



Introduction to Metal Processing Technology



Dalian Guli Electromechanical Technology Co., LTD.

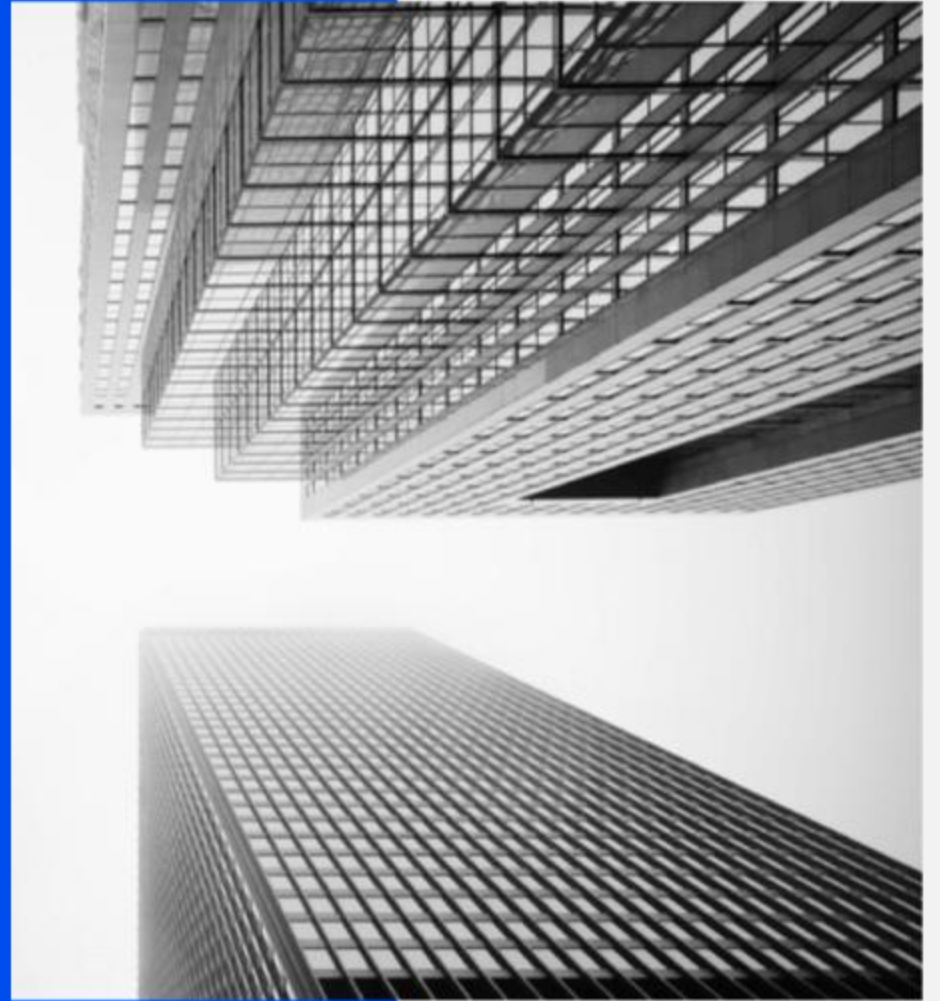
CATALOGUE

- Laser cutting technology
- Sheet metal bending process
- Discussion on three-dimensional pipe bending technology
- Machining methods and equipment
- Wire cutting processing technology
- Introduction to customized non-standard metal services

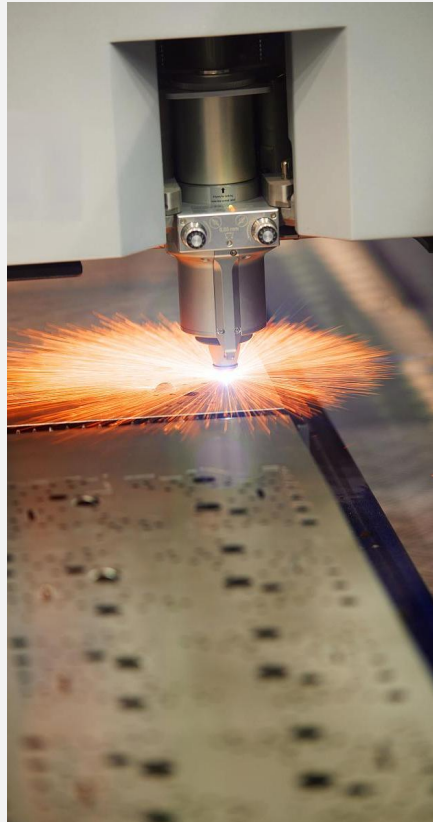
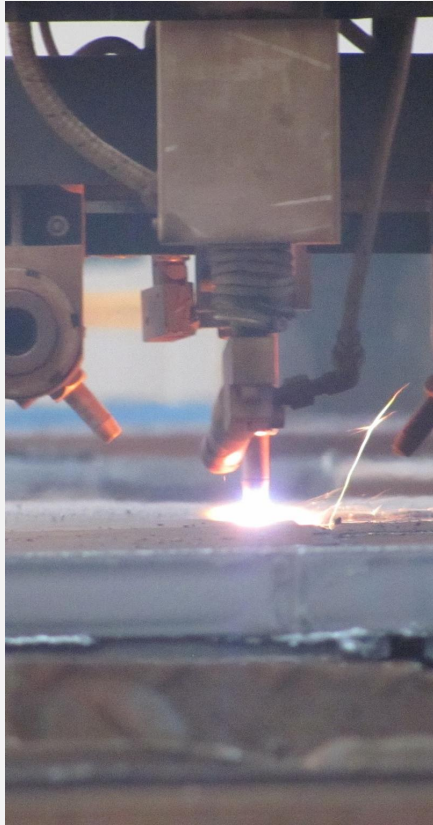


01

Laser cutting technology



The principle and characteristics of laser cutting



Principle

Laser cutting is a process in which a laser beam with high energy density irradiates the surface of the workpiece, causing the material to melt, vaporize rapidly or reach the ignition point. Meanwhile, the melted or burned products are blown away by a high-speed airflow, thereby achieving the cutting of the workpiece.

Characteristic

High precision, high efficiency, small heat-affected zone, narrow kerf, smooth and burr-free cutting surface, and capable of processing various complex shapes, etc.

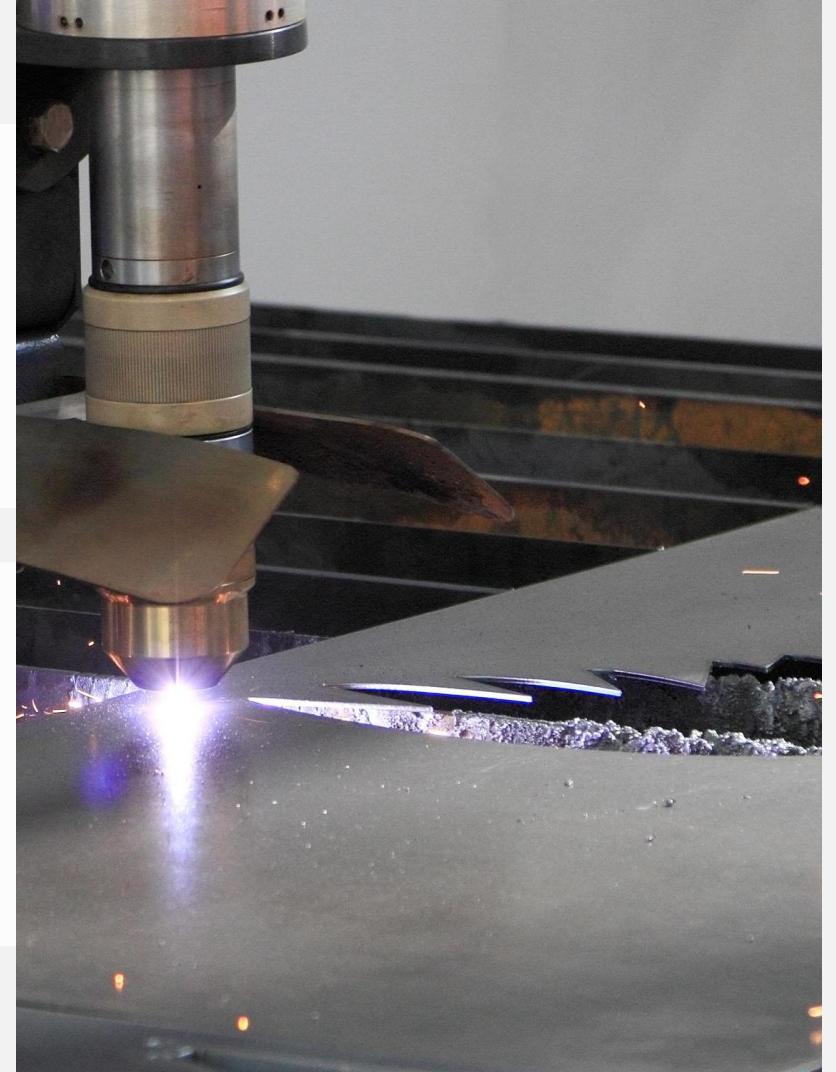
Laser cutting equipment and application fields

Equipment

It mainly includes the laser, the cutting head, the beam transmission system, the numerical control system and the workbench, etc.

