



We Shape Your Ideas

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Badr Engineering System Company strives to improve the quality of human life through engineering design, manufacturing and refurbishment of Hi-Tech parts in energy, transportation, agriculture and medical industries, maintaining human dignity by transparency indeed creating sustainable jobs via R & D and transferring new technologies to become a world-class company

About Us

Badr Engineering Systems Company (Pjsco) is a Knowledge-Based private enterprise founded in 1992 by Dr.Alireza Darvishi, a university professor. The company was established with the goal of developing advanced technologies in the field of technical know-How Development and the manufacturing of Hi-Tech components.

With a strong focus on CAD/CAM/CAE techniques and decades of experience in reverse engineering and reengineering, Badr System has specialized in rotating machinery components including gas turbines and aerospace engines.

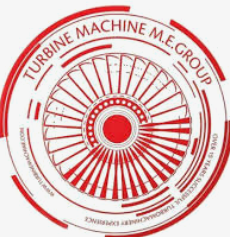
The company's core activities are structured around three main areas : Manufacturing, Refurbishment, Engineering services.



Clients

Our main clients include power generation industry, oil, gas, and petrochemical sectors, as well as Civil Aviation, road, and rail transportation industries.

Looking ahead, Badr System also envisions expanding its capabilities to provide parts and services to the marine transportation, agriculture, mining, and medical industries.

 MAPNA GROUP TUGA MAPNA TURBINE ENGINEERING AND MANUFACTURING COMPANY	 مصادکاران Mavadkaran	 PGPICC Persian Gulf Petrochemical Industry Commercial Co.	 NISOC	 ICOFC	 IOPTC	 SPGC
 euroturbine total turbine technology	 Tavanir	 TURBINE MACHINE M.E. GROUP	 SABRA Operation and Maintenance	 Ray Power Plant	 Mashhad Power Plant	 Sabalan Bargh Omid
 Tehran Power Plant	 میراج MERAJ AIR	 Qeshm Airlines هوایپیمانی قشم	 RAJA RAIL TRANSPORTATION CO.	 IKCO	 SAIPA	 AERO MAPNA GROUP

Manufacturing and Refurbishment of Gas Turbine Components

Badr Engineering Systems (BES), utilizing modern industrial equipment and facilities, is recognized as a pioneer in the manufacturing and refurbishment of stationary and rotating components for gas turbines and aviation engines.

In the manufacturing division, BES focuses on the development of technical Know-How and the production of critical components, such as stationary and rotating blades, discs, and combustion chamber parts, using advanced technologies including investment casting, precision machining, and post-processing operations.

With a strong emphasis on the energy and aviation sectors, BES has successfully developed the expertise to produce over 300 different components for various industries.

The refurbishment division is primarily dedicated to restoring and extending the service life of gas turbines and aviation engines worn components. The refurbishment process includes welding, coating, heat treatment, and other performance enhancement techniques.

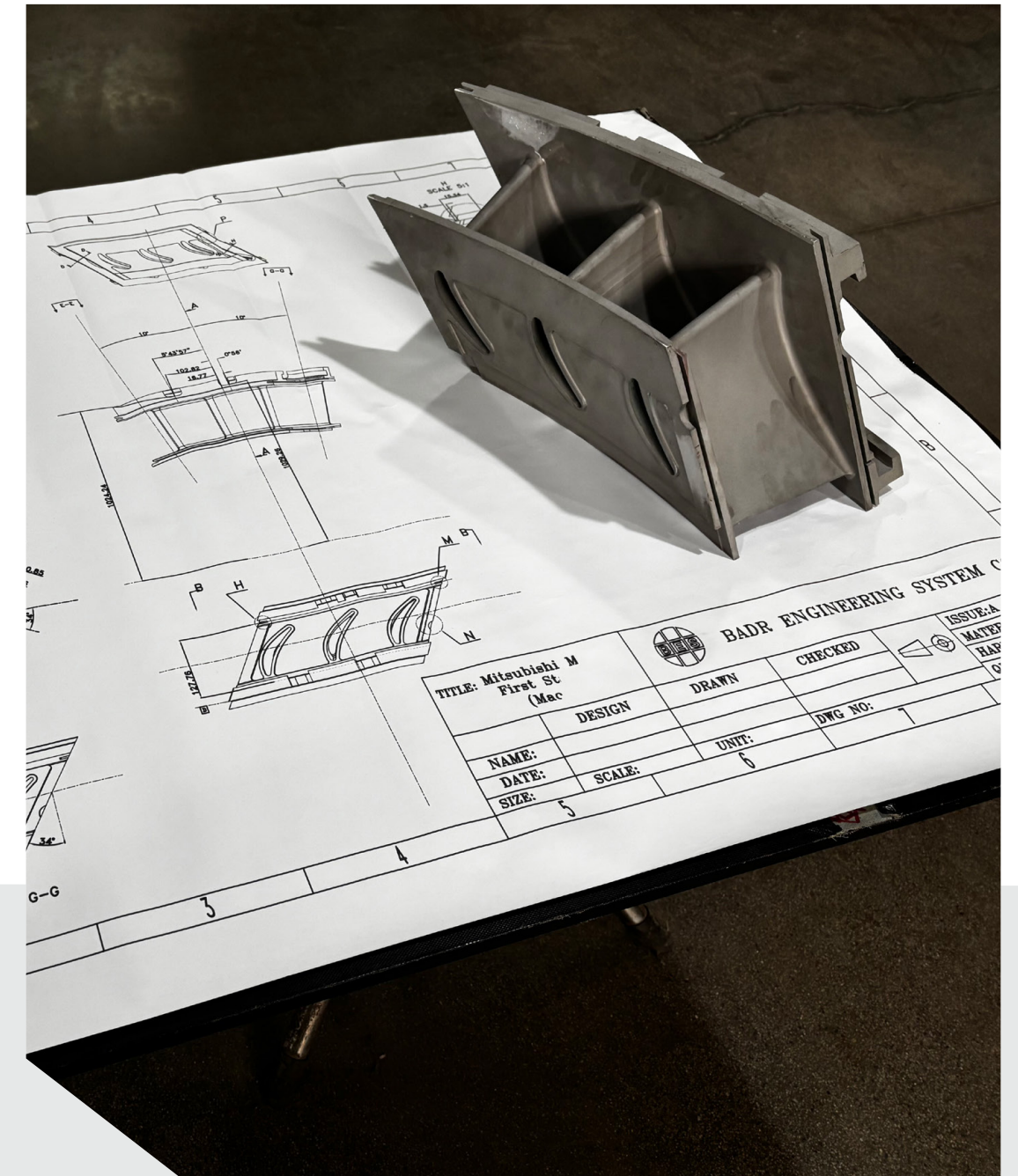
More than 200 types of components have been successfully refurbished so far. Through its innovative solutions, Badr System has made a significant contribution to increasing equipment efficiency and reducing maintenance costs in the above industries.



