EICO

Esfarayen Industrial Complex

Special Steel Solutions

We are Making History...

INTRODUCTION

Esfarayen Industrial Complex (EICO) is the largest manufacturer of forged alloy steel in Iran and the Middle East which was founded in 1990. It's located in 12 km of Esfarayen - Bojnord road in North Khorasan in Northeast of Iran.

The main units of EICO are as follows:

1. **Melt Shop (EAF-LF-VD-VOD-VSD-IC-CCM-ESR)**
2. **Heavy Forge Shop (63MN hydraulic press)**
3. **Forge Shop (5 Radial Forging Machines)**
4. **Heat Treatment shop (Annealing, Normalizing, Quenching, Continuous Induction Hardening, Stress Relieving, Spray Quenching and Tempering)**
5. **Peeling and Straightening Shop**
6. **Machining Shop (Rough and final Machining)**

All of above units are equipped with modern facilities and updated know-how technology which guarantees to obtain the best quality in production of different alloy steel grades according to customer requirements and international standards as well. Special equipment and high ranking capabilities have made EICO the first choice

for special steel solutions for various applications in different industries such as Oil and Gas, Mining and Cement, Power Generation, Railway, Steel and Automotive and Marine. However, EICO has acquired its technology and know-how from well-known Companies such as **GFM, BOHLER, INTECO**, **SKODA** and **DANIELI**.

By using a dynamic R&D center, EICO is continuously improving its products and processes as well as creating new products and services. In addition to domestic market, products of EICO have found their way into export destinations.

EICO is the name you can trust:

- **High quality of our steels,**
- **Technical skills of our employees which go from one generation to another,**
- **Own development continuously pursuing market requirements,**
- **Future oriented investments into technical progress.**

We already have many customers who are satisfied with our expertise.

You are invited to join them and convince yourself of the high quality of our products and services.

Electric Arc Furnace (EAF)

VD/VOD/VSD

Electro Slag Remelting (ESR)

6300 ton Open Die Hydraulic Press

History

Founded in 1990, Esfarayen Industrial Complex aims to serve metal related industries both domestically and internationally. With modern equipment and high technical knowledge of personnel, EICO is the largest manufacturer of heavy forged alloy steel in the Middle East. EICO originated from the concept of independence in required steel parts during post-revolution industrial development of Iran.

EICO has installed a new ESR system since 2017 and a CCM since 2021 enabling the company to produce high quality Steel as bloom in addition to the long list of products comprising castings, parts and forged sections. Due to rapid development in the past 10 years, EICO has evolved into a large scale, stand-alone manufacturer of alloy steel in Iran and the Middle East as well. EICO is a young, growth-oriented company which was supported know-how by leading Austrian manufacturers such as, GFM, BOHLER and INTECO and Czech company SKODA and DANIELI Italy.

Ingot Casting

CCM (Round bloom 250 to 630mm)

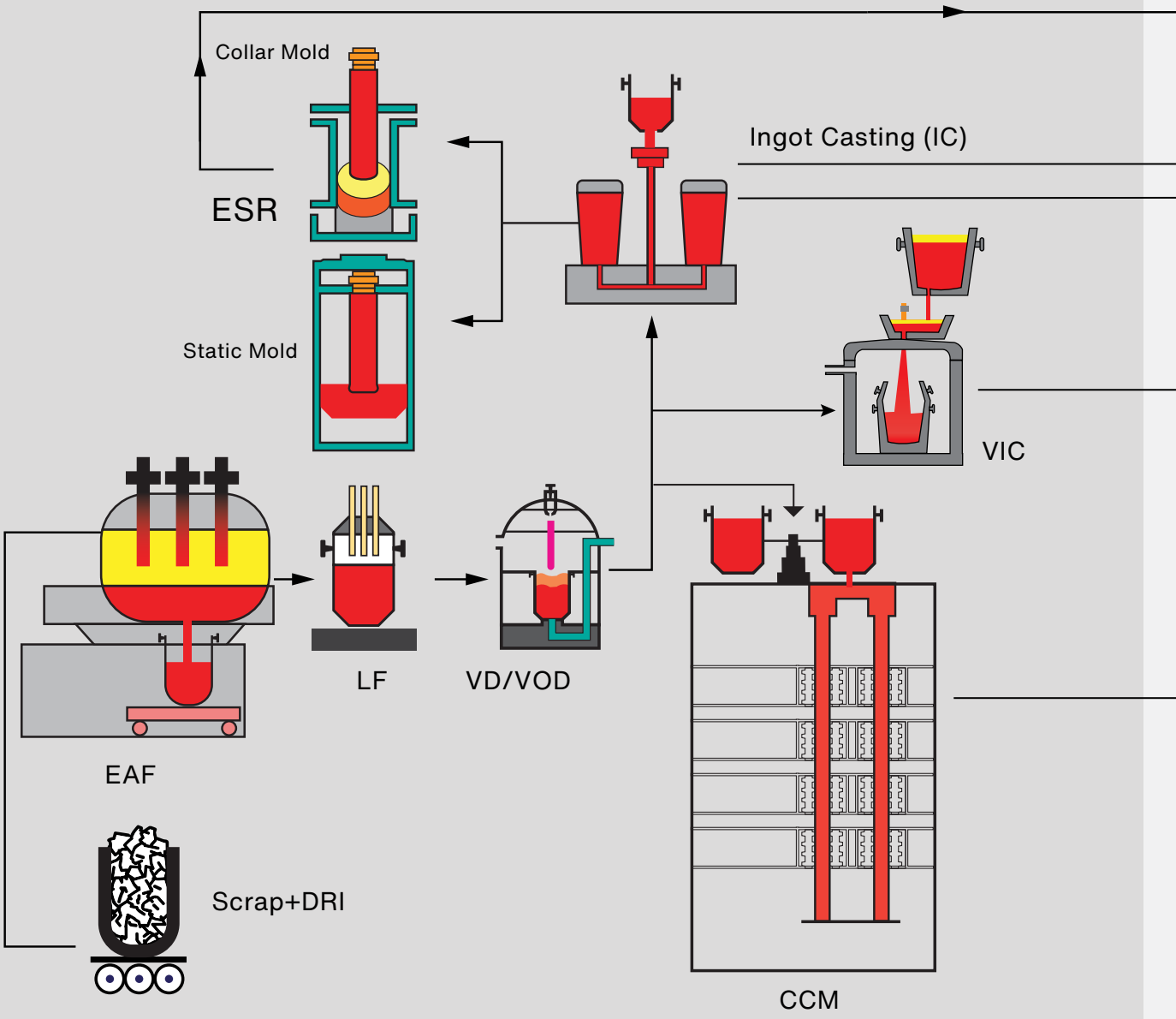
Radial Forging Machines (SXP 65,25,13,10, SHP06)