Application field

It is widely applied in fields such as automotive manufacturing, shipbuilding, aerospace, electronic industry, petrochemical industry, etc. and is suitable for processing various metal materials, such as carbon steel, stainless steel, aluminum alloy, etc.



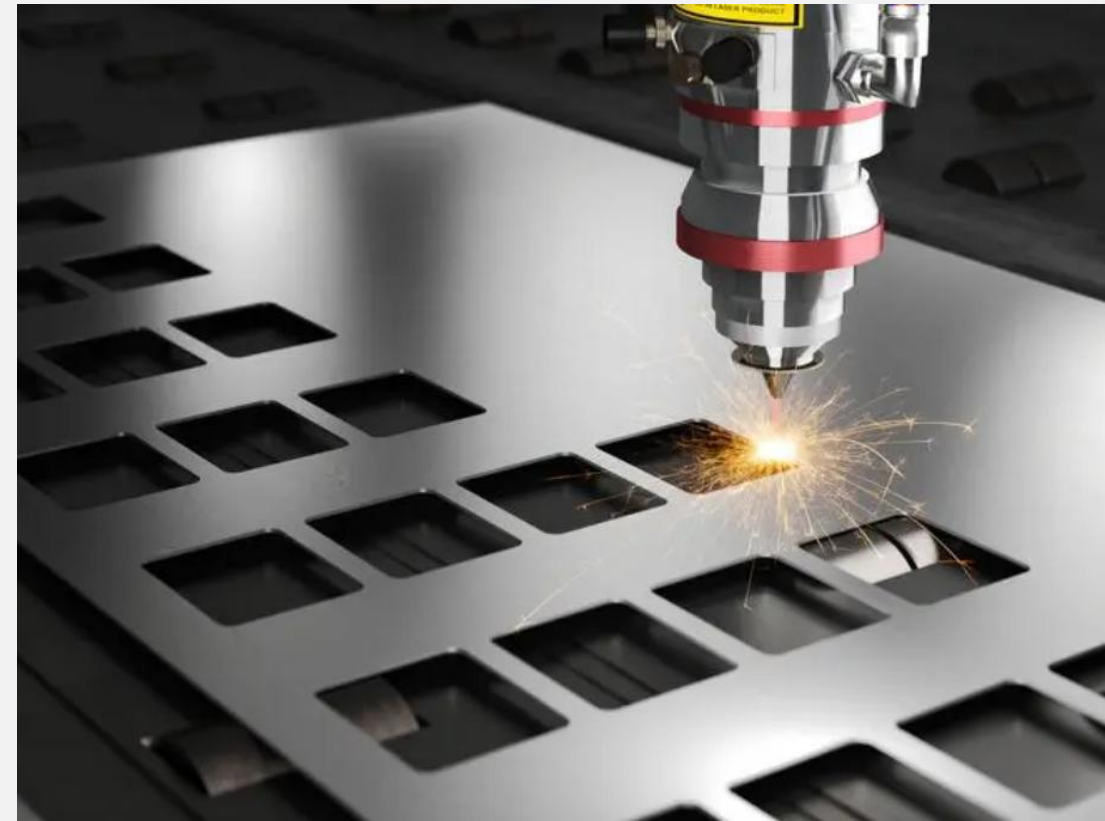
Laser cutting process flow and optimization suggestions

Technological process

Material preparation →
Graphic design →
Programming and typesetting → Laser cutting → Quality inspection → Follow-up processing. ◦

Optimization suggestions

Reasonably select cutting parameters, such as laser power, cutting speed, auxiliary gas pressure, etc.; optimize graphic design to reduce unnecessary idle strokes; regularly maintain and service the equipment to ensure it is in the best condition.



Quality assessment and improvement methods of laser cutting

"Quality assessment"

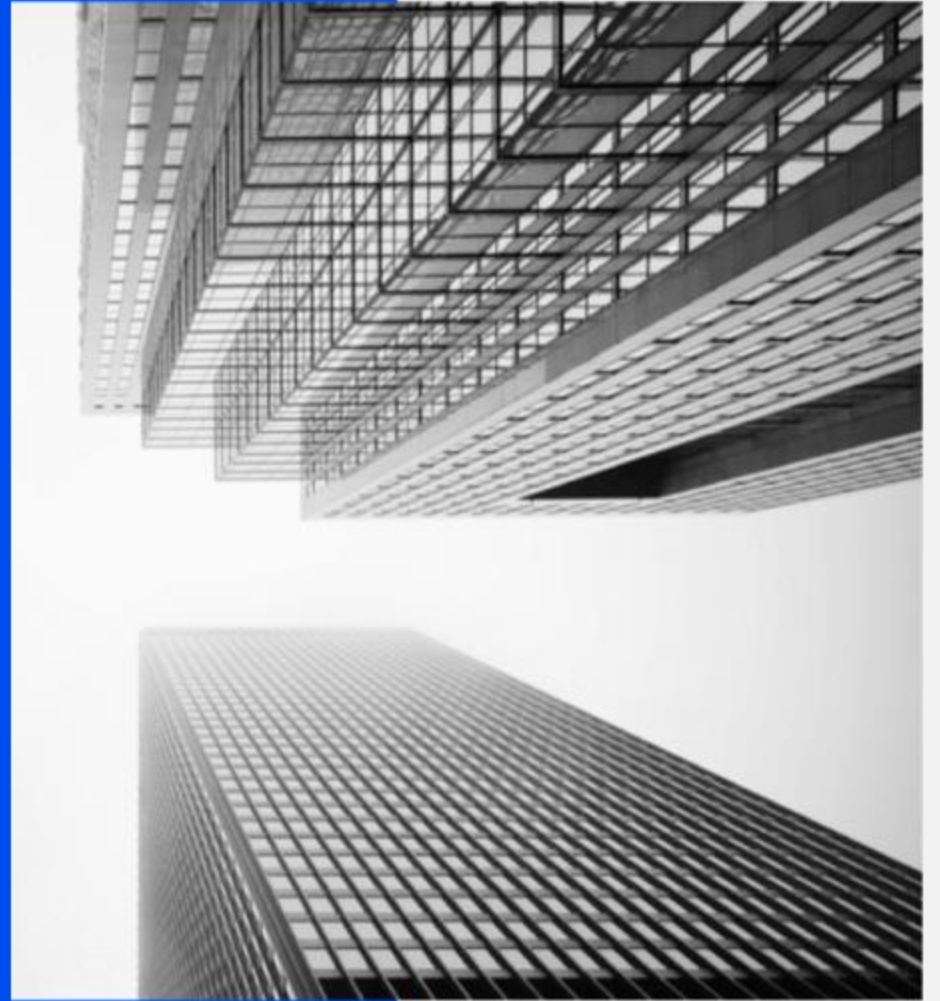
It mainly includes aspects such as the flatness, perpendicularity, roughness of the cutting surface and dimensional accuracy, etc.

Improvement methods

Select high-quality lasers and cutting heads to ensure the beam quality and stability; precisely control the cutting speed and the pressure of the auxiliary gas to obtain the best cutting effect; for special materials or materials with larger thickness, process measures such as multiple cutting or pre-drilling can be adopted to improve the cutting quality.

