

Efficient Fast Accurate

Robotic Material Separation

DUO Machinery Equipment (Shanghai) Co.,Ltd

www.duoshanghai.com

DUO

DUO Machinery Equipment (Shanghai) Co Ltd. We provide the automotive, aerospace and composite industries with smart and cost efficient 3D Robotic Solutions for material separation. Our turnkey systems with Fanuc & ABB robots are used for:

- Waterjet cutting (pure water & abrasive)
- Waterjet cleaning & surface preparation
- Routing (Milling)
- Ultrasonic cutting
- Laser cutting

DUO Shanghai started up in year 2010, our expertise is based on our dedicated team and the founder’ s 25 years waterjet & robotic experience, including 20 years combined with Flow Europe in Germany and KMT Robotic Solutions (now DRS, formerly ABB Ingersoll Rand JV), part of that as KMT Shanghai’ s General Manager.

The applications in the industry include soft automotive interior trims materials such as carpets, headliners, trunk liners and various insulations. Some customers cut as well advanced materials like fiberglass, carbon fiber and other modern composites as well as thin metal alloys.

Our high productivity waterjet systems are the benchmark on the Chinese market. Our customer produce accu- rate products with short cycle time; both the high production output and uptime provide them fast return on investment and sustainable profitability at lowest possible cost per part.

Intensifier pump KMT Streamline
Flowrate from 2.3 l/min up to 14.5 l/min
At operating pressure up to 6,000 bar

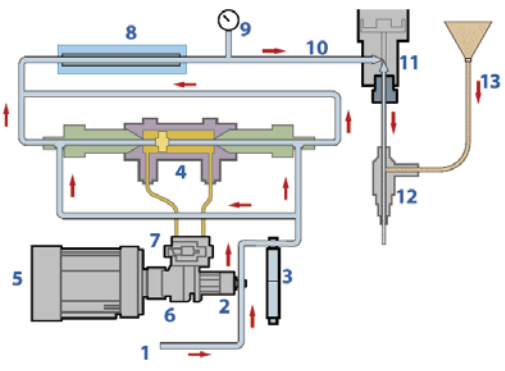
Robot with Waterjet cutting head
with nozzle and high pressure coils kit
for the robot' s axis motion

WATERJET Cutting

High-pressure waterjet is a powerful cutting tool able to cut through a wide range of materials used for automotive soft interior trims such as carpets, headliners, trunk liners, NVH insulations, instruments and door panels as well as thin composite parts.

The energy required for cutting materials is obtained by pressurizing water up to 4,100 bar and forming a fine water stream accelerating up to 900 meter per second when it passes through the nozzle made of sapphire or diamond. The 6 axis robot guides the waterjet cutting head along the part achiev- ng typical cutting speeds of 150 up to 500 mm/sec. for headliners and carpets. The material cut with waterjet remains dry because of the small water quantity (<1.5 liter /min) and very high cutting speed.

1 Water inlet
2 Booster pump
3 Water filter
4 Intensifier
5 Electrical motor
6 Hydraulic pump
7 Shifting valve
8 Attenuator
9 Pressure gauge
10 HP tubing
11 On/off valve
12 Cutting head
13 Abrasive feeder



+ The waterjet can cut many different materials even multi-layers
+ Adaptable process, the robot(s) can cut complex 3 dimensional parts contours
+ Flexible production: the same machine can be used for different parts
+ Clean process, only pressurized water is used, no additive, no dust
+ Cold process, no heat affected zone in the material, no smoke, no fume
+ Omni-directional cutting of contours with very fine cutting kerf.
+ Limited cutting force on the part, low tooling costs as compared to 3D die cutting
+ Fast and accurate, short part cycle times
+ Fully automated, safe and cost efficient production, low cost per pant cut

ABRASIVE WATERJET Cutting

Robotic Abrasive Waterjet Cutting Systems Provide an efficient alternative to conventional machining methods such as sawing, shearing, punching and milling as well as thermal processes including laser and plasma cutting for deburring and cutting castings, forged parts and composite components.