Machining

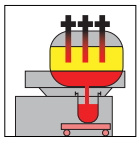
EICO has advanced facilities and technologies complying with world standards. EICO has deployed ISO standards for quality management.
Since its establishment, EICO has provided a strong support for the development of domestic and international forged steel for a variety of industries such as Oil, Gas and Petrochemical, Power Generation, Mining, Railway, Steel and Automotive and Marine.

BÖHLER EDELSTAHL GFM ŠKODA INTECO DANIELI

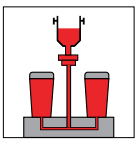
Melting



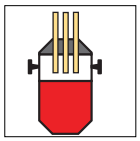
Main Steelmaking and Casting Equipment



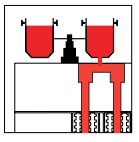
Electric Arc Furnace (EAF)- 50 ton



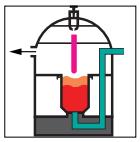
Ingot Casting
2.2 - 110 ton



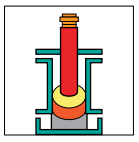
Ladle Furnace (LF)- 50 ton



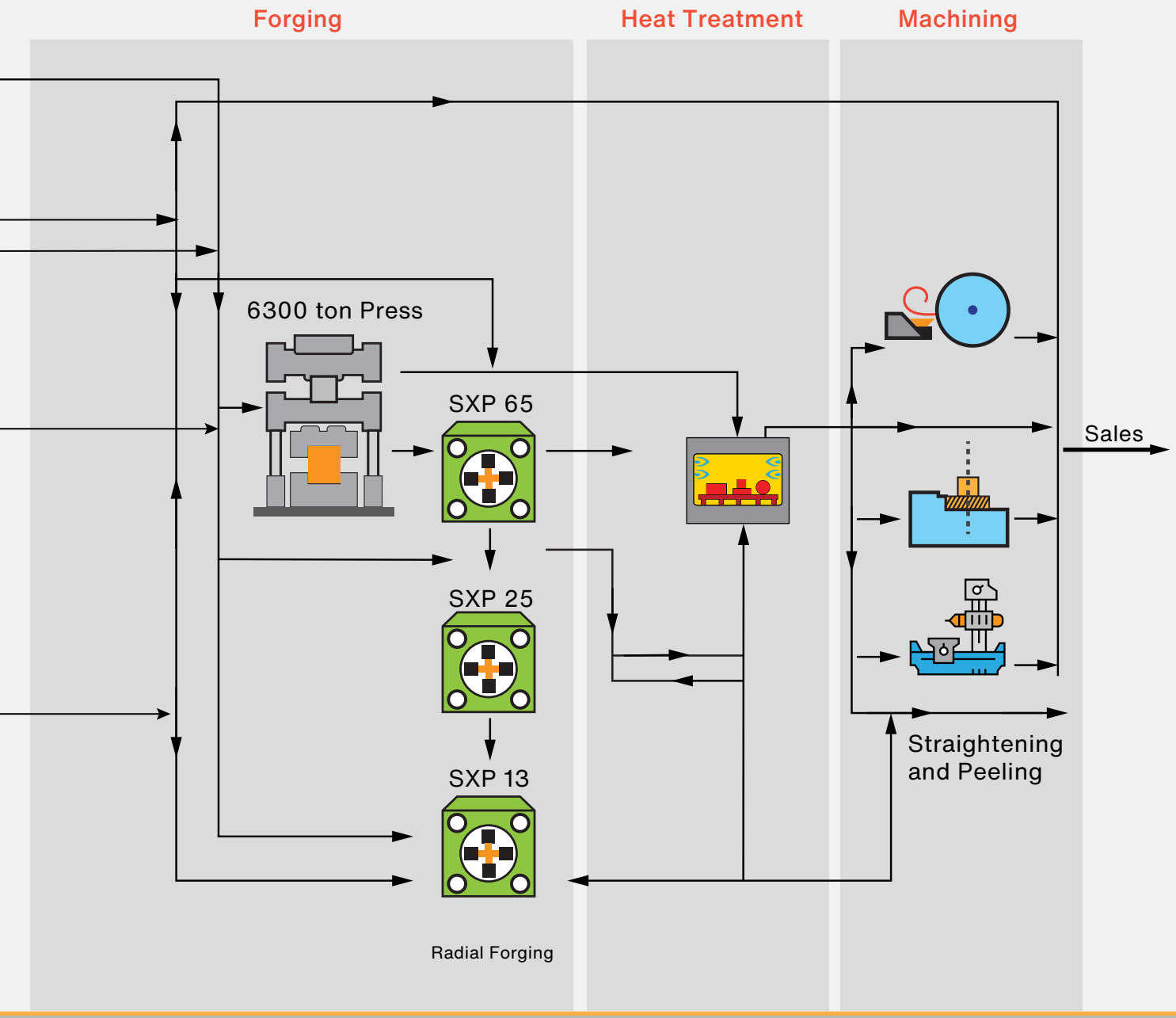
Continuous Casting Machine (CCM)
250 mm- 630 mm