02

Sheet metal bending process



The Principle of Sheet Metal Bending and Introduction to Equipment



Principle

Sheet metal bending is achieved by placing the metal sheet on a bending machine and utilizing the relative movement of the upper and lower molds to cause plastic deformation of the sheet at the bending radius of the mold, thereby achieving the expected bending angle and shape.

Equipment Introduction

Sheet metal bending machines are usually composed of the machine body, worktable, upper and lower molds, hydraulic system, electrical control system, etc. Among them, the precision and wear resistance of the upper and lower molds have an important influence on the bending quality.

Setting and Adjustment Skills of Bending Process Parameters



Bending angle

Set the bending angle according to the product requirements and achieve it by adjusting the mold clearance and the pressure of the hydraulic system.

Bending radius

The size of the bending radius affects the deformation degree and stress distribution of the sheet, and it needs to be reasonably selected according to the sheet thickness and material.

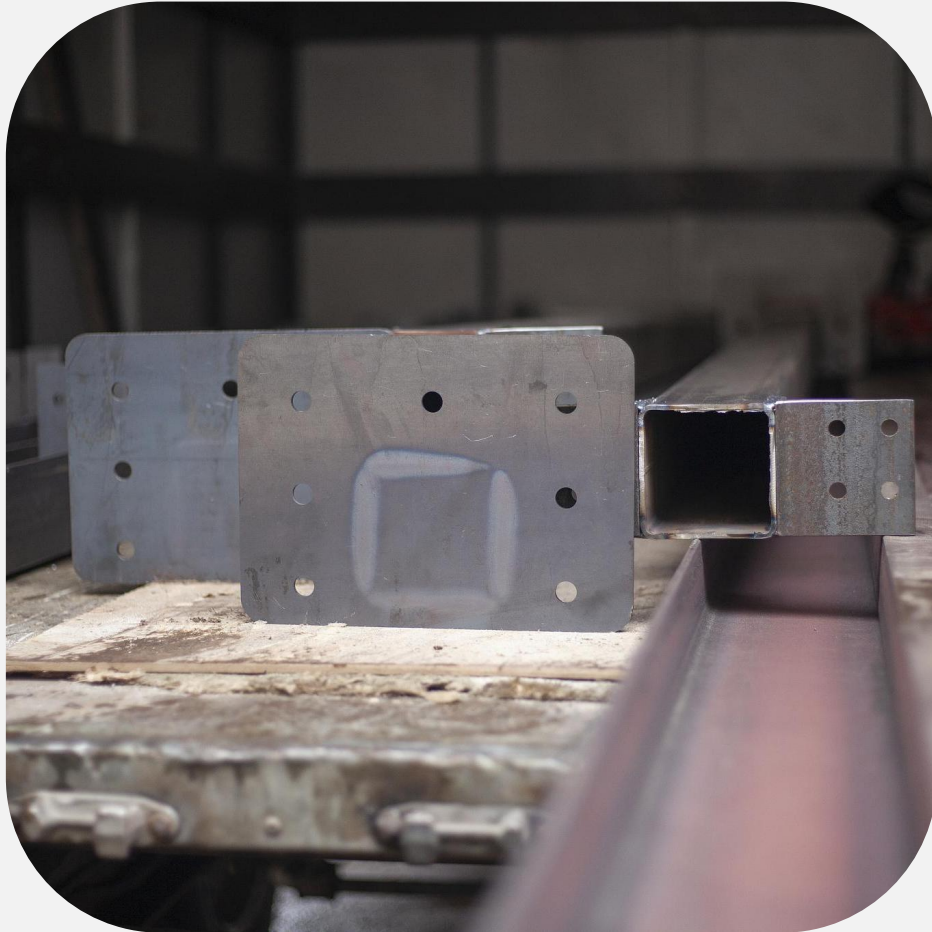
Sheet thickness

Plates of different thicknesses require different bending forces and mold clearances, and the equipment parameters need to be adjusted according to the thickness of the plates.

Sheet material

Plates of different materials have different elasticity and plasticity. Bending process parameters need to be adjusted according to the material characteristics.

Analysis of Common Problems and Solutions



- **The bending angle is inaccurate.**

It may be caused by improper adjustment of the mold clearance, unstable pressure of the hydraulic system, etc. It is necessary to check and adjust the relevant parameters.

- **Cracks appear at the bending part**

It may be caused by reasons such as the plate material being too hard and the bending radius being too small. It is necessary to replace the appropriate plate or adjust the bending radius.

- **Scratches on the surface of the plate**

It may be caused by reasons such as the rough surface of the mold and the incorrect placement of the plate. It is necessary to keep the mold clean and smooth, and ensure the correct placement of the plate.

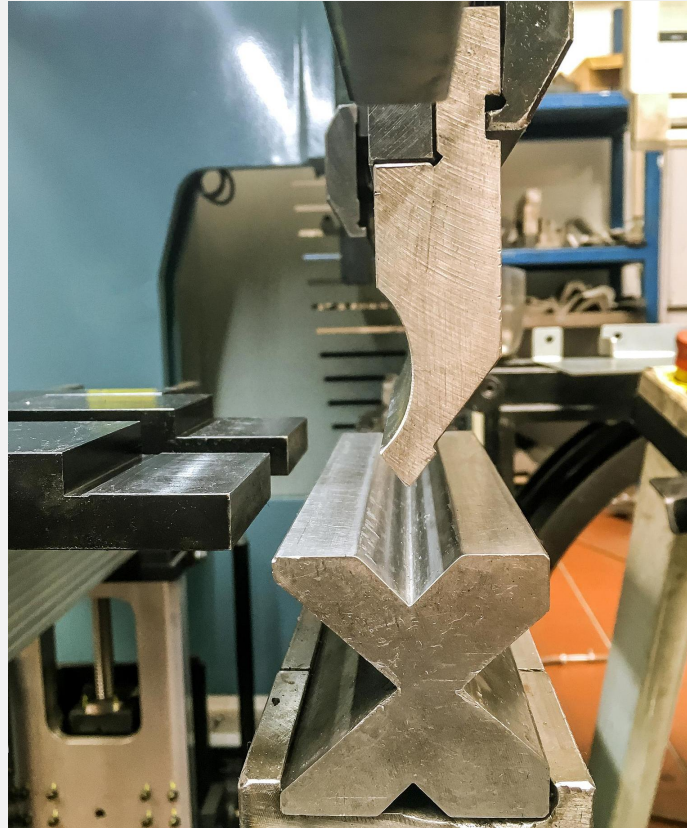
Application examples of sheet metal bending

Home appliance manufacturing

For the manufacturing of the shells of home appliances such as refrigerators and washing machines, the sheet metal bending process is often used for shaping.

Architectural decoration

For the manufacturing of architectural decoration materials such as metal doors and windows, metal partitions, etc., the sheet metal bending process is also often adopted.



