

PASSION FOR STEEL



AC ARC FURNACE

SOLUTION FOR QUALITY STEEL MAKING

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MODERN ELECTRIC STEELMAKING

Over the last few year, increasing customer demands for reducing operating costs and improved efficiency have encouraged equipment supplier to develop highly efficient melting machine for modern steelworks. This led to a design of ARC Furnace that meets the demands of Ultra High power technology.

New processes and new equipment such as water cooled furnace walls and roof, O₂ lances and oxy fuel burners have led to modification of traditional design of an arc furnace, such as split and or interchangeable shell and eccentric bottom tapping.

Arc furnaces are designed to comply with the requirement of modern steel works. Ease of operation PLC based control system and automation, combined with safety system.

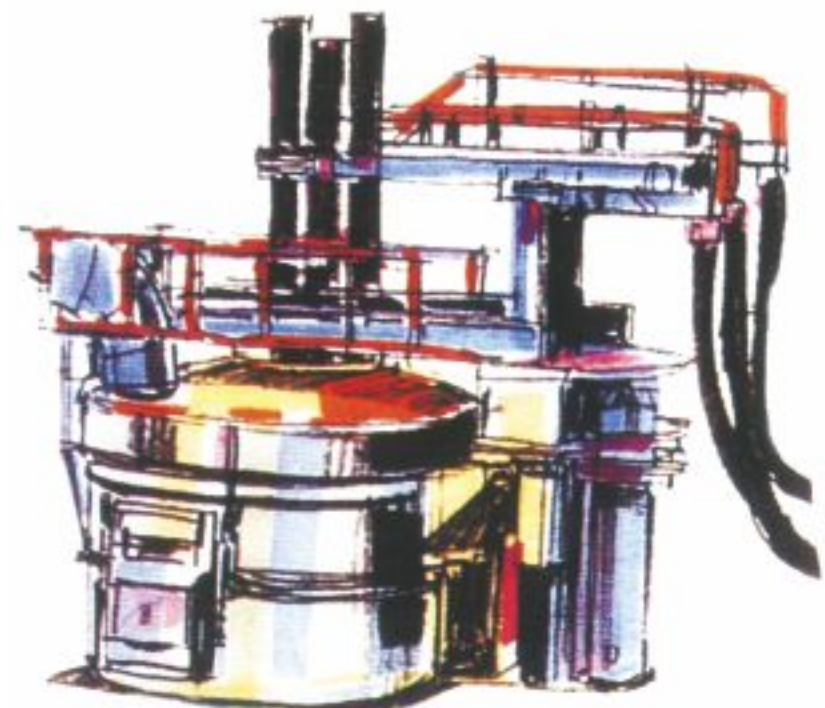
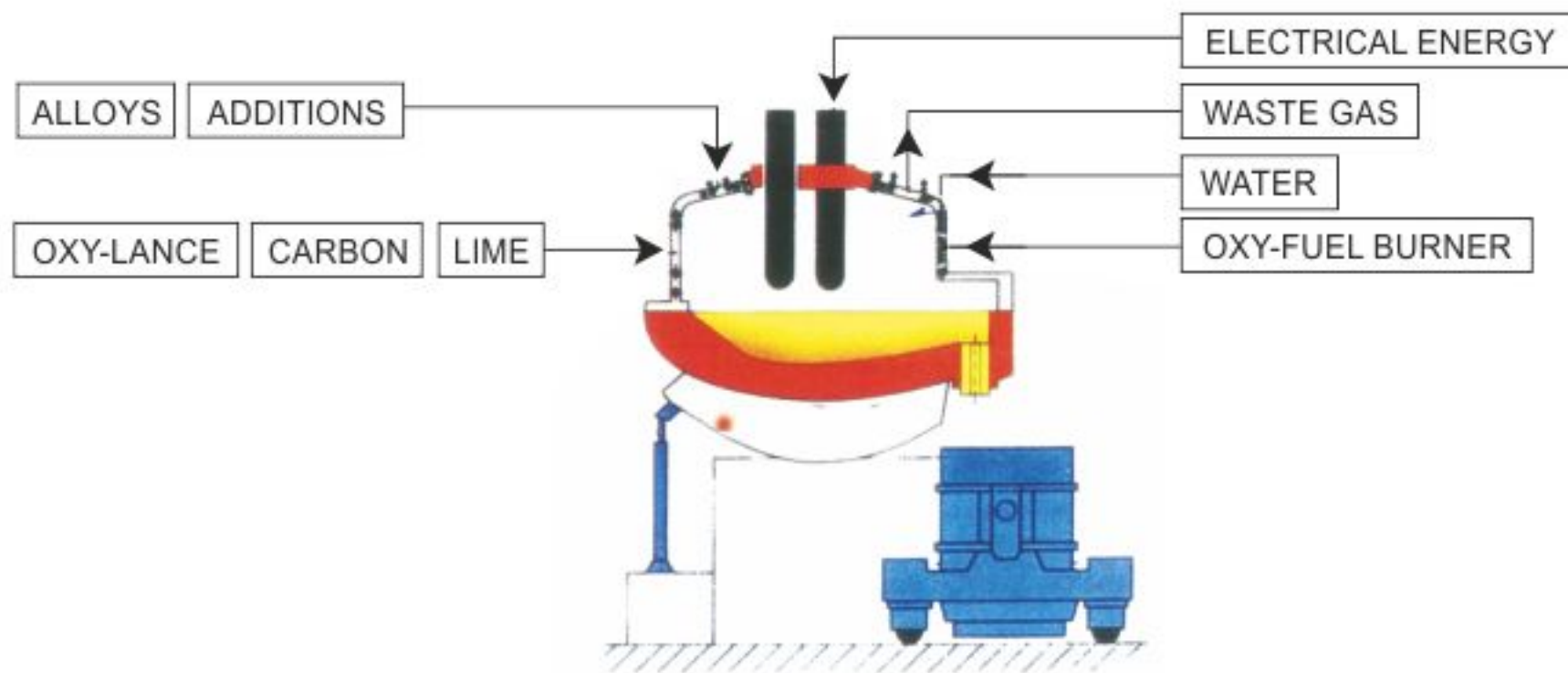
Higher availability Minimum power off times and short shutdown times for maintenance and repair.