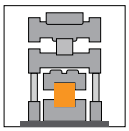
Vacuum Degassing (VD),
Vacuum Oxygen Decarburization (VOD),
Vacuum Ingot Casting (VIC-95 ton),



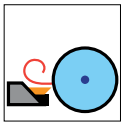
Electro Slag Remelting (ESR)
Max Dia: 1200 mm
Max Weight: 52 ton



Main Forging and Machining Equipment

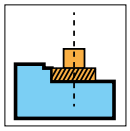


6300 ton Open Die Hydraulic Press

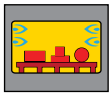


CNC Lathe Machines
Max Weight: 80 ton

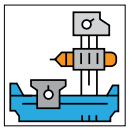
GFM Radial Forging Machines
SXP 65,25,13,10, SHP 06



CNC Milling Machines
Max Weight: 40 ton



Heat Treatment Furnaces (13 Furnaces)



CNC Horizontal Boring Machines
Max Weight: 80 ton

EICO

Quality is never an accident. It is always the result of intelligent effort

Melt Shop

Thanks to our advanced steelmaking equipment that has enabled us to produce variety of clean steel grades with close control of composition. Steel production plant consists of several technological operations including charge preparation, melting, steel refining and casting. Steel making process takes place in one Electric Arc Furnace with annual capacity of 120 thousand tons of steel followed by ladle refining and VD process.

The production of alloy steels requires processes that can produce homogeneous, free from non-metallic inclusions, with minimum amount of undesirable elements, such as sulfur, phosphorus, as well as the least amount of detrimental gases. For this purpose, the steel making plant was designed to produce high quality alloy steel grades.

Liquid steel is either poured into cast iron moulds (Ingots) or into sand moulds (foundry).

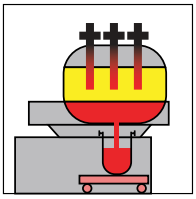
A considerable proportion of the ingot production of carbon, low and high alloyed tool and stainless steel with the highest claims for quality of material are intended for the Forging Shop.

Steel-making shop can produce both bottom-poured ingots up to 110 tons in weight poured in controlled Ar atmosphere and 95 tons Ingot as VSD.

The raw materials are for steel production includes steel scrap, sponge iron and ferroalloys. Raw materials are first melted in an electric arc furnace and subsequently refined in the secondary metallurgy unit (LF-VD-VOD). This method makes it possible to attain the following limits of impurities:

Phosphorus (P)	**≤ 0.005%**
Sulphur (S)	**≤0.003%**
Hydrogen (H_2)	**≤ 1.5 ppm**
Oxygen (O_2)	**≤ 35 ppm**
Nitrogen (N_2)	**≤ 60 ppm**

Inclusion content of steel is then evaluated via related standards such as DIN 50602 and ASTM E45 and other standards according to costumer request.



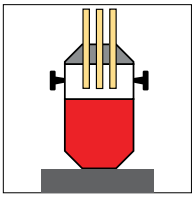
Electric Arc Furnace (EAF)

Furnace transformer: max. 55 MVA

Melt shop is equipped with 50 ton ultra-high power electric arc furnace with EBT system. This furnace is designed by Tagliaferri (Italy) and installed by INTECO (Austria) company. Addition to carbon, the furnace is capable to reduce phosphorus content lower than %0.003.

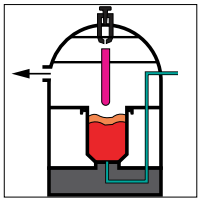
Secondary Metallurgy

Ladle Furnace **(LF)**
Vacuum Degassing **(VD)**
Vacuum Oxygen Decarburization **(VOD)**



Ladle Furnace (LF)

- Furnace transformer: max. 11 MVA
- 50 tons capacity,
- Desulfurization process S≤ 0.003,
- Adjustment of temperature and alloying elements by and adding ferroalloys,
- White slag making for producing clean melt**.**



Secondary Metallurgy

Vacuum Degassing (VD)

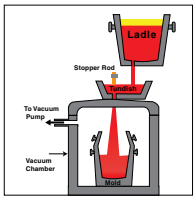
Vacuum Oxygen Decarburization (VOD)

Vacuum Degassing (VD)

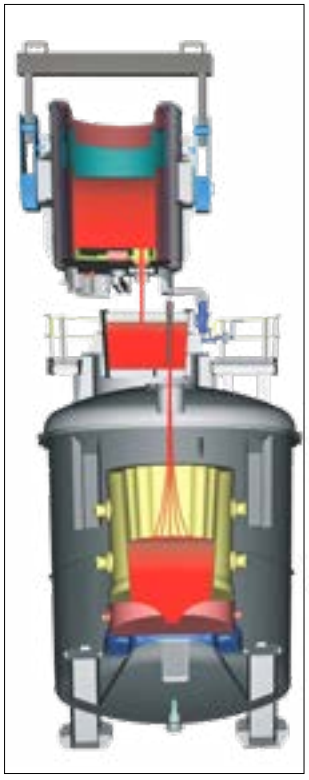
To reduce/eliminate dissolved gases, especially hydrogen and nitrogen.