Automobile manufacturing

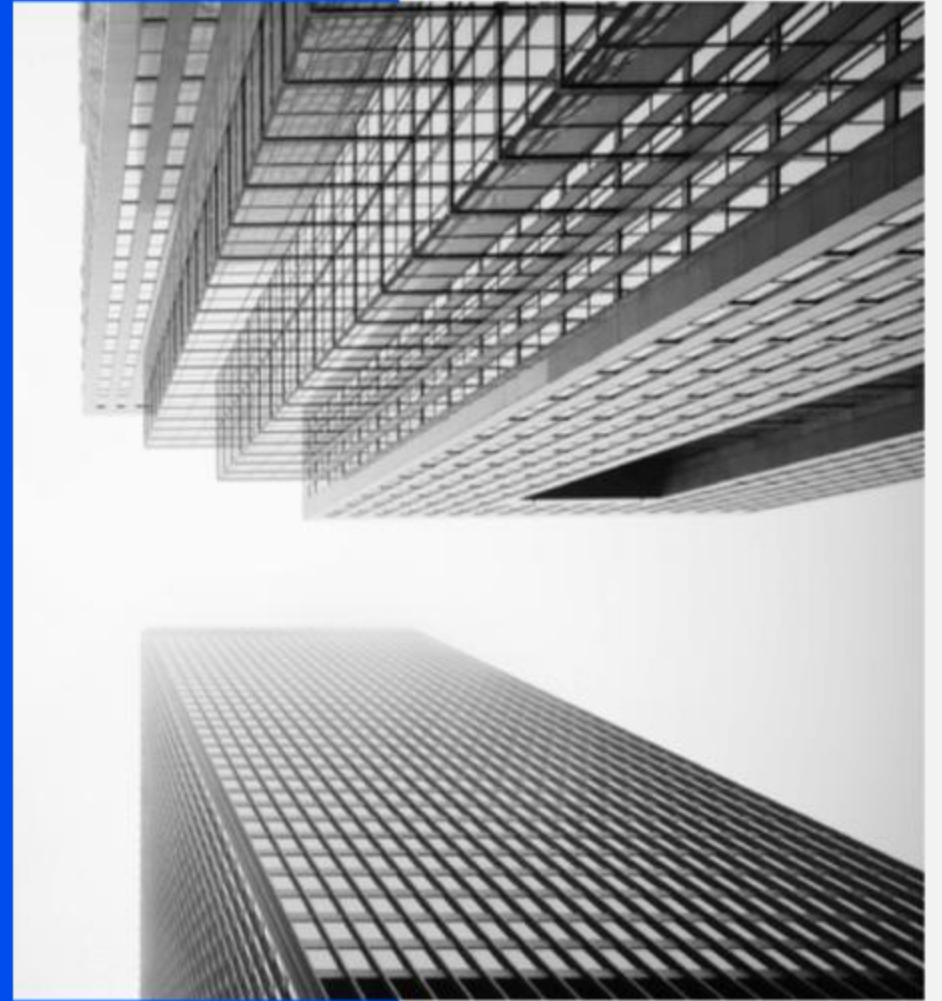
In the manufacturing process of components such as car bodies and car doors, the sheet metal bending process is widely used.

Aerospace

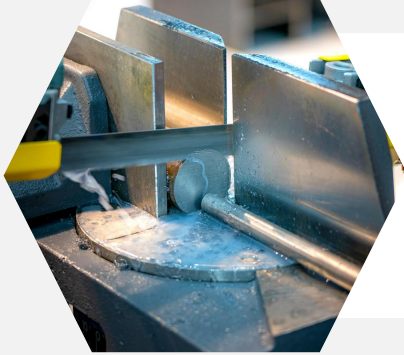
In the aerospace field, the sheet metal bending process is used to manufacture metal components of aircraft, rockets and other aircraft.

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Discussion on Three-Dimensional Pipe Bending Technology



Overview of Principles and Equipment of Three-Dimensional Pipe Bending Technology



Technical Principle:

Bending Principle: The three-dimensional pipe bending technology enables the metal pipe to be bent along a predetermined path in three-dimensional space by controlling the bending mechanism of the pipe bender. This usually involves the bending of the pipe in multiple planes to form complex shapes.

Forming method: According to the pipe material and bending requirements, the three-dimensional pipe bending technology can adopt the methods of cold bending or hot bending. Cold bending is suitable for thinner pipes and materials with good plasticity, while hot bending is suitable for thicker pipes and situations that require a larger bending radius.



Overview of the Principles and Equipment of Three-Dimensional Pipe Bending Technology

Equipment Overview:



Pipe Bender: The three-dimensional pipe bender is the core equipment for achieving pipe bending, usually composed of a control system, a hydraulic system, a bending mechanism, a positioning mechanism, and a pipe bending die, etc. The control system is responsible for setting the bending parameters, the hydraulic system provides power, the bending mechanism realizes the bending of the pipe, the positioning mechanism ensures the stable position of the pipe during the bending process, and the pipe bending die is designed according to the pipe diameter and the bending angle.

Auxiliary equipment: Besides the pipe bender, some auxiliary equipment is also needed, such as pipe cutting machines, grinding machines, heat treatment equipment, etc., for the pre-treatment and post-treatment of pipes.

Analysis of Key Factors in the Pipe Bending Process

Accuracy of the bending die

The accuracy of the bending die directly affects the shape and dimensional accuracy of the bent pipe. During the pipe bending process, it is necessary to select the appropriate bending die according to the pipe diameter and ensure that the accuracy of the bending die meets the requirements.

Bending radius and angle

The bending radius and angle are important parameters in the pipe bending process. A too small bending radius may cause the pipe to deform or rupture, while a too large bending angle may increase the processing difficulty and cost.

Pipeline material

The performance of the pipe material has a significant influence on the quality of the bent pipe. Different materials have different bending properties and springback characteristics, and it is necessary to select the appropriate bending process and parameters according to the material characteristics.

Heat treatment

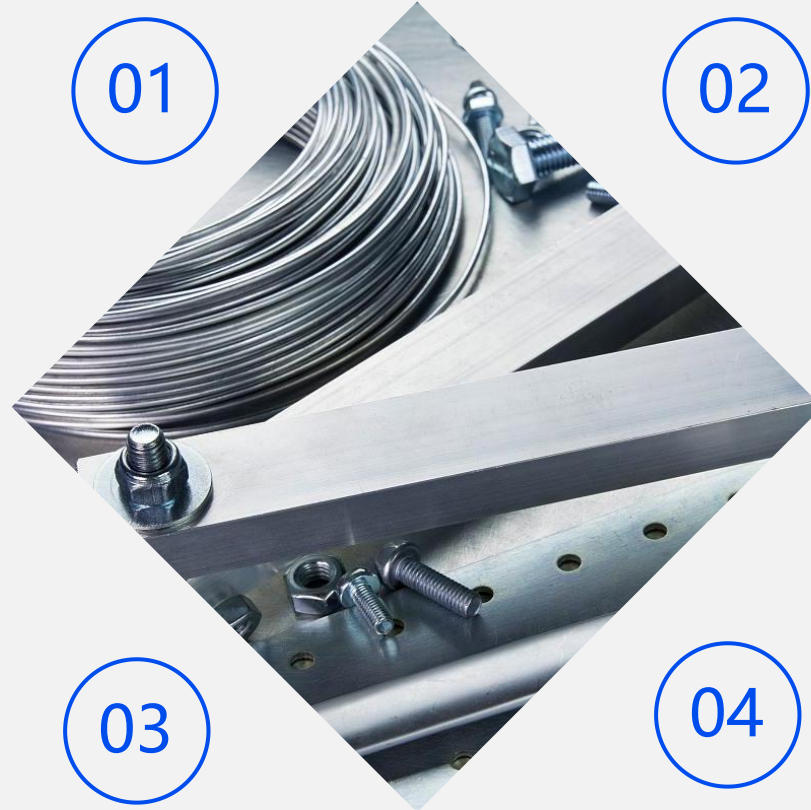
For some bent pipes that require a larger bending radius or higher precision, heat treatment may be necessary to improve the bending performance of the material. Heat treatment can eliminate the residual stress inside the pipe and enhance the plasticity and toughness of the material.

Quality Inspection and Acceptance Standards for Three-Dimensional Pipe Bending

Geometric dimension inspection

It includes the inspection of the dimensions such as the outer diameter, wall thickness, bending radius and bending angle of the pipe. These dimensions should comply with the relevant national standards and design requirements.

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Surface quality inspection

Check whether the surface of the pipeline is smooth, flat and defect-free. Surface defects such as cracks, bubbles and scars should be removed or repaired.

Material quality inspection

Test whether the chemical composition, mechanical properties and other indicators of the pipeline material comply with the relevant standards. Ensure that the quality of the pipeline material meets the design requirements.

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Other precautions

During the acceptance process, factors such as the processing quality of the bent pipe, the flatness of the bending surface, and the service life of the bent pipe should also be considered. Ensure that the quality of the bent pipe meets the engineering requirements.