- Stainless steel
- Aluminum
- Brass
- Composites FRP, CRP
- Stone
- Glass
- Ceramic tiles

Benefits of Robotic Abrasive Cutting

+ Flexible process able to cut about any type of material up to 100 mm thickness
+ No heat affected zone, hardening or stress in metals
+ No secondary finishing needed for metals vs. Oxyfuel, Plasma or Laser cutting
+ Material savings: small kerf width
+ Omni-directional cutting of contours
+ Can drill the starting hole directly in the part
+ Limited cutting force on the part
+ Only simple cost effective fixtures needed
+ Rapid and easy part prototyping, ideal for small serials
+ Allow for simple design changes

Robot with rotating head stripping plasma Coating from a cylindrical jet engine part With a turntable

Removing residual paint build-up from an Automotive skid (before & after)

Stripping plasma layer from a jet engine casing

WATERJET Surface Preparation and Cleaning

Robotic surface preparation includes cleaning, deburring, de-coring and stripping all kind of contaminants from parts, carrier assemblies, molds, fixtures or engine using only water. It is environmental friendly and replaces efficiently conventional methods such as mechanical (grinding, scraping), thermal (oven) and chemical (acids, detergent) processes as well as sand or grit blasting.

The water is pressurized up to 3000 bar with a triplex plunger pump or even 4000 bar with intensifier pumps. The robot is used to guide the Waterjet nozzle along the part to process. The Waterjet kinetic energy applied precisely provides fast, efficient and precise removals using the right nozzle configurations adapted to the various applications and part geometries.

Benefits of robotic waterjet cleaning

+ Automated process suitable for complex 3D geometric shapes
+ The process uses only tap water under pressure
+ It is a cold process which does not damage the part itself
+ Containment of the removed coating chips and process water
+ The process can remove a wide variety of substances
+ Replaces manual intensive dirty and dangerous cleaning works
+ Results in a cleaner part than with other cleaning processes

ROUTER Trimming

DUO's robotic router trimming systems are designed to help manufacturers cut more parts per hour, reducing downtime and improving the employee safety. Selecting the right machine configuration with proper routing tool & related process parameters permit to cut high quality parts at finished dimension within tight tolerances.The robot flexibility with its 6 axis permits to reach a part from different directions and its fast air moves provide faster part cycle times than 5 axis CNC will typically achieve.

Robotic routing is a fast and efficient material separation process. The routing bit is set in rotation with a high-speed spindle fixed to the robot wrist. The bit is driven through the part along the contour to be trimmed with up to 40,000 RPM. The router produces a very clean edge in plastics and composites; it can be programmed to cut through the part or trim the material to a predetermined depth (blind holes and pockets).

Applications

+ Plastics PP, ABS, Polycarbonate PC
+ Vynil, Acrylic, wood,
+ Fiberglass, SMC, Gelcoat, FRP & carbon

Benefits of robotic Routing

+ Will machine easily very complex contour geometries and cut accurate holes
+ Router bits cut cleanly through thick materials without leaving burrs.
+ Faster cycle time than CNC due to time savings with quick robot air moves
+ Robots designed for harsh environment, better dust protection than a CNC
+ Robots require virtually no maintenance as compared to CNC gantries
+ A robotic cell requires much less floor space than a CNC Gantry

LASER Cutting

The Laser beam used for cutting or drilling is generated by a powerful light source based on CO2 Laser or Diode pumped Fiber Laser.

+ Metals & alloys
+ Plastics
+ Composites

Benefits

+ Flexible: will cut various materials
+ No contact between the tool and the part
+ No cutting forces on the part.
+ Material savings: small kerf width
+ Fast and accurate, short cycle times
+ Very limited noise generation

ULTRASONIC Cutting

The robot mounted ultrasonic blade is set under high frequency vibrations generated by the oscillator and penetrates the part to cut.

+ Rubbers & polyurethane foams
+ Woven and non woven fabrics

Benefits

+ Flexible: will cut various materials
+ Generates a high quality smooth edge
+ Silent process, no noise generation
+ No air contamination, almost no dust
+ Material saving: small kerf width
+ Low running and maintenance cost
+ Improved working place safety

ROBOTIC Turnkey Systems

Our systems are designed as modular platform and each machine concept described beneath can be used and easily customized for the various processes described above.

DUO Turntable Gantry - LRT

The operator loads the part on the worktable outside whilst the robot(s) cut the part inside the cell. The turnwall with dual worktables indexes 180° to bring the part to cut into the cell.