Vacuum Oxygen Decarburization (VOD)

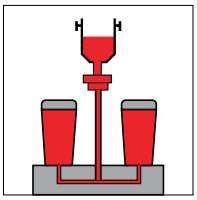
To reduce dissolved carbon via promoting preferential oxidation of dissolved carbon rather chromium when producing/refining stainless steel grades with C≤%0.03.



Vacuum Stream Degassing (VSD)



Stream degassing involves drawing a vacuum on the molten steel while it is being poured from a tundish to the casting mold. During pouring, the steel breaks up into droplets which greatly increases its surface area. Since degassing is so dependent on the exposed surface area, degassing happens very rapidly as the steel falls into the mold. The height the molten steel drops (i.e. the pouring height) is one of the most important variables impacting the effectiveness of the stream degassing process. Due to the rapid nature of stream degassing, this method is used to produce heavy ingot (95 tons) with ultra-low gas level in EICO that requiring multiple ladle pours (2 Ladles).



Ingot Casting with Ladle Car

- Casting of ingots weighting from 2.2 tons to 110 tons,
- Controlling casting rate and carrying ladle over the mould exactly and quickly,
- Argon protection (Argon Shield) is applied during ingot teeming.

Heavy Casting Parts

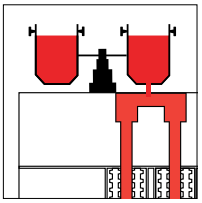
EICO is capable to produce heavy casting parts up to 120 tons for wide variety of alloy steels and cast irons.