Product Engineering

At BES, comprehensive reverse engineering processes are carried out to accurately identify and extract geometrical, structural, and functional data from incoming OEM components, across both mechanical and metallurgical domains.

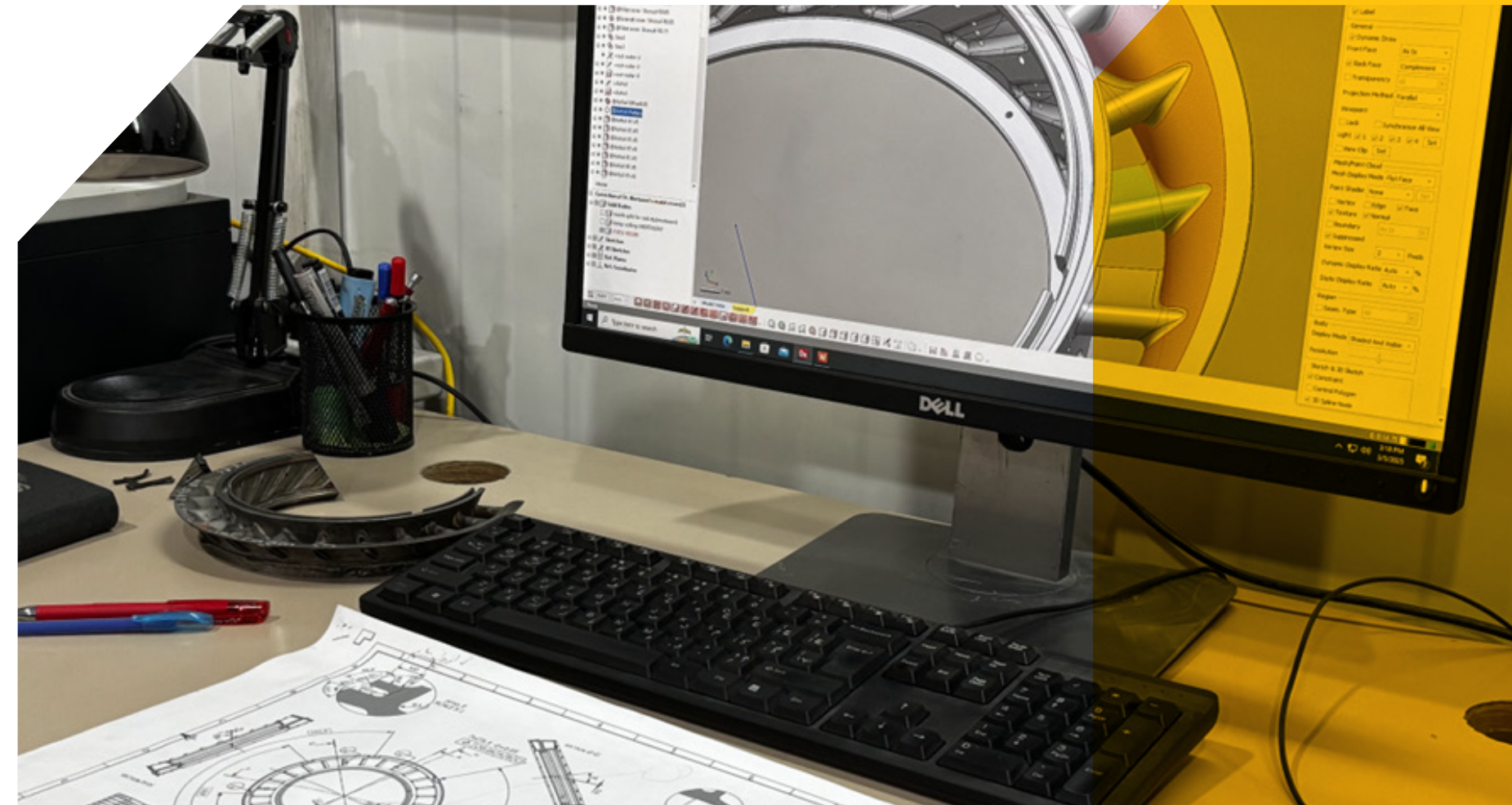
The generated data is then compiled into 3D models, manufacturing drawings, and detailed specifications including physical, mechanical, and chemical properties, as well as quality control requirements and acceptance criteria. These deliverables are transferred to the relevant departments for production or refurbishment of the specified component.