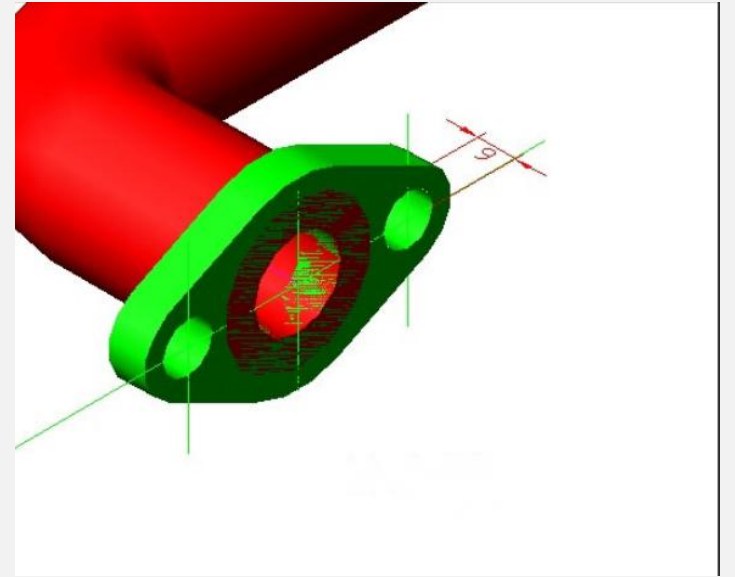
Typical case analysis

Automotive Industry Application

In automotive manufacturing, three-dimensional pipe bending technology is widely used in the manufacturing of pipelines for braking, transmission, steering and other systems. By precisely controlling the parameters and processes of the pipe bending machine, high-quality bent pipes that meet the design requirements can be produced, improving the performance and safety of automobiles.

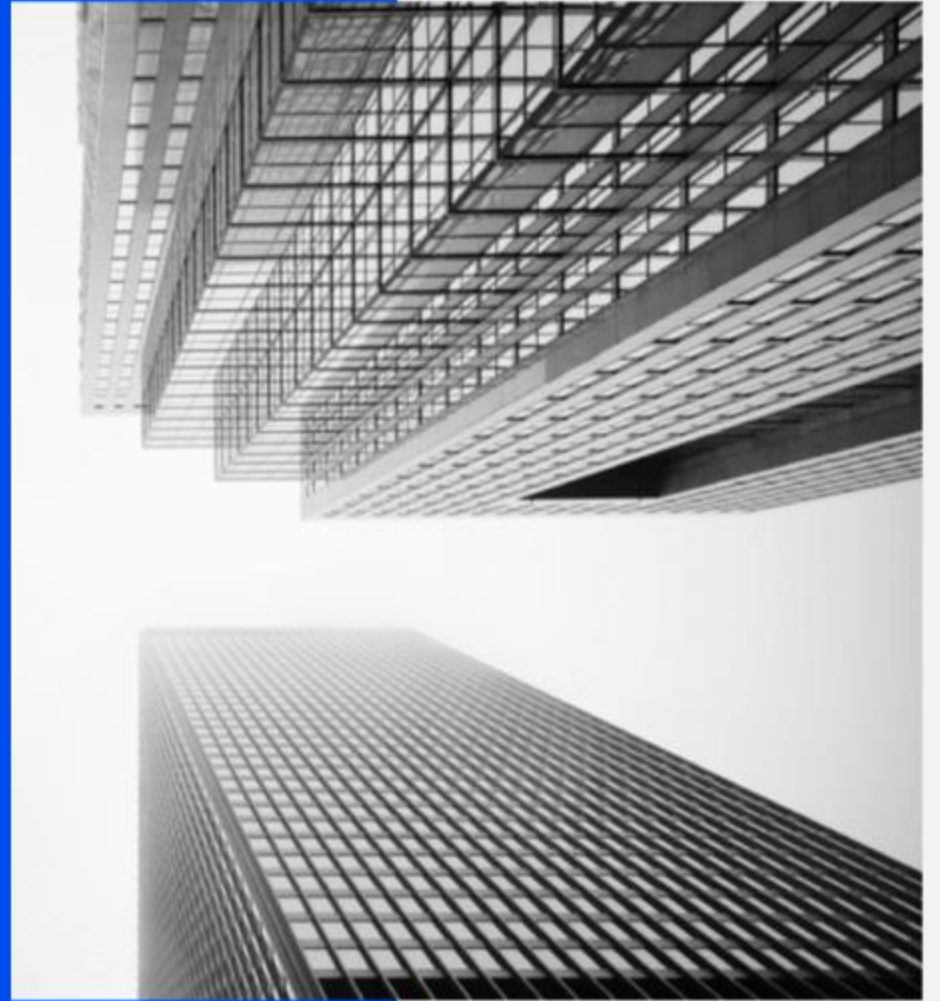
Aerospace field

In the aerospace field, three-dimensional pipe bending technology is used to manufacture various complex pipeline systems. These pipeline systems need to withstand extreme environments such as high temperature and high pressure, so the requirements for the quality and precision of the bent pipes are very high. By adopting advanced pipe bending technologies and equipment, the reliability and safety of the pipeline systems can be ensured.

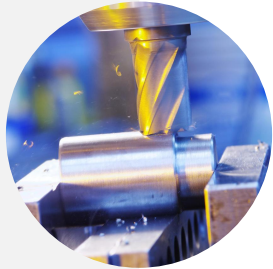


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Machining methods and equipment

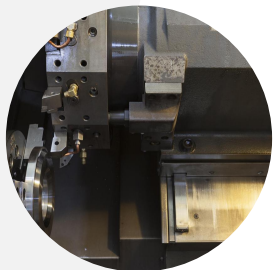


Comparison between Traditional Mechanical Processing and CNC Machine Tools



Process and Procedure :

Traditional mechanical processing: It mainly relies on manual operation by workers, such as lathes, drilling machines, milling machines, etc. Each step requires manual operation and cannot achieve automation.



CNC machine tools: The machine tools are controlled by computer programs for processing, precisely controlling the processing parameters, quickly and efficiently completing the processing operations, and can be automated for batch or large-scale production.

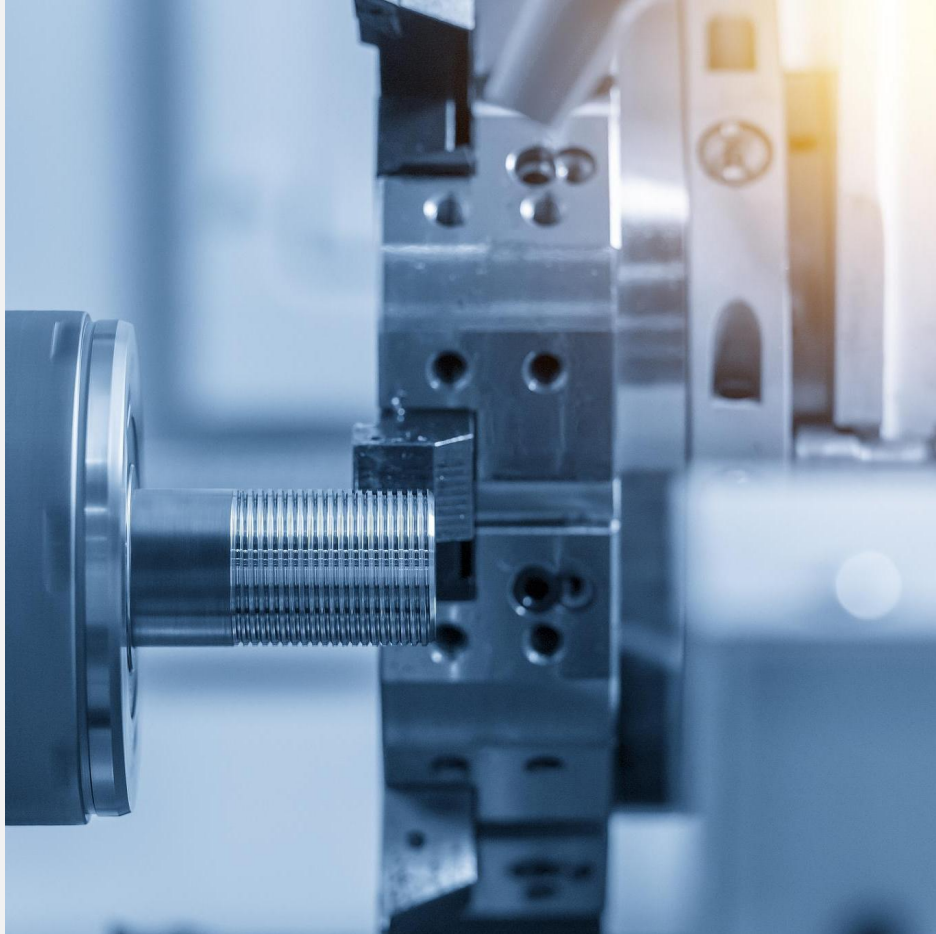
Comparison between traditional mechanical processing and CNC machine tools

Accuracy and Equipment :

- **Traditional mechanical processing:** The accuracy is limited by the technical level of workers. The processing speed is slow, the efficiency is low, and the accuracy and stability of products are difficult to guarantee.
- **CNC machine tools:** Adopting high-precision tools and machine tools, and ensuring processing accuracy through program control, with high precision, good stability, and relatively low cost.