+ Ideal for large parts (carpets, headliners, etc…)
+ Available with several robots for short cycle time
+ Inverted robot Fanuc M20iA or ABB 2400 / 1600
+ Offline part loading for minimum downtime
+ The machine cuts 2 different parts alternatively
+ Single loading area, footprint under 60 m2
+ Single operator keeps manpower cost down
+ Available as open gantry with optional enclosure
+ Vacuum system holds the part & collects cut-outs
+ Many available options, easy to customize

DUO Turntable compact - SRT

+ Same principle as above but designed for small parts under 2.000 mm in length.
+ Ideal for instrument and door panels
+ Available with 1, 2 robots
+ Floor mounted Fanuc M20iA or ABB 2400
+ Offline loading for minimum downtime
+ The machine cuts 2 different parts alternatively
+ Single loading area, footprint under 45 m2
+ Single operator keeps manpower cost down
+ Vacuum system hold the part & collects cut-outs
+ Many available options, easy to customize

Siemens HMI Touchscreen Display
User friendly and easy to learn menu with key functions to control the robotic system. Modular software with easy customization.

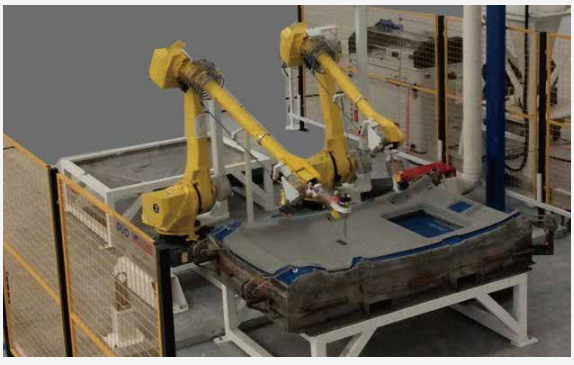
Automatic Tool Center Point Calibration
Automatic TCP checking procedure with self recalibration of the robot in case of offset (for instance after Maintenance or Collisio)

DUO Fixed Table Gantry - LFT

The operator loads the part on the fixed worktable in

the machine, goes out and the robot(s) cut the part.

+ Ideal for large parts (carpets, headliners, etc…)
+ Available with up to 4 robots for short cycle time
+ Inverted robot Fanuc M20iA or ABB 2400 or 1600
+ Offline part loading for minimum downtime
+ Compact footprint under 40 m2
+ Available as open gantry, optional rolling doors
+ Vacuum system holds the part and collects cut-outs
+ Many available options, easy to customize



DUO Open System – 2FT

+ The operator loads the part on one of the fixed worktable, the floor mounted robot cut on the other worktable.
+ Offline part loading for minimum downtime
+ Ideal for large parts
+ Available with 1 or 2 robots
+ With Fanuc M710iC/20 or ABB 4600
+ Dual loading area, about 90 m2 footprint
+ Vacuum system holds the part and collects cut-outs
+ Simple design

OPTIONS

1. **Additional robot:** will nearly double the productivity by limited addi¬tional investment and operating costs. Fast return on investment with higher part output & lower cost per part.

2. **Interchangeable fixture frame:** stiff, self- centering stainless steel pallet, repeatable location, less than 10 minutes downtime for changing fixture

3. **Fixture identification coding plug:** the robot identify the part auto¬matically and selects the right program when changing the fixture. Less downtime, avoids expensive collision due to operator mistake