Metallurgical Engineering

- Chemical composition analysis of components
- Coating analysis
- Microstructural analysis
- Macro-etching and grain size determination
- Evaluation of mechanical test results
- Preparation of quality inspection procedures



Mechanical Engineering

- Laser scanning and cloud of point collection
- Precision measurement and dimensional validation (CMM, Contour graphy, VMM, etc.)
- Radiographic & scanning inspection for internal geometries
- 3D modeling
- Generation of manufacturing drawings
- Development of QC process

Flexible Manufacturing System (FMS)

The Flexible Manufacturing System (FMS) is Badr System Engineering company's advanced solution for producing a wide range of industrial components. Utilizing modern technologies, this system enables fast and efficient adaptation to varying production volumes and diverse product requirements based on clients needs.

The company's equipment is organized into three core operational areas: investment casting, precision machining, and post-processing. These units operate in an integrated and centralized manner and are equipped with the most advanced technologies in the gas turbine and aviation engine industries.

Key technologies include vacuum induction melting (VIM) furnaces, various CNC machines, thermal spray systems, and additive manufacturing technologies. Additionally, the implementation of integrated production automation systems, advanced quality control, and a dynamic organizational structure enables the company to deliver high-quality components through a flexible and efficient manufacturing approach.



Casting Simulation

At Badr System Engineering, all manufacturing processes begin with simulation in order to determine optimal process parameters and minimize time and costs. These simulations include various thermal, fluid flow, and stress analyses.

Key simulation capabilities include:

- Design and optimization of gating systems
- Optimization of casting parameters
- Molten metal flow analysis
- Temperature distribution in the part and mold
- Solidification time and rate
- Prediction of shrinkage cavity location and size
- Prediction of gas-related defects
- Prediction of microstructure formation
- Assessment of hot tearing risks
- Thermal and mechanical stress analysis
- Prediction of deformation and distortion
- ...and more



Rapid Prototyping / Rapid Tooling

Given the critical importance of time and cost in the manufacturing process, rapid prototyping technology has brought significant transformation to the production landscape.

Badr System Engineering is equipped with the state-of-the-art facilities for rapid prototyping, including various types of 3D printers, rapid mold-making systems, and fast fixture-building equipment.

These capabilities enable the company to deliver functional prototypes in the shortest possible time, tailored to customer requirements.



Key Advantages of Our Capabilities:

1. Production of initial prototypes to verify manufacturing parameters
2. Capability to produce complex parts for which traditional processes is not feasible
3. Fast delivery of prototypes for functional testing and customer evaluation
4. Cost-effective and time-efficient production of low-volume parts



Tooling

High-quality manufacturing and refurbishment require the use of specialized, precision tools. At Badr System Engineering, a skilled team of experts designs and produce a wide range of tools essential for various stages of the manufacturing and refurbishment processes.



Key in-house tooling capabilities include:

- Wax injection molds
- Ceramic core injection
- Sheet metal forming dies
- Assembly tools
- Machining fixtures
- Welding fixtures
- Heat treatment fixtures
- Coating fixtures
- Measurement fixtures and gauges



Investment Casting

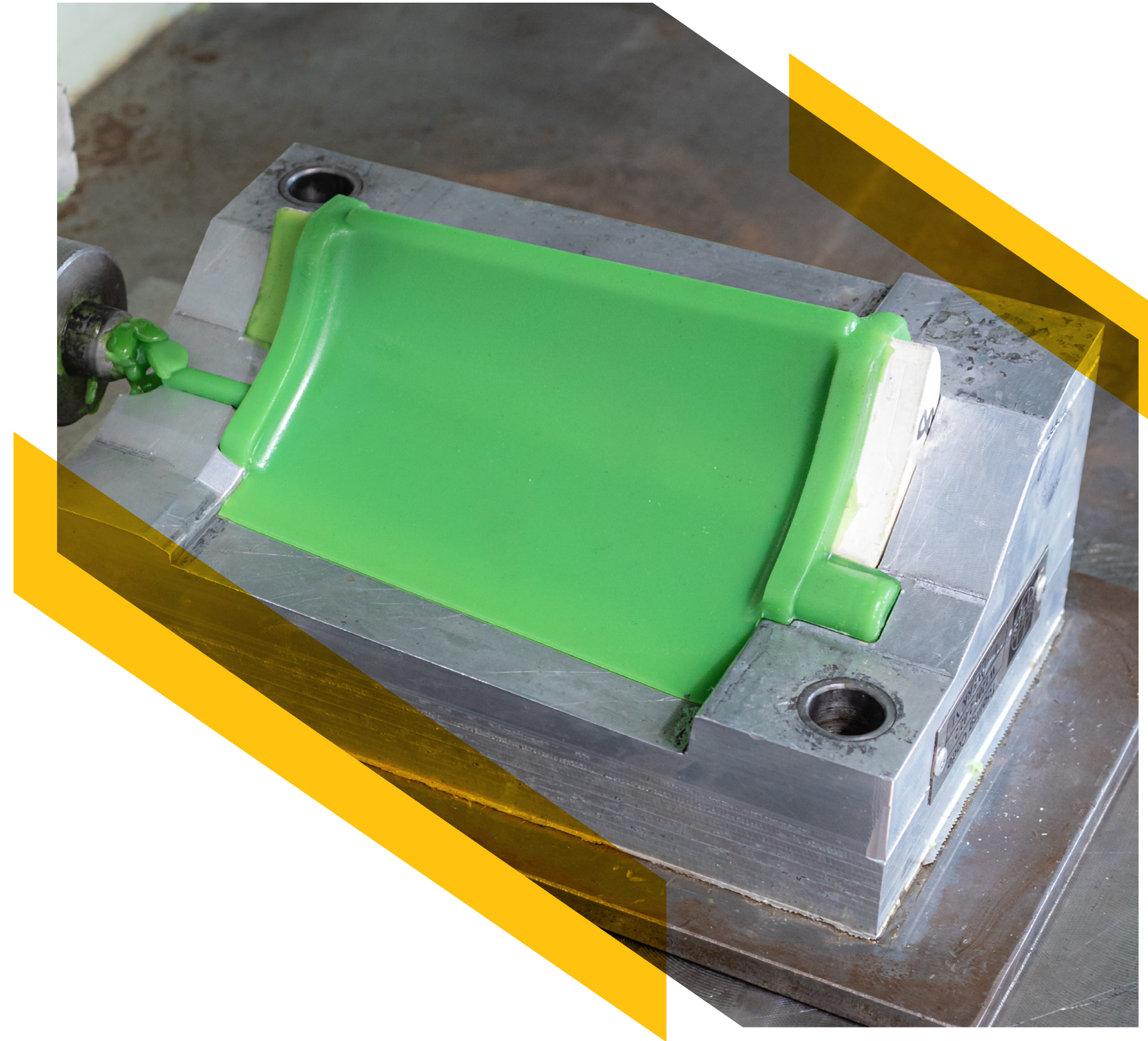
Investment casting, also known as lost-wax or precision casting, is one of the key manufacturing processes for producing metal components. In this process, a ceramic mold is formed by layers of ceramic slurry over expendable wax patterns. The patterns are then removed by heating or in an Autoclave Furnace, resulting in a hollow ceramic shell that is ready for metal pouring.