Comparison between Traditional Mechanical Processing and CNC Machine Tools



Production efficiency :

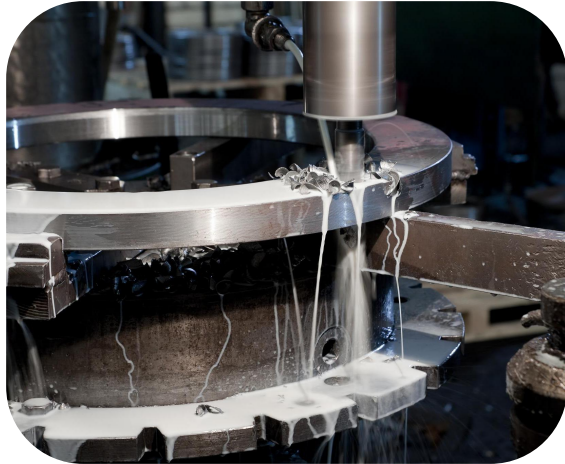
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Traditional mechanical processing: The production efficiency is low and it requires a lot of time and manpower.

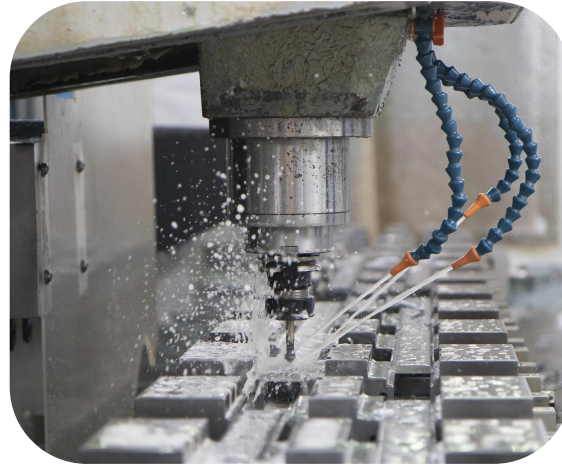
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CNC machine tools: The production efficiency is high, reducing the time of manual intervention and labor costs.

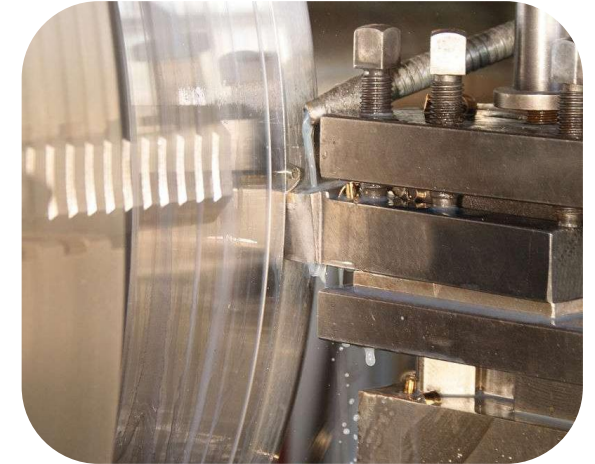
Comparison between Traditional Mechanical Processing and CNC Machine Tools



Scope of application :



Traditional mechanical processing: It is suitable for the processing of simple and small-batch parts.



CNC machine tools: It is suitable for the processing of parts with various complex shapes and in batches, and can be precisely manufactured regardless of size.

Mechanical processing technological process and optimization strategies

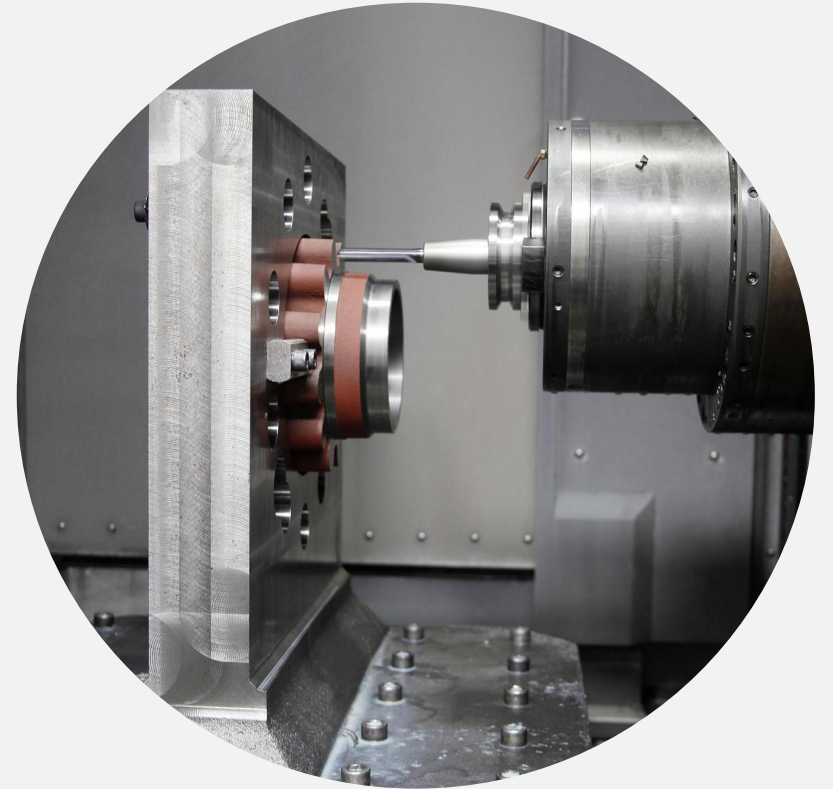
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Analysis and optimization of the design stage:

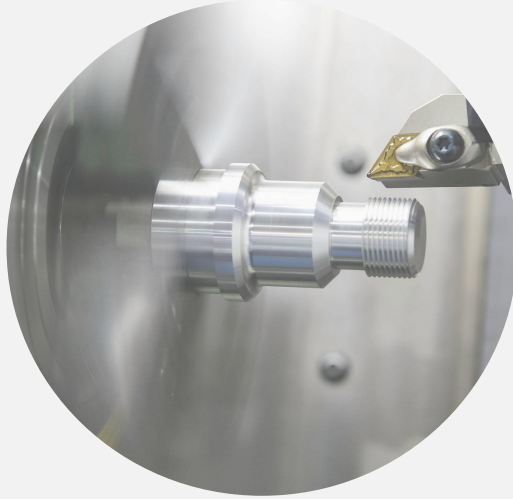
Product design and process design collaborate closely to avoid process bottlenecks caused by the design.

02

Introduce advanced design and simulation software to discover problems in advance and make adjustments.



Mechanical processing technological process and optimization strategies



Introduce reliability engineering and design reviews to improve product stability and reliability.

Mechanical processing technological process and optimization strategies

Optimize the processing technological process :

- Optimize the selection of cutting tools and fixtures to improve processing quality and efficiency.
- Reasonably select the processing methods, and comprehensively consider the product size, shape, material and processing requirements.
- Introduce automation and intelligent technologies to reduce manual intervention and improve production efficiency.



