea of a stable system core and flexible outriggers with the patented TÜNKERS® square tube system has been transferred to handling grippers.

The base frame is form-closed and constructed of square tubes. In case of a crash it contributes to improved geometry stabilisation. Moreover, the tubes are equipped with a hole pattern which makes the positioning of the connectors via locating pins easier. This option is recommendable for applications in which increased importance is attached to the retention of the geometry of the base frame.

**Tubes and clamps**

The square tubes are available in the dimensions 50 x 50 mm (GVR 50) and are flanged to the base plate of the gripper. Other than this the components shown in chapter “TÜNKERS® Round Tube System” are used via a combined circular-square joint (GNK 50-40).

**Application example**
The Euro-Gripper system was developed by the Euro-Gripper research group (current members: Audi, BMW, Daimler, Porsche, Volkswagen) and is exclusively intended for the use of the plants of these OEM. The concept is based on an octagonal profile which facilitates modular integration of clamping and centring units for grippers in body-in-white via connectors, adapters and tubes.

Next to uniformly used standard components, the specific designs differ from OEM to OEM. Consequentially, there is a basic catalogue differentiated by each OEM.

Tünkers® - Licensed Manufacturer of EGT Components and EGT Systems

Tünkers® - is a licensed manufacturer of EGT components and supplier of complete systems The use and marketing of Euro-Gripper Tooling is currently restricted to the OEMs participating in the research group. The current CAD data and Euro Gripper Tooling catalogues are available from the OEMs directly. We would be happy to assist you with any questions on the systems and arrange for communication with the contact partners of the research group.

Examples of EGT Components and EGT Assembly Groups

Examples of EGT profiles and connecting elements

Examples for profile connecting elements and connectors

Example of assembled connecting elements
Example of clamp connections

Examples from practice

Specification Volkswagen

Specification Audi

Specification BMW

Specification Daimler
Special Solutions
Customised Solutions in Accordance with Customer Specifications

In addition to the standard programmes we offer customised solutions for handling systems, including special applications such as fixtures.

- Manipulator – Round tube basis
- Gripper – Composite Design
  Carbon/Aluminium
- Manually-operated fixture – Round tube basis
- Mecatron System
- Customised Fixture

Subject to technical changes. Data sheets and CAD data upon request.
Current Product Catalogue

We would be pleased to provide you regularly with our latest catalogue upon request.

CAD Bibliothek

CAD data in DXF, Autocad and partially in CATIA format available upon call.

TÜNKERS®-Report

We provide you with regular information about new products, applications and solutions regarding the topic of clamping technology and fixture construction.
Clamping

Pneumatically and electrically operated tools for clamping, positioning, position clamping and position holding

Moving

Turnkey systems for sliding, lifting, swivelling and turning of fixture components

Forming

X- and C-frame clamps for punching, clinching, nut piercing, marking and embossing

Welding

Toggle-joint welding tongs for spot welding tasks as stationary, pedestal and manual unit

Gripping

Robotic grippers in modular design for handling of car body components with respect to transport tasks, welding functions and in the form of complete geometry stations

Rotating

Expert indexing rotary tables and trunnion drives for dynamic indexing of heavy loads