1-WaxPatternProduction

In the conventional investment casting process, expendable patterns are created by injecting wax into a metal mold.

In addition to traditional methods, at Badr System, expendable patterns are also produced using additive manufacturing technologies.

To create complex internal geometries, such as air-cooling channels in stationary and rotating blades of gas turbines and aviation engines, ceramic cores are used.



2- Wax Pattern Cleaning and Assembly

After the wax injection stage, the patterns undergo cleaning and repair processes.

Following that, they are assembled into gating systems based on the casting process simulation and design models prepared in earlier stages.





3- Ceramic Shell Building/Molding

Ceramic shell building is one of the most critical and precise stages in the investment casting process.

In this step, wax assembly is dipped into a ceramic slurry and then coated with ceramic powders, forming the initial ceramic layer over the wax tree.

After drying, the process is repeated multiple times, alternating between slurry dipping and powder coating, until the desired shell thickness is achieved.

4- Dewaxing and Firing

To prepare the ceramic mold for metal pouring, wax pattern must be removed. This is typically done using methods such as autoclaving or flash firing, which melt and empty the wax from the mold.

Following dewaxing, the ceramic molds are placed in furnaces for firing to achieve the necessary strength and structural integrity.



5- Ceramic Shell Quality Control

Quality control procedures are performed on the ceramic shells to ensure their integrity before continuing to the next stages.

These inspections include visual examination, borescope inspection, dye penetrant testing, and weighing of the shells.

6- Vacuum Casting

In the casting stage, the ceramic molds undergo final preparation procedures, including cleaning, insulation wrapping, and filter placement.

Once prepared, the molds are placed in preheating furnaces before the casting process begins.

Badr System Engineering Company has the capability to cast nickel-based, cobalt-based, and iron-based alloys and superalloys using Vacuum Induction Melting (VIM) furnaces with capacities ranging from 5 to 200 kilograms.



7- Knock-Out and Part Removal

After the molds have cooled down to room temperature, they are subjected to pneumatic hammering to break the ceramic shell and release the cast parts.

Subsequently, cutting machines are used to separate the metal components from the gating system.