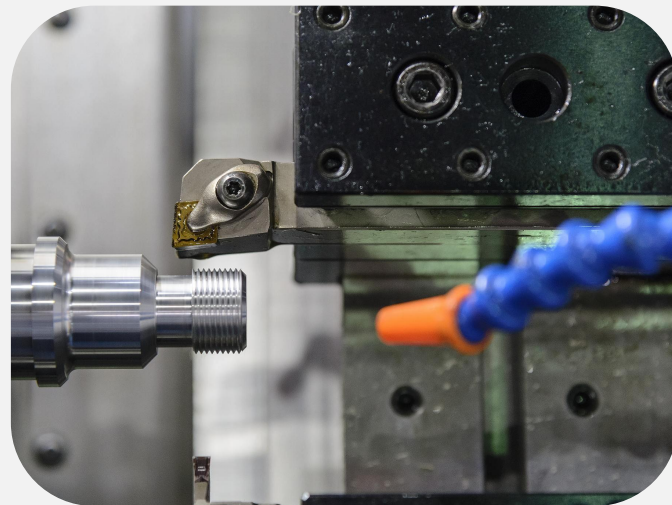
Guidance on Equipment Selection and Parameter Setting

Demand analysis

Clarify the specification parameters, functional requirements, etc. of the required equipment.

Performance requirements

Select equipment with reasonable configuration such as processor, memory, hard disk, etc. according to the work requirements.



Brand reputation and service support

Choose well-known brand equipment to ensure quality and after-sales service.

Durability and maintenance

Choose equipment with good quality and reliability to reduce maintenance and replacement costs.

Forecast of the Development Trend of the Mechanical Processing Industry

Intelligence and Automation

With the development of artificial intelligence and automation technologies, the mechanical processing industry will achieve a higher degree of intelligence and automation.

Environmental protection and energy conservation

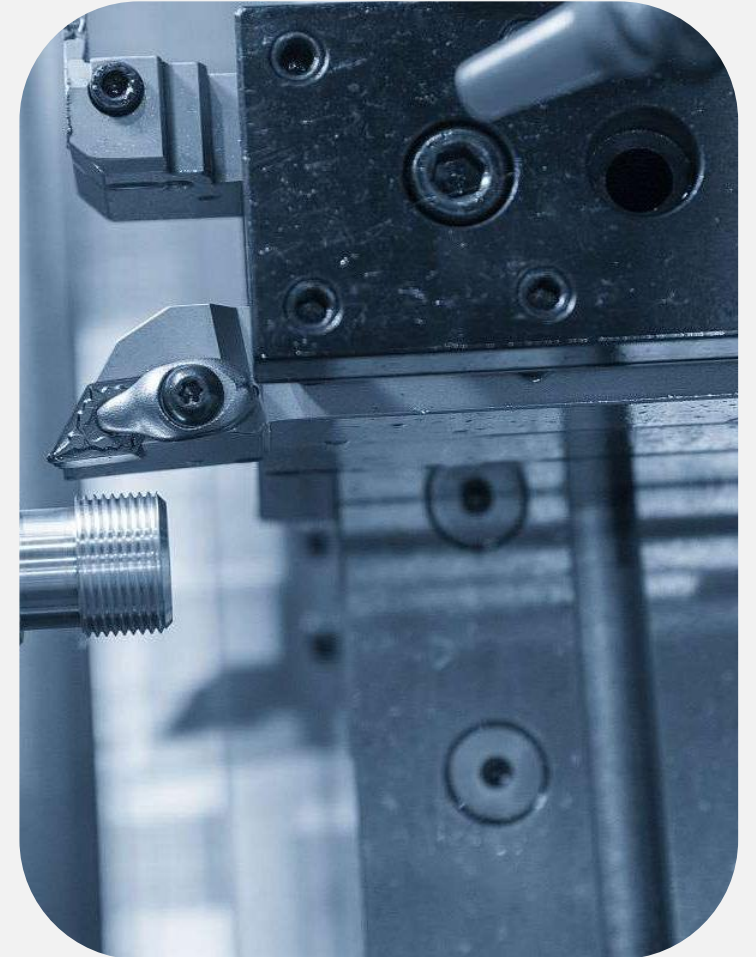
Environmental protection and energy conservation will become important considerations in the mechanical processing industry, promoting the industry to develop in a green and low-carbon direction.

High precision and high efficiency

High precision and high efficiency will become an important development direction of the mechanical processing industry to meet the market demand for high-quality products.

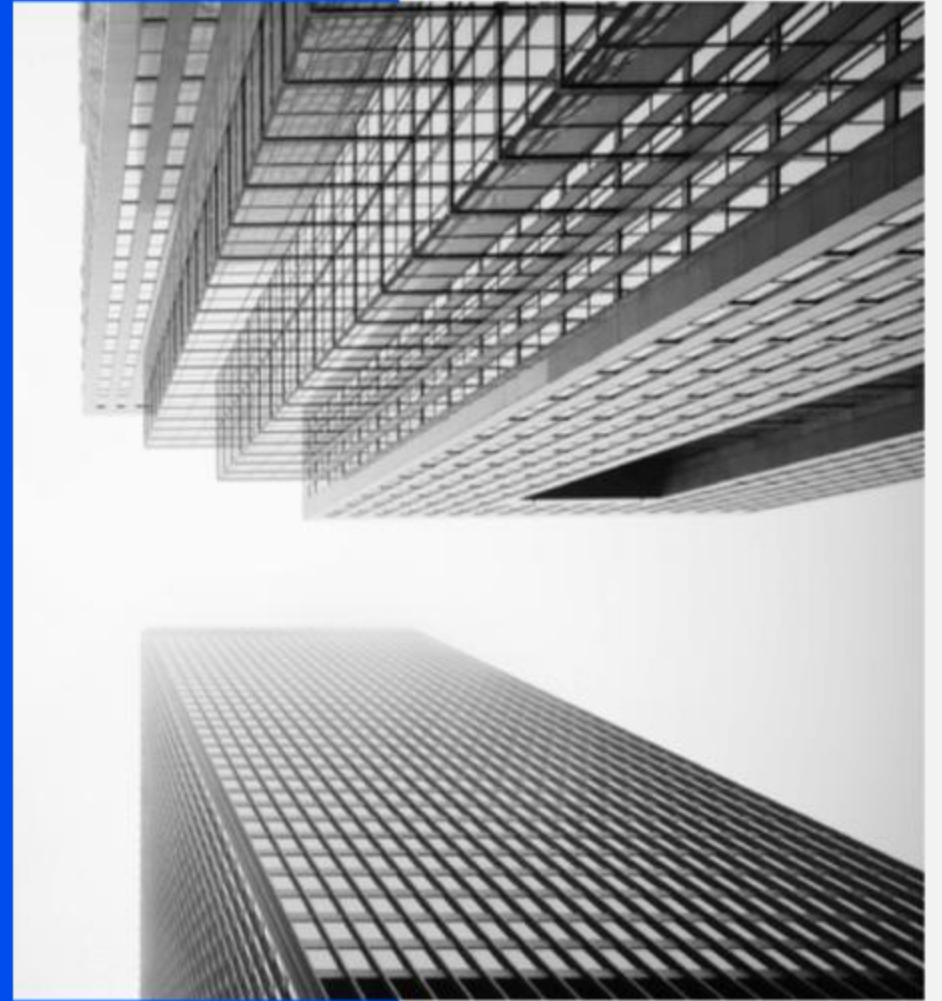
Customization and Personalization

With the diversification of consumer demands, the mechanical processing industry will pay more attention to customized and personalized production to meet the needs of different customers.