High melting performance High power density up to 1000 KVA per ton. Series Reactor concept for low secondary current to achieve low electrode consumption.

Flexibility Scrap and reduced iron of all types can be charged. From ordinary to high-alloy steel grades.

CNES make AC Arc furnace meets all stringent demands regarding Sturdy construction, high availability and operating performance which ensures a highest productivity with lower operating cost.

Our long experience in AC arc furnace design and operation, proficiency in successfully employing state of art digital electronic electrode control system makes it possible to offer complete AC arc furnace plant with latest features of Arc furnace technology.



ELECTRIC AC ARC FURNACE - DESIGN

The principal features of the CNES arc furnaces are compact and sturdy construction, resting on a simple foundation, and the adapted electrical equipment.

CNES offer two different series of mechanical designs : \

- for 2.3 ...35.0 t liquid steel: Type SSKD
- for 30.0 ...80.0 t liquid steel: Type AL

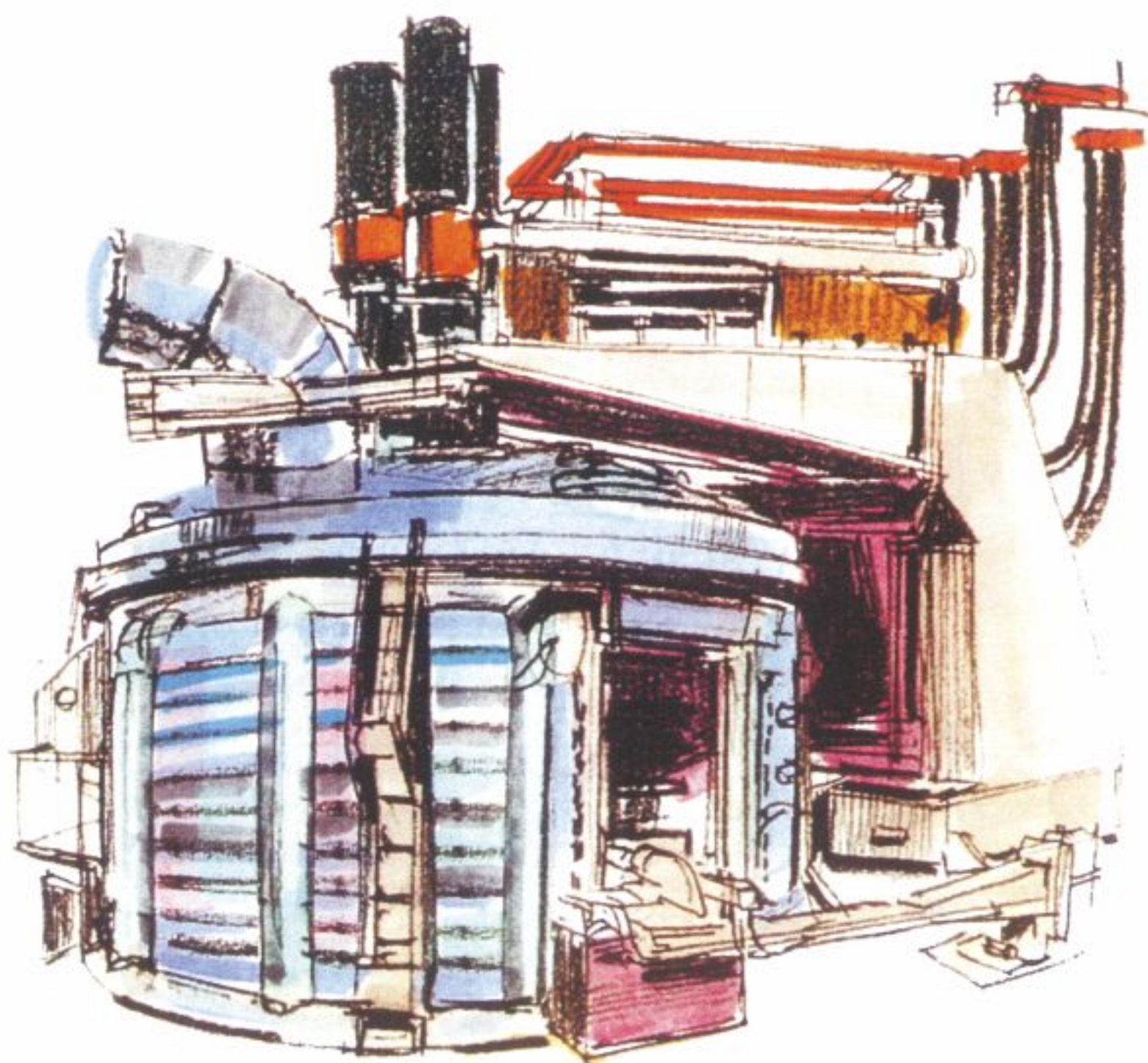
The main design characteristic of these two type are:

SSKD

To lift off the furnace roof and swivel out the upper part of the furnace for charging, a cylinder is employed which is positioned on the foundation, next to the furnace shell. This well tried principal is used for furnaces up to a shell diameter of 4.20 m.

AL

For furnaces with shell diameter larger than 4.30 m the so-called platform design was chosen; a platform constructed of heavy plates and sections welded together carries the furnace shell and the superstructure of the upper part of the furnace, as well as the roof swiveling device. These furnaces are equipped with interchangeable shells.