Ingot Mold - 72 Ton

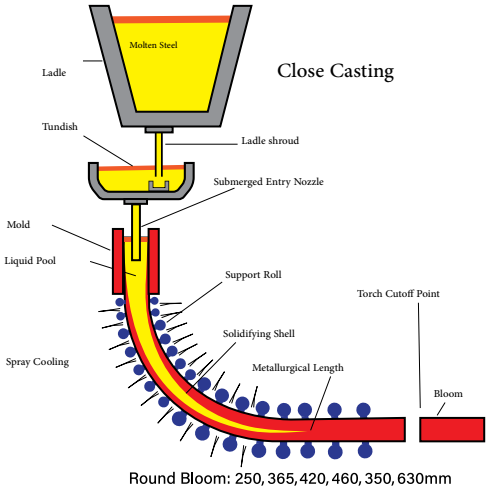
Slag Pot - 49 Ton

Spider - 20 Ton

Cement Mill Girth Gear - 27 Ton

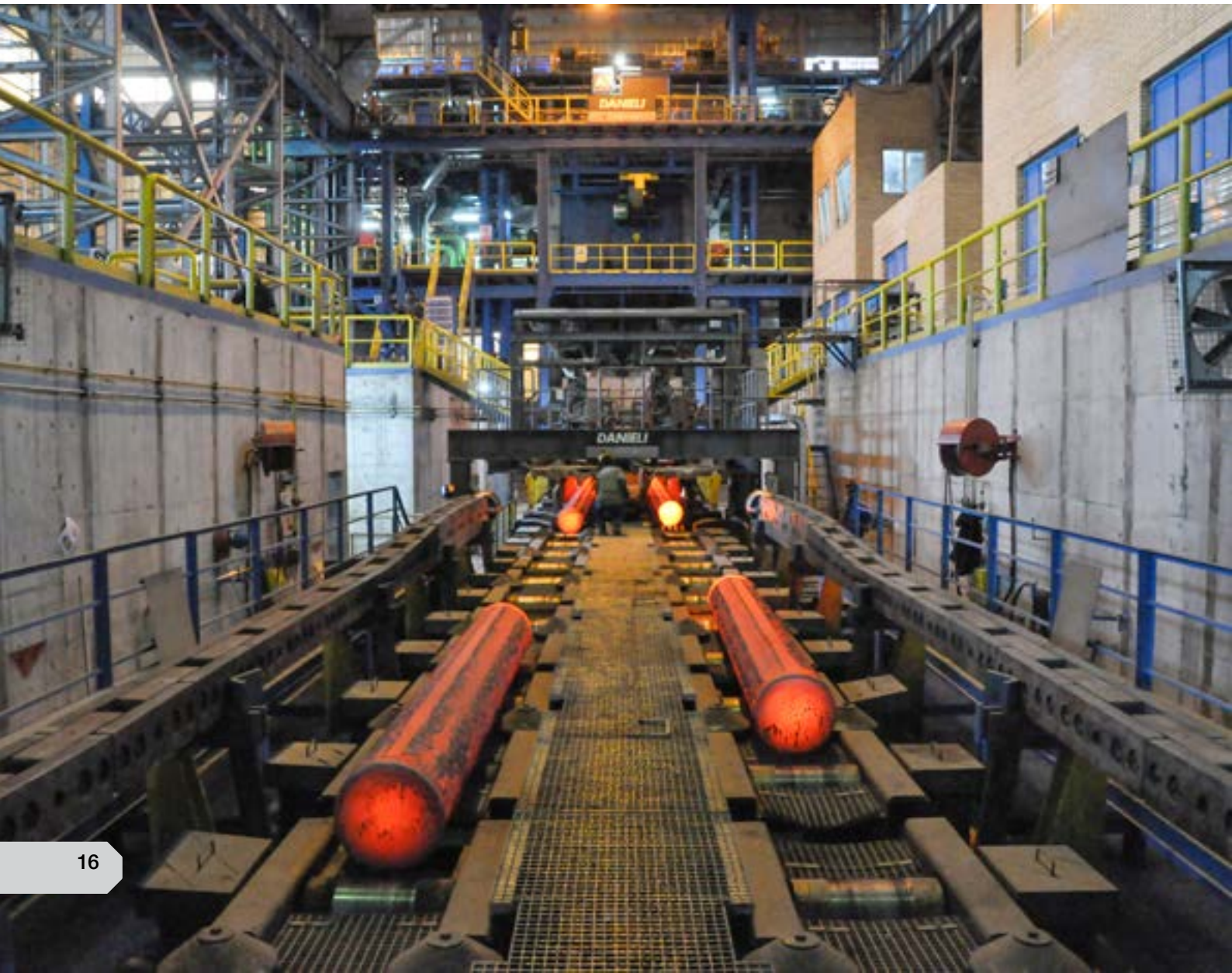


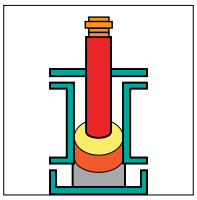
CCM



CCM (Continuous Casting Machine) Unit

It is a modern Continuous Casting Machine with 2 strands, 14 meter bending radius, 1800mm distance between strands is dimensioned to produce round bars of sections between Φ250 and 630 mm. casting is done in complete close condition with Argon Protection.





ESR Plant

Electro-Slag Remelting (ESR) process is used to remelt and refine various steel grades resulting in high-quality ingots.
ESR process is important because it provides better control of the solidification microstructure and chemical homogeneity. It also enables greater cleanliness and better mechanical properties. The produced low and high alloy ESR ingots are used in aerospace, thermal and nuclear power plants, chemical engineering and special tools.
To prevent absorption of gas specially oxygen and hydrogen, remelting is done under protective atmosphere (argon and nitrogen).

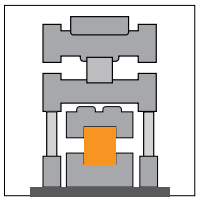
Technical specification of ESR ingots:

The amount of oxygen in produced low and high alloy ingots is max 25 ppm.

- The maximum deviations in chemical composition in the ingots: Ti:±0.05%, Si:±0.01%, Al:±0.01%.
- High level of compositional and elemental homogeneity and at the same time high purity level.
- Annual Capacity: 6000 tons.
- With three melting stations capable of producing ingots with 5800 mm length, 1200 mm diameter in short collar mould. Also ingots with 2700 mm length and 900 mm diameter can be produced in static moulds.
- To prevent gas absorption the machine is equipped with a neutral gas injection system (Ar, N2).

ESR Mould Type	Dimension
short collar mould	Length: max. 5800 mm
	Diameter: 450, 800, 1000, 1200 mm
	Weight: max. 52000 Kg
static mould	Length: max. 2700 mm
	Diameter: 900 mm
	Weight: max. 12500 Kg

Forging Shop



6300 ton Open Die Press

Heavy forging shop has a 63 MN open die hydraulic press with manipulator of 80tons capacity. The height of stroke can be up to 3.2 m and the maximum distance between the columns is 5 m. The maximum length of the piece to be forged is about 18000 mm.
Open Die Forging is an important technique for many types of manufacturing. It allows rough and finishing shaping of metal, most commonly steel and steel alloys.

Advantages of Forging:

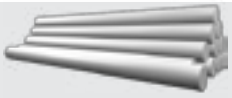
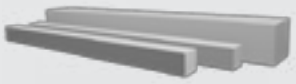
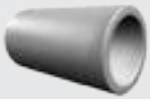
- **Reducing ingot defects**
- **Better fatigue resistance**
- **Improving microstructure**
- **Finer grain size**
- **Greater strength**
- **Longer part life**

We have developed the knowledge to compile helpful resources and information about forging for our customers. Whether you seek to learn more about the process, are looking for smart ways to save money in your manufacturing, or ways to increase the durability or life of your product, review these helpful resources or reach out to one of our sales experts.

What you gain when you select our forgings:

- Stronger parts than those produced by other metalworking processes due to the elimination of porosity, contoured grain flow, and fine grain size.
- Near net shape parts with less material waste and cost for low quantity orders.
- Efficient production methods utilizing in-house tooling.
- Multi-component fabrications can be combined into single piece forgings, resulting in reduced process time.
- The technical expertise of our sales staff and metallurgists, help to discover ways that reduce costs and improve lead time.