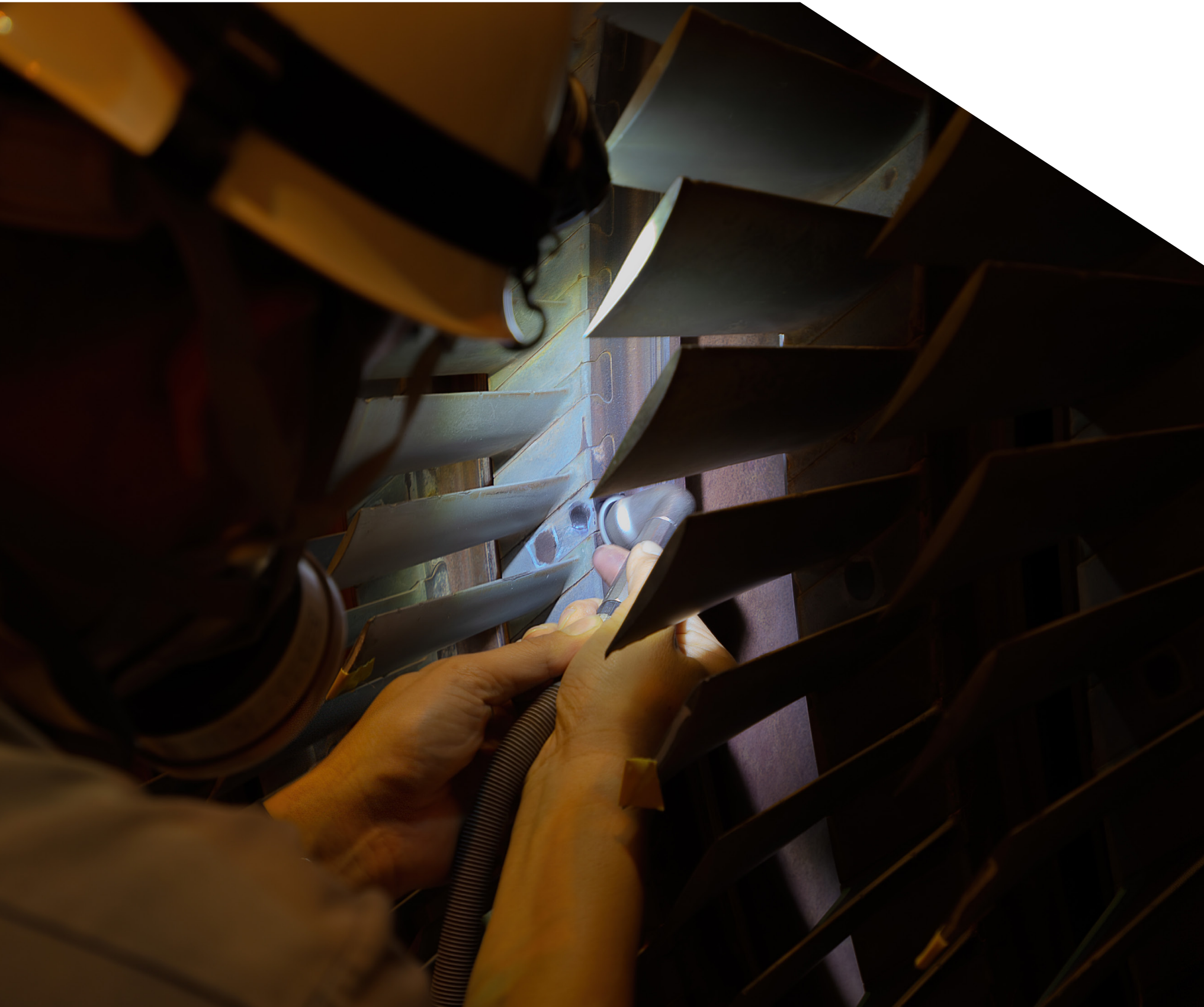


Machining

The machining process is carried out to achieve the final shape, dimensions, and surface quality of components.

At Badr System's machining unit, a full range of advanced equipment including milling, turning and EDM (Electrical Discharge Machining) machines is employed to ensure precision and quality in every finished part.





Refurbishment and Finishing

Refurbishment and rejuvenation processes are carried out on various components of gas turbines and aerospace engines, covering all levels of damage-minor, moderate, major, and critical.

In this unit, worn parts are refurbished and newly manufactured components are post-processed using advanced techniques and in accordance with OEM standards.

These methods help to extend component life, optimize performance, and significantly reduce maintenance costs, making the reuse of parts in strategic industries both feasible and efficient.

Key processes include:

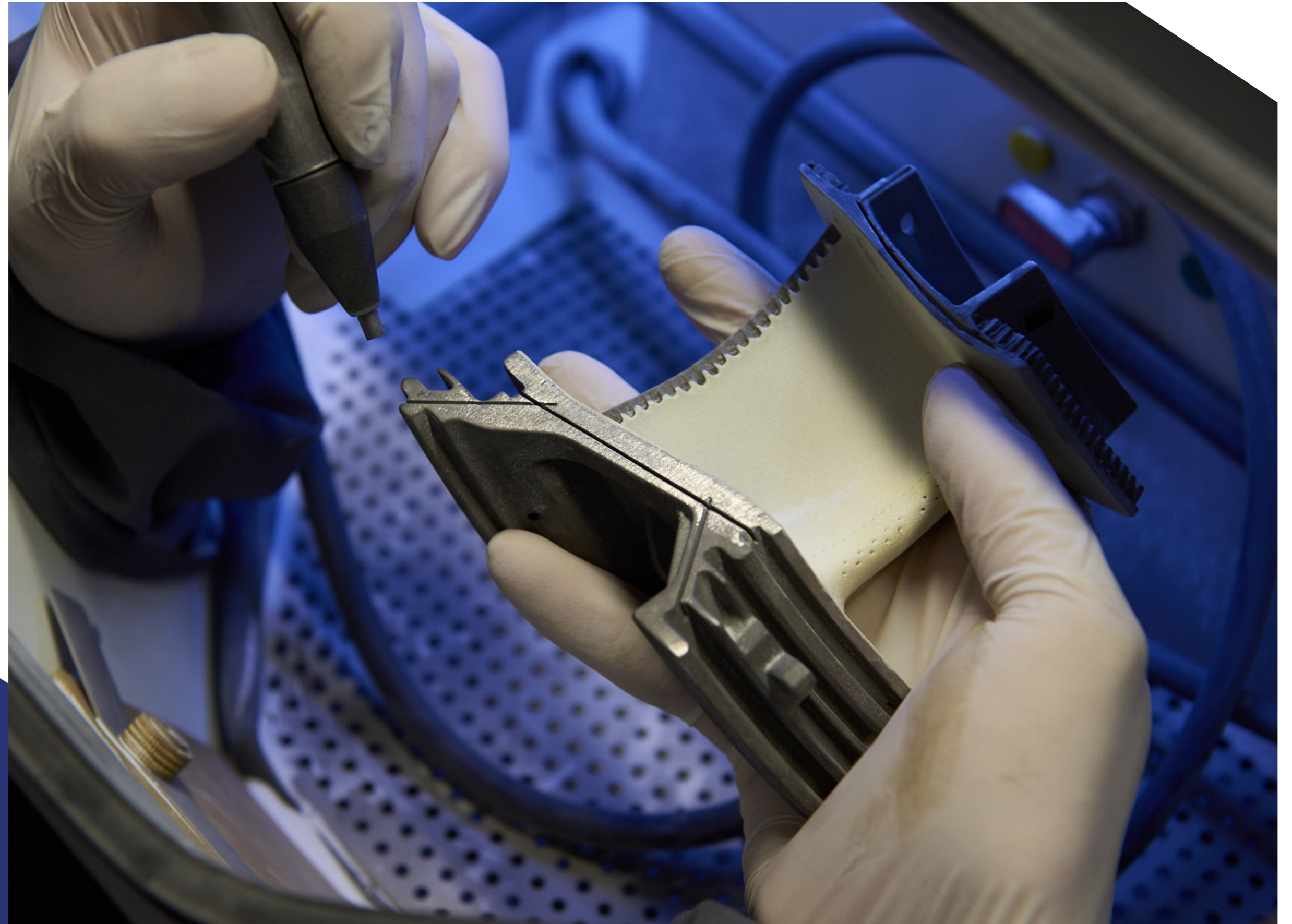
- Cleaning
- Blending and grinding
- Dimensional restoration
- Heat treatment
- Welding
- Surface coating



1- Cleaning Processes

At Badr System Engineering, ultrasonic cleaning and sandblasting methods are used for cleaning components during both manufacturing and refurbishment processes.