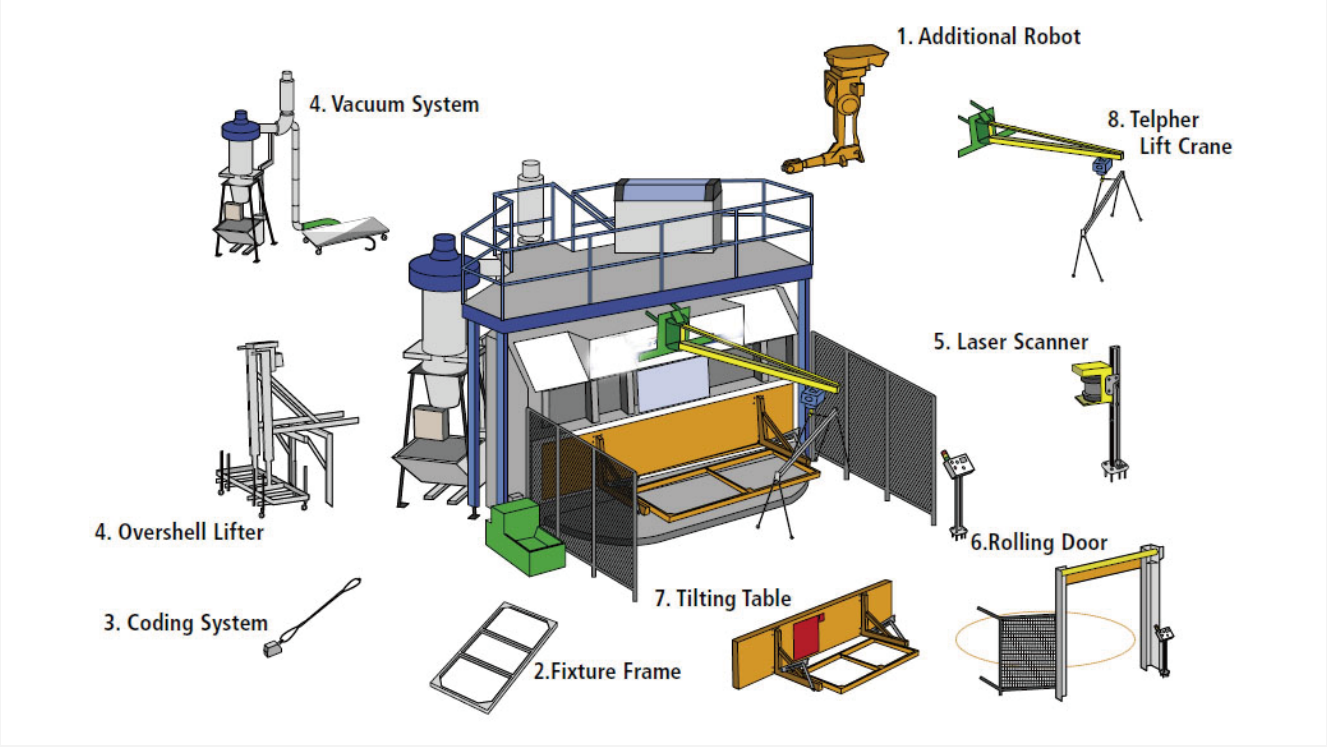
4. **Vacuum system or overshell-lifter:**
   Vacuum: suitable for most carpets and headliners
   Vacuum cups can be used on non-porous stiff parts.
   Overshell system: permits to lift and drop the over-shell used to press the part down whilst cutting.

5. **Laser scanners:** improved safety controlling the presence of an operator behind the rolling door or the light curtains.

6. **Automatic rolling door:** rallows the operator panel to be located closer to the worktable, reducing the footprint and saving the operator walking distance and time for the loading procedure.

7. **Tilting table**
   Better ergonomy for loading large heavy parts such as automotive foamed carpets.

8. **Telpher lift arm**
   Enables safe and easy handling of the fixtures with an electrical lifting hoist, simplifies the fixture position¬ing on the worktable.



VISION System

The robot mounted Camera with the Laser Measurement identifies the position the details to cut, used for parts not consistent in shape and geometry. The software automatically recalibrates the program setting the cutting path at the right place. This device saves the user a lot of time and money avoiding to cut “scrap parts” or reworking some bad parts later on.

SERVICES

Fast installation, smooth start-up
Our systems are fully tested before shipping and normally up and running after 5 days commissioning at customers’ plant. We provide robot programming and maintenance training during the second week.

Time savings and flexibility
Our integrated gantry systems permit to program the robot(s) before shipping, the machine can be easily transported to the installation site without any impact on the accuracy of the robot programs.

Ergonomics & Safety in production
Making our systems safe and easy to use for the operator and the robot programmer are our major priorities when it comes to design.

Risk analysis process
The machine will be designed and configured with the right functions and features considering its production environment in order to optimize the material flow and avoid any danger in operation.

Customers support
Our customers work globally, wherever the automotive manufac¬turers assemble their cars. We support them via our own global service organization in coop¬eration with the robot supplier.

Refresher training
Keeping the best trained staff at peak efficiency is the key to success for our customers; we offer refresher courses for robot programming, process and maintenance of the equipment.

Productivity and cost efficiency
We support our customers to achieve their main targets: shortest possible part cycle time, high uptime and affordable running costs.

Fast return on investment
An efficient robotic system with high production output volume with constant parts quality means a low cost per part and a good profitability with fast return on investment for our customers.

Robotic Material Separation