6300 ton Open Die Press Capabilities

Product	Dimention(mm)	Length(mm)	Weight (ton)	Shape
Round	Min: Ø 450 Max: Ø1600	Min: free Max:18000	Max: 70	
Square	Min: 400×400 Max: 1250×1250	Min: free Max: 10000	Max: 70	
Flat	Min thickness: 180 Max thickness: 2400	Min: free Max: 10000	Max: 70	
Disc	1200 < D < 3600	th > 170	Max: 70	
Ring & Bush	1000 < OD < 3600 600 < ID < 3300	L < 2500	Max: 70	
Tube (hollow)	1000 < OD < 2500 300 < ID < 1200	L < 4000	Max: 70	
Backup Roll	D_{barrel} : 1650	L~ 6000	Max: 70	
Work Roll	D_{barrel} : 650	L~ 6000	Max: 10	
Main Shaft (Gyratory Crusher)	Max Dia. : 1600 Min Dia. : 600	L~ 6000	Max: 70	

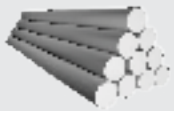
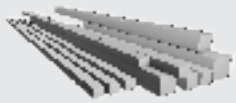
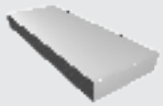
6300 ton Open Die Press

GFM Radial Forging Machines

The **GFM** rotary forging technique provides superior precision than conventional hot forging techniques, which in turn decreases machining allowances and costs. The GFM machines are employed for working on ingots and to make long bars of different cross sections such as round, square or rectangular cross sections and tapered or stepped shafts. The automated system and software offers great flexibility and simplicity of use. Extensive knowledge of the process in view of recrystallization and grain refinement as well as strain and stress at each forging stroke have been taken into account.

EICO has five radial forging machines (GFM-Austria) which enables it to forge different types and grades of steels.

Four radial forging machines (SXP65, SXP25, SXP13, SXP10) and one SHP06 radial forging machine are available at EICO.

Radial Forging Capabilities				
Product	Dimension(mm)	Length(mm)	Weight (ton)	Shape
Round	Min: 30 Max: 500	Min: free Max: 12000	Max: 8	
Square	Min:40×40 Max: 350×350	Min: free Max: 12000	Max: 8	
Flat	Min thickness: 20 Max thickness: 420	Min: free Max: 12000	Max: 8	
Tube (hollow body)	180 < OD < 500 ID: 130,80	Max: 8000	Max: 8	
Stepped Round Bars	Min: 50 Max: 500	Max: 8000	Max: 8	
Hexagonal Section Bars	a= 150 - 255	Max: 6000	Max: 3	
Octagonal Section Bars	a= 120 - 400	Max: 6000	Max: 3	

Some High Alloy Steel Grades Produced in EICO	
Material	Produced Shape
AISI 304L	Round-flat
AISI 316L	Round-flat
AISI 403Cb	Round-flat
CUSTOM 450	Round-flat
1.4057 (X17CrNi16-2)	Round-flat
1.2379 (K110-X155CrMoV12-1)	Round-flat
1.2080 (K100 - X210Cr12)	Round-flat
1.2344 - (W302 - X40CrMoV5-1)	Round-flat
1.2367 - (X38CrMoV5-3)	Round-flat
1.4462 - (SAF 2205)	Round-flat

Heat Treatment Shop

Heat Treatment (13 Furnaces)

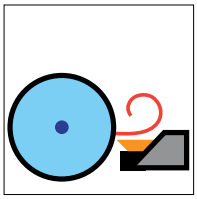
Heat treatment workshop is capable of performing various heat treatment processes on products to achieve desired microstructures and mechanical properties:

- Annealing,
- Normalizing,
- Quenching and tempering,
- Stress relieving,
- Spray quenching facility for parts up to 50 tons,
- Dual Frequency Continuous Induction Hardening machine up to 10 tons.

Heat Treatment Furnaces		
Number	Max Furnace Load	Range of Process Temperature
13	100 ton	400-1150 ˚C ±8

Hardening Tank Dimensions		
Name	Dimensions (m) (W×H×L)	Cooling Media
Q.T.1 (Combined Shape)	3×2.5×13	Water
Q.T.2	6×6×6	Water
Q.T.3	6×6×6	Water
Q.T.4	3×1.5×12	Water
Q.T.5	3×2.5×7	Polymer
Q.T.6	6×2.5×6	Oil

Machining Shop

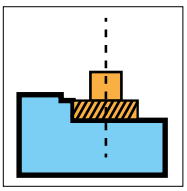


CNC Lathes:

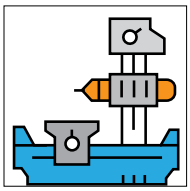
Φ_{Max}: 2500 mm

L_{Max}: 12000 mm

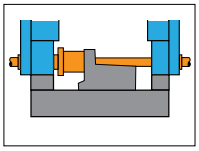
Max Weight: 80 ton



CNC Gantry Milling Machine
L: 4000 mm
W: 2000 mm
H: 1500 mm
Max Weight: 40 ton
4- axis with C- axis simultaneous

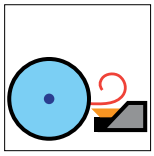


CNC Horizontal Boring Machine
L: 6000 mm
H: 3000 mm
Max weight: 80 ton
4- axis Rotary Table (B- axis)



Deep Hole Drilling

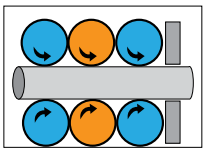
Max Inner Diameter: 200 mm
Min Inner Diameter: 50 mm
Max Length:10000 mm
Max Weight: 60 ton



Small CNC lathe machines with the following specifications

- Height of centers 410 mm, Distance between centers 2000mm
- Height of centers 410 mm, Distance between centers 3000mm

And many other heavy and light Machining equipment
Distance between centers up 12m, Height of centers of 1000 mm

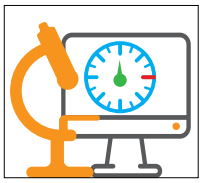


Peeling and Straightening Shop

Peeling Machine Type: PL100 and PL 200
Min Diameter after Peeling: 20 mm
Max Diameter after Peeling: 200 mm
Min Peeling Speed: 1 m/min

Straightening Machine Type: Hydrulic press 1000 ton and RLL 150
Min Dimension Processable: Ø50 mm or Square 80×80
Max Dimension Processable: Ø350 mm or Square 350×350

Quality Control Unit



Quality Control Unit

- Control of raw materials
- Control of production process (QCP)
- Control of final product

In this department, Destructive (DT) and Non-Destructive Tests (NDT) are done to investigate the quality of final products.