Additionally, to remove existing metallic coatings and expose the base material, chemical stripping techniques are employed.



2- Welding

In both refurbishment and manufacturing processes, welding is used to repair defects and attach additional features.

Depending on the nature of the defect and the sensitivity of the component, various techniques such as GTAW (Gas Tungsten Arc Welding) and Laser Welding are applied.



3- Blending and Grinding

This step involves the use of various grinding and blending operations to eliminate surface defects and achieve the required geometry and surface smoothness.



4- Heat Treatment

Heat treatment is a critical step in both manufacturing and refurbishment processes, especially for alloys and superalloys, to achieve the desired microstructure and optimized mechanical properties.

At Badr System Engineering, a range of heat treatment processes is performed-such as:

- Solution Heat Treatment
- Aging
- Stress Relieving

These processes are carried out at temperatures up to 1200°C, depending on material requirements and application.

Coating

A wide range of diffusion and overlay coatings is applied using advanced equipment to enhance surface protection and performance.

- Overlay Coating Methods
 - HVOF (High Velocity Oxy-Fuel)
 - APS (Air Plasma Spray)
 - Wire Arc Spray
- Diffusion Coating Methods
 - Aluminizing
 - Chromizing
 - Al-Si Slurry Coating



A photograph showing two men in a dark environment, likely a laboratory or factory. One man, with a beard and wearing a dark shirt, is holding a small electronic device with a glowing screen. The other man, wearing a blue shirt, is leaning over him, looking at the device. The device has a label that says 'LCD' and 'LED'. The scene is dimly lit, with the primary light source being the device's screen.

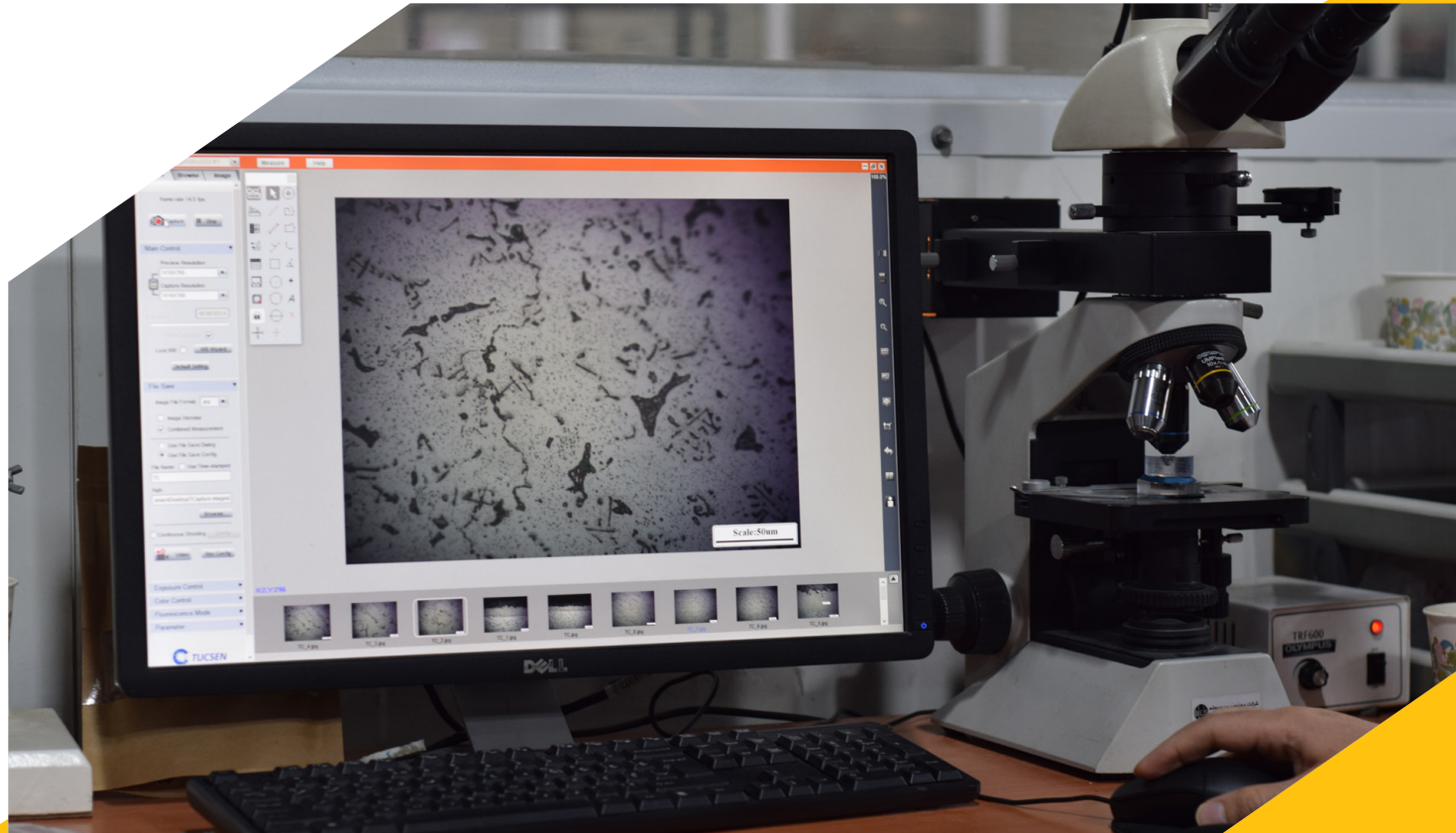
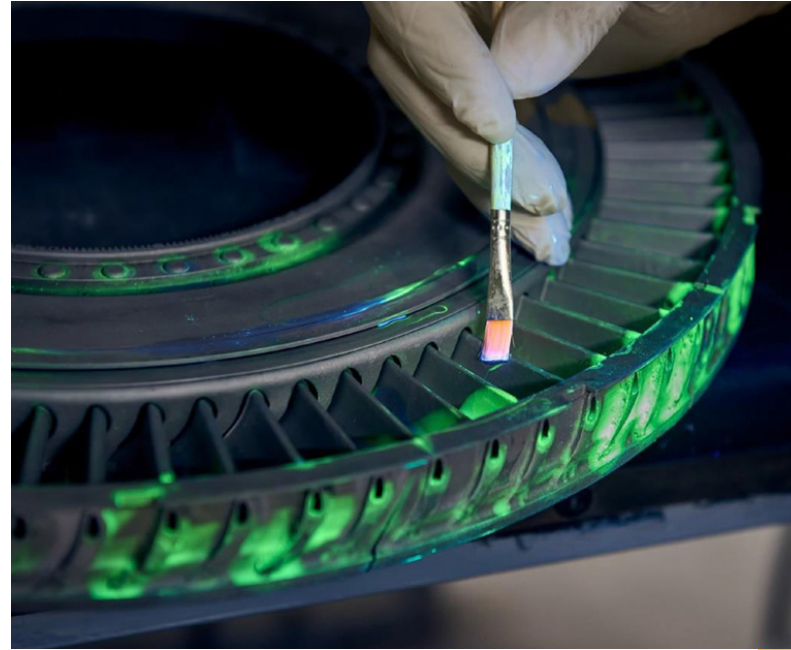
Quality Control