05

**Wire cutting
processing
technology**

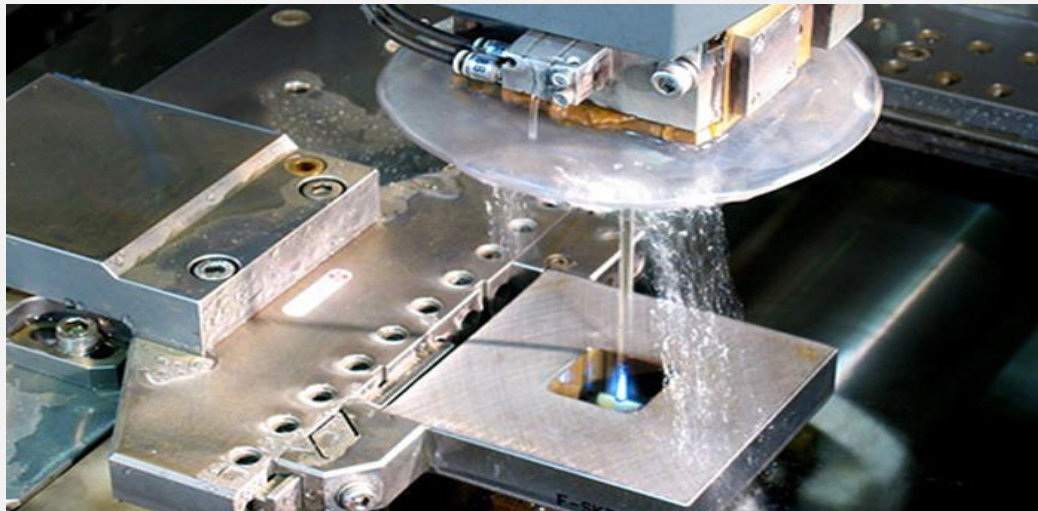


Introduction to the Principle and Characteristics of Wire Cutting Processing



Processing principle

Wire cutting processing utilizes a continuously moving thin metal wire (referred to as the electrode wire) as the electrode to perform pulsed spark discharge on the workpiece to erode the metal and achieve cutting and shaping.



Characteristic

High precision, high efficiency, high automation, wide processing range, and suitable for the processing of various conductive materials.

The structure and operation guide of wire cutting equipment



01 Equipment Structure

It mainly includes parts such as the main body of the machine tool, pulse power supply, control system, and working fluid circulation system. Among them, the electrode wire is driven by the wire feeding mechanism to perform high-speed reciprocating motion on the surface of the workpiece.



02 Operation Guide

First, conduct equipment inspection and debugging to ensure the normal operation of each component; then install the workpiece and electrode wire, and adjust the tension of the electrode wire; next, set the processing parameters and start the processing; finally, conduct inspection and processing after processing.

Precautions during the processing and handling of common problems

Precautions

Keep the working fluid clean and with an appropriate concentration. Regularly inspect the wear condition of the electrode wire and replace it in time. Reasonably set the processing parameters to obtain the best processing effect.

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Handling of Common Problems

In case of problems such as wire breakage or short circuit, the installation of the electrode wire and the condition of the working fluid should be inspected, and parameters should be adjusted or worn parts replaced.

The application scope and prospect of wire cutting processing

Application scope

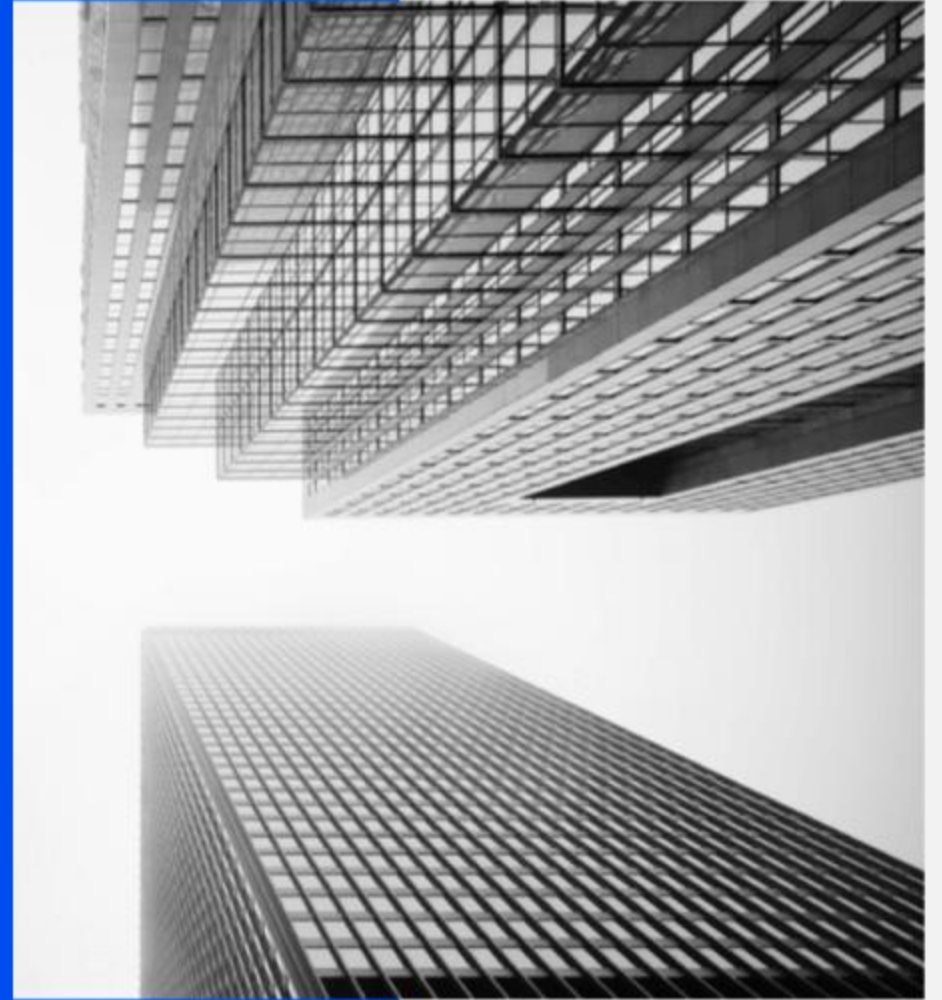
Wire cutting processing is widely used in fields such as mold manufacturing, aerospace, and automotive parts, and is particularly suitable for the processing of parts with complex shapes and high precision requirements.

Prospect Outlook

With the continuous development of the manufacturing industry, wire cutting processing technology will be continuously optimized and upgraded to achieve more efficient and more precise processing effects. At the same time, the application of new materials and processes will also promote the innovative development of wire cutting technology.

06

Introduction to Customized Metal Non-standard Services



The concept of non-standard customization and the definition of service scope

01

The concept of non-standard customization

Non-standard customization refers to customizing non-standard and non-universal metal products according to the specific needs of customers. These products usually have unique size, shape, material or functional requirements to meet the special application needs of customers.

02

Definition of service scope

The metal non-standard customization service covers the entire process services from raw material procurement, product design, process formulation, production and manufacturing to post-processing, surface treatment, and quality inspection. The service scope includes but is not limited to metal structural components, mechanical parts, molds, fixtures, jigs, etc.

Analysis of customer needs and sorting out of communication processes



Analysis of customer needs

Thoroughly understand the specific needs of customers, including requirements in terms of product usage, working environment, performance requirements, material selection, size accuracy, etc. Through full communication with customers, ensure a comprehensive and accurate understanding of customer needs.



Sorting out of communication processes

Establish an effective communication mechanism to ensure smooth information flow among all parties such as customers, designers, technicians, production personnel, etc. Through regular meetings, emails, phone calls, etc., timely convey information such as customer needs, design plans, production progress, etc. to ensure the smooth progress of the project.

Introduction to the Design Scheme Formulation and Review Process

Formulation of the design scheme

According to customer needs, combined with factors such as product usage, working environment, and performance requirements, a detailed design scheme shall be formulated. The design scheme should include product drawings, material lists, process flows, etc., to ensure the smooth progress of subsequent production and manufacturing.

Brief Introduction to the Review Process

Establish a review mechanism for the design scheme and invite experts in related fields and customer representatives to review the design scheme. The review contents mainly include the rationality, feasibility and innovativeness of the design scheme. Through the review, problems existing in the design scheme can be discovered and corrected in time to ensure that the product quality and performance meet the customer's needs.

Quality control measures in the manufacturing process



01

Quality control of raw materials

Strict quality inspections are carried out on the purchased raw materials to ensure that they meet the design requirements. For unqualified raw materials, communicate with the suppliers in a timely manner and handle them.

02

Monitoring of the production process

The production and manufacturing process is monitored in real time to ensure that all links in the production process meet the process requirements. For the problems found, measures are taken in a timely manner to correct them to prevent the problems from escalating.

03

Quality inspection and acceptance

After the product production is completed, comprehensive quality inspection and acceptance are carried out. The inspection contents include aspects such as size accuracy, surface quality, and performance parameters. For unqualified products, rework or scrap processing is carried out to ensure that the quality of the factory products meets customer requirements.

THANK YOU