The tests we do consist of:

- Chemical Analysis
- X-Ray Fluorescence Spectroscopy (XRF)
- Tensile Testing
- Impact Testing
- Hardness Measurement
- Ultrasonic Testing
- Jominy Test
- Metallography Examination

XRF Analyzer : Model AXIOS Panalytical

H-MAT 2500: Bruker G8

SPECTROLAB M12

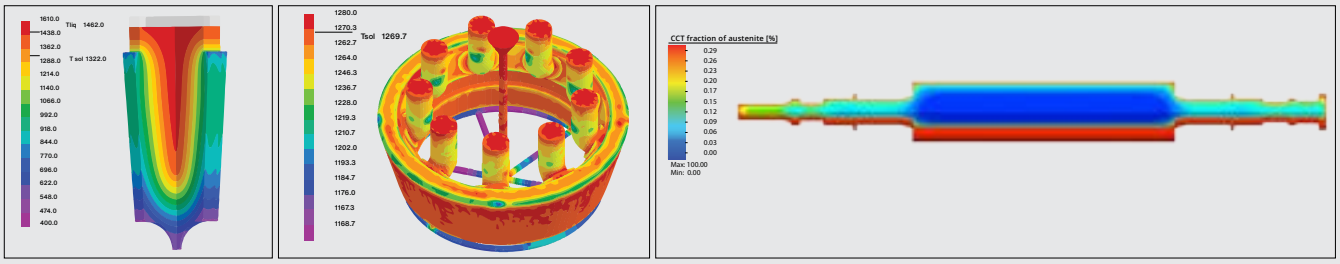
Tensile Machine : ZWICK - Model Z1200Y

Impact Machine : Roell Amsler - Model RKP450

R&D

The main functions of R&D department are as follows:

- Participate in the new product development process with emphasis on developing grades and processing.
- Provide engineering expertise in evaluating and identifying causes of quality problems originating from processing and handling operations.
- Evaluate data, conduct trials and recommend actions to produce premium steels products.
- Assist operations management in evaluating and modifying standard operating practices in relation to improved yield and product quality.
- Position will involve responsibility for managing either product or process quality for an assigned product line or operating.
- Lead trials for new products, establish mill qualifications and follow-through to customer production unit.
- Significant coordination and work with cross-functional teams including operations, commercial, technical and quality groups.
- Investigating sources of nonconforming materials and follow up containment actions for potentially rejected materials.
- Develop and approve manufacturing/work processes and written instruction.



Certificates

Throughout our processes, from receiving the raw material to delivery of the products to our customers everywhere, we control everything to prevent any deviation which would cause our customers dissatisfaction. Our quality assurance system guarantees the quality of our products and services all the way through.

Integrated Management System (IMS)

ISO 17025: 2012, Accredited Laboratory Certification
ISO 9001: 2015, Quality Management System Certification
ISO 14001: 2015, Environmental Management System Certification
ISO 45001:2018, Occupational Health and Safety Management System Certification
ISO 50001:2018, Energy Management System Certification

Description of Products

As the largest manufacturer of forged alloy steel in Iran and the Middle East, EICO is striving for advanced technology to lead forged steel in the region and to provide the excellent products to meet the requirements of domestic and international customers.

For many years, EICO has provided strong support for different segments of Iranian industries such as Oil and Gas and Petrochemical, Railway, Mining and Cement and Iron and Steel industries. Our products are currently exported to many countries such as Russia, Turkey, Italy, Bulgaria and so on. EICO will persist in the research and development of advanced technology to serve its customers.

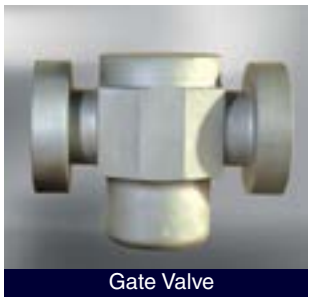
Oil and Gas Industries

Commitment of EICO in producing exceptional products has made it a prominent provider for Oil and Gas industry. Products of EICO, mostly in the form of semi-finished, meet the needs in this industry.

AISI 4130, 4140, 4145, 4718, 4815, 304, 316L, 410, A350-LF2, A105 and **ASTM A694** are typical alloys in these industries.

Example of products:

Casing, Drill Pipe, Drill Collar, Adapter Flange, Adapter, Tubing Head Spool, Casing Head, Solid Block Valve, Gate Valve, T.H Spool, Double Gate Valve, Riser Body, Ball Valve and Solid Block.


Gate Valve


Ball Valve


Adapter


Solid Block Valve

Railway Industries

EICO is capable of producing various products for railway industry. So far, the production of axles for cargo and passenger wagon has been utilized. The company is capable of producing wheels by forging, machining, spray quenching and final machining.