Quality control is carried out using advanced equipment and in compliance with international standards.

All manufacturing and refurbishment processes undergo rigorous metallurgical, dimensional, and functional inspections at various stages to ensure the highest level of quality and reliability is maintained.

1- Metallurgical Testing

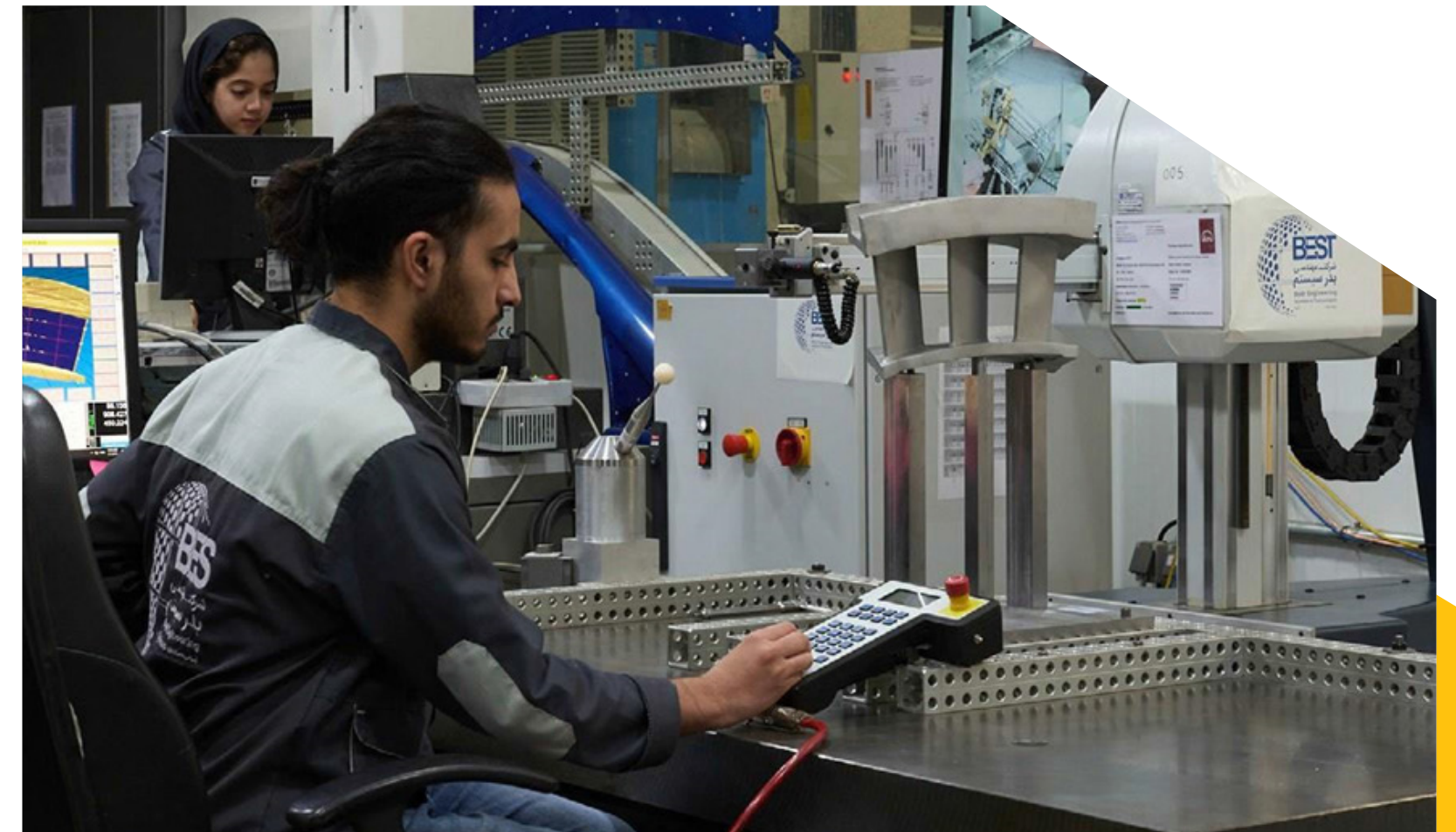
- Chemical composition analysis
- Mechanical properties testing
- Microstructure and macrostructure inspection
- Visual Testing (VT)
- Penetrant Testing (PT)
- Magnetic Particle Testing (MT)
- Radiographic Testing (RT)
- Ultrasonic Testing (UT)
- Hardness Testing