Locomotive Axle and Mono Block Wheel


Mono Block Wheel


Locomotive Axle, Passenger Wagon Axle, Freighter Wagon Axle

Power Generation Industries

EICO produces a range of semi-finished and finished products for power generation industry.

EICO is currently producing the following sections for this industry:

a) 185 MW and 45 MW Generator Rotor Shafts,

b) Rings, Discs and Bearing Shell with various dimensions used in generator,

c) Stainless steel sections used in turbine blades,

d) Various other steel sections that can be used in power generation industry.

Turbo Generator Centering Ring

Compressor Disc

Wind Turbine Main Shaft

Shaft

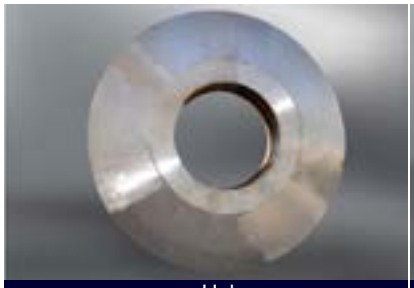
Generator Rotor Shaft 185 MW, 45 MW

Iron and Steel Industries

Varied products used in steel industry such as rolling sector can be produced by EICO.

The main products in this category are as follows:

- Parts used in rolling mill industry such as work rolls, back up rolls and chock,
- Light and heavy shaft,
- Other parts made of plain carbon steel, alloy steel and stainless steel in the range of 30 mm to 1600 mm diameter.


Hub


Half Coupling


Work Roll


Chock

Slag Pot


Backup Roll

Cement and Mining Industries

Recently the Cement and Mining industries have become the main customers of EICO. There are a lot of strategic parts in this industry which can be produced by EICO. During the last year, EICO has produced many parts and pieces such as shaft and ring for HPGR (High Pressure Grinding Rolls) system. Heavy main shaft used in crushers are one of the other main products which are produced in EICO. Modification of analysis via addition of micro-alloying elements such as Nb and V is the other research services to the customer to produce products with high quality and high fatigue life.

HPGR Tire

Crusher Main Shaft

Supporting Roller

Spider

Mill Roller Shaft

Cement Mill Girth Gear

Market Development

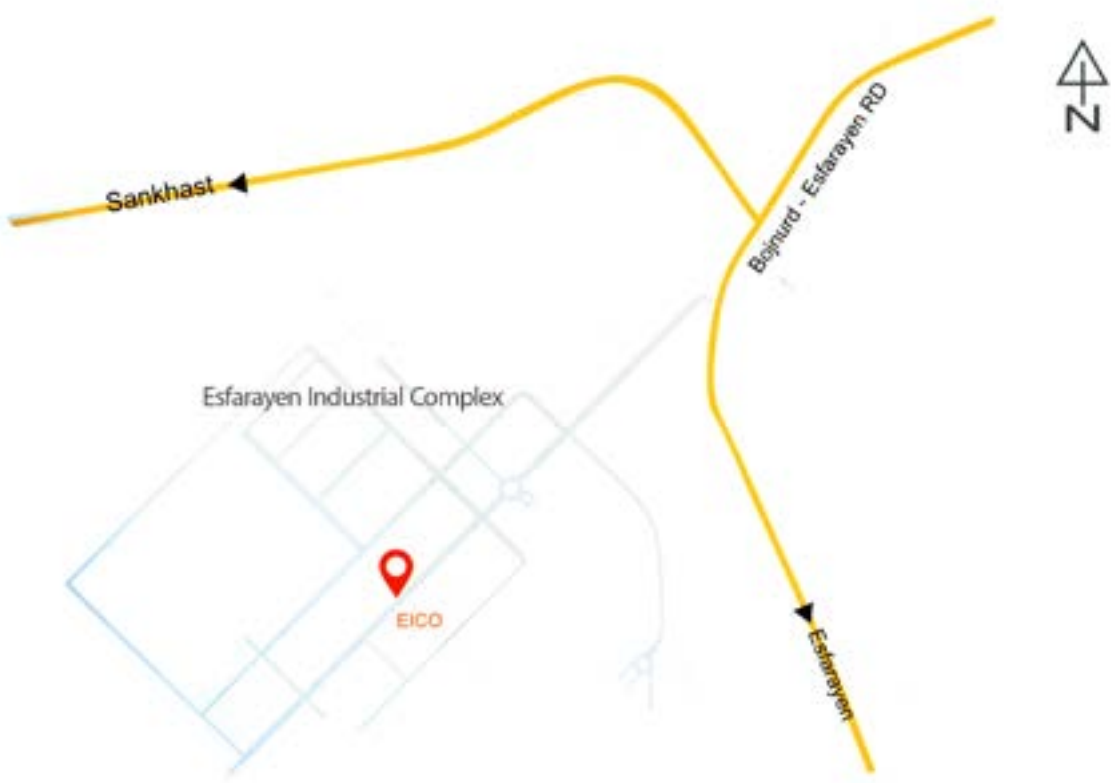
Esfarayen Industrial Complex as a regionally recognized company by alloy steel base and talent bank, provides the customers with strong technical supports. With powerful assistance from the EICO research group, it engages the customers throughout the production of products and takes into account issues that may arise during the service of the products.

Social Activities

As employees are the corner stones of our corporate development, EICO provides a variety of channels to meet the needs of the employees to be a part of the company. This is done in line with a program for career development at EICO. Leisure time activities create a friendly environment and give the employees means for self-expression. Participating in public activities such as running, mountain climbing, visiting the ancient monuments and recreational places are some of the activities held at EICO.





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