2- Dimensional Testing

- Dimensional inspection using CMM (Coordinate Measuring Machine)
- Dimensional inspection using VMM (Video Measuring Machine)
- Dimensional inspection using point cloud data
- Dimensional inspection using manual measuring tools
- Ultrasonic thickness measurement



3- Functional Testing

- Water flow test
- Air flow test
- Flame test (Cold & Hot)
- Assembly fit test



Engineering and Consulting Services(ECS)

Based on international standards and documentation, and supported by specialized experts, advanced production infrastructure, and fully equipped technical laboratories, Badr System Engineering provides engineering consultation and solutions to industries in the fields of component manufacturing and refurbishment.

These collaborations help reduce production time, improve product quality, and lower manufacturing costs.

Core ECS capabilities include:

- Life Assessment of components
- Remaining Life Assessment
- Root Cause Failure Analysis (RCFA)
- Design optimization
- Development of technical know-How for manufacturing and refurbishment
- Simulation services in casting, fluid dynamics, thermal analysis, and mechanical behavior



Products

As a project-based company, Badr System Engineering manufactures a wide variety of products across different industries. The company's core product portfolio in the manufacturing sector focuses on gas turbine components for renowned brands such as GE, Siemens, Mitsubishi-Hitachi, Ruston, Alstom, Ansaldo and others.

Siemens



SGT400-CT1 Blade



SGT400-CT2 Blade



SGT400-CT1 Nozzle



SGT400-CT2 Nozzle



V94.3-F Class heat shield



V94.2-V1



V94.2-V2

Garrett



APS3200-B2

Hitachi-Mitsubishi



MW701B-V1



MW701B-V2



H25-Swirler

Werkspoor



W72M-B1



W72M-B2



W72M-B3



W72M-B4



W72M-Compressor Stage 1~12



BBC13D-Rotary Segment 01



BBC13D-Rotary Segment 02



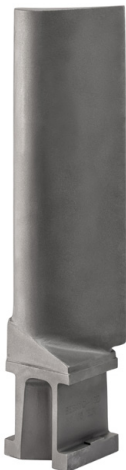
Turbo Charger-Nozzle Ring



BBC13D-V1



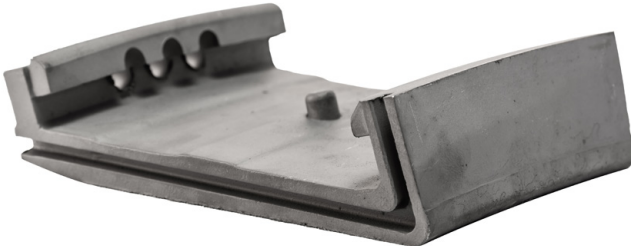
BBC13D-V2



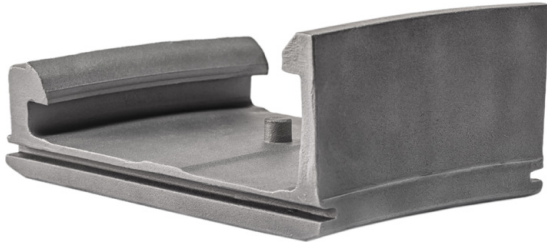
BBC13D-V3



BBC13D-Stator Segment 01



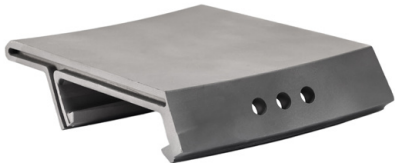
BBC13D-Stator Segment 02



BBC13D-Stator Segment 03

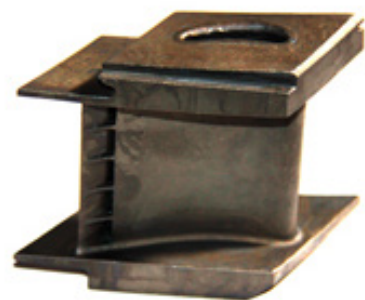


BBC13D-Stator Segment 04



BBC13D-Stator Segment 06

Ruston



TB5000-N1

RollsRoyce



T56-N2



T56-B3



Compressor Blade 1



Compressor Blade 2

Honeywell



APU-N1

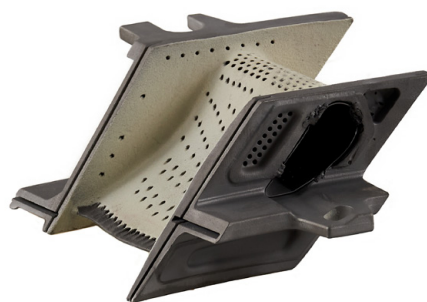


APU-N2



LF507-N2

Pratt & Whitney



V2500-N1



PW4000-N2



V2500-Liner Segment

GE



CF6-80C2-N1

Motor Sich



D36-N1(1 Airfoil)



D36-N1(4 Airfoil)

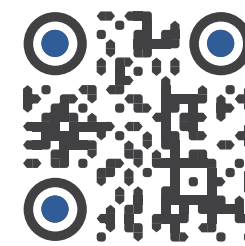


D36-N1(Complete set)



D36-Flame Tube

Manufacturing & Repair Hi-Tech Parts



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