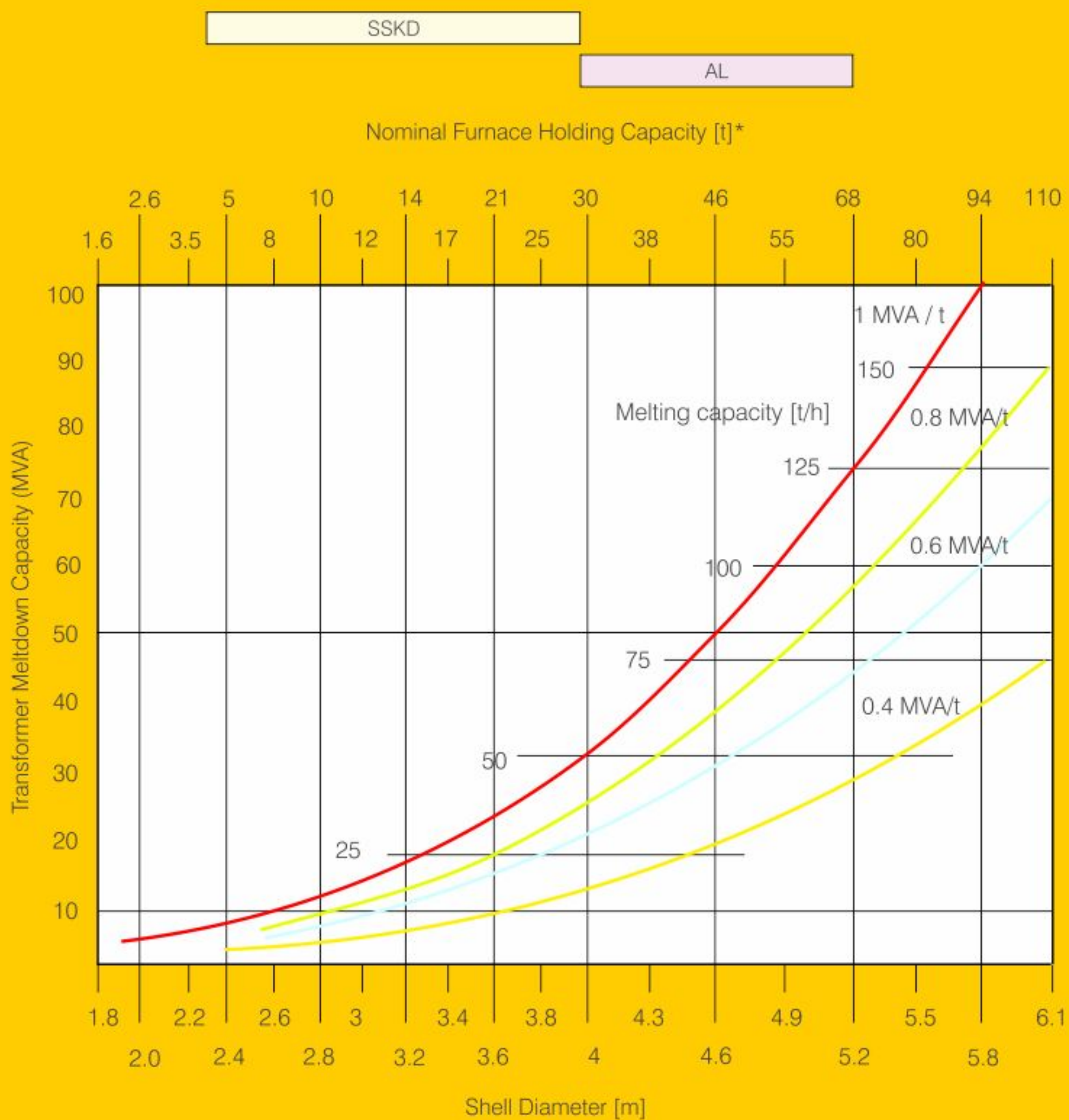


AL



DESIGN PARAMETER

Electric Arc Furnace Type



* Type AL with eccentric bottom tapping device: +15%



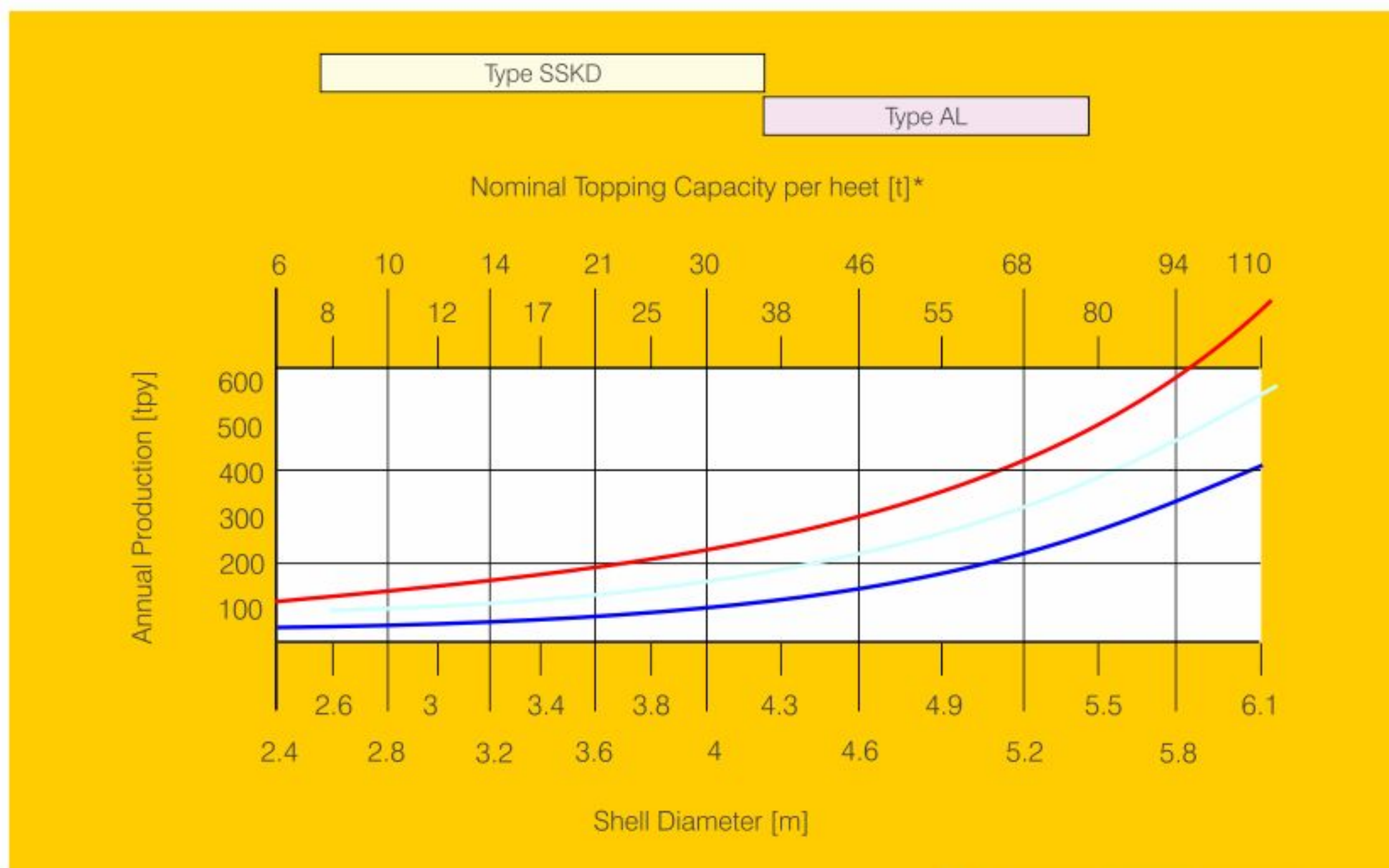
DESIGN DATA

Ac Electric Arc Furnace - Capacity

Furnace Type		Nominal Capacity tons	Typical Meltdown Power MVA	Shell Diameter mm	Electrode Diameter mm	Pitch Circle Diameter mm
SSKD	240	6.0	3.0	2,400	250	600
	260	8.0	4.8	2,600	250	700
	300	10.0	7.2	3,000	250	700
	320	12.0	10.0	3,200	300	800
	340	17.0	12.0	3,400	350	850
	370	22.0	18.0	3,700	350	1000
	390	25.0/30.0	21.0	3,900	400	1100
	420	30.0/35.0	24.0	4,200	400	1150
AL	430	35/40	32.0	4,300	450	1150
	460	45/50	36.0	4,600	450	1150
	490	55.0	45	4,900	500	1150
	520	70.0	54.0	5,200	500	1150
	550	80.0	64.0	5,500	550	1200
	580	94.0	75	5,800	550	1200
	610	110.0	90	6,100	600	1300

Annual Production

Depending on the meltdown power, the quality of raw material, the required steel quality, and the operation mode (with / without ladle furnace), up to 24 heats / day can be produced. Based on approx. 300 production days / year, the following annual production can be reached.



BASIC COMPONENTS AND ADDITIONAL ITEMS

Furnace Part	Type SSKD Shell Diameter : 2.4 to 4.2 m. Nominal Capacity : 6 to 35 t.
Basic Design	Tiltable furnace shell which supports the upper part of the furnace.
Swingbridge	Hydraulic lifting and swivelling mechanism permanently mounted on the foundation separate from the tiltable furnace shell.
Shell	Simple but sturdy design with water-cooled upper rim.
Slagging Door	Box section steel structure, refractory-lined.
Tapping Facilities	Conventional runner and eccentric bottom tapping device available
Roof	Refractory-lined roof supported by water-cooled roof ring and water cooled roof with fourth and fifth hole on request.
Electrode Arms : - Arms - Clamp - Power Supply	Box / Tube design on which electrode clamping and release system is mounted. Water-cooled steel clamp, pressure shoe design. Water-cooled copper current tubes OR current carrying arms on demand.
Hydraulic Installation : - Equipment - Medium - Pressure	A pressure vessel is employed as energy accumulator for electrode lifting and furnace tilting. Roof lifting on-line with pump Oil in water emulsion. For roof motion : mineral oil. Low and medium.
High Voltage Switchgear	11 KV OR 33 KV Special duty circuit breaker
Automatic Electrode	Quick-acting valve regulator, with Ferraris operating mechanism. Digital Electronic electrode regulation on request.
Furnace Operation - Motions - Control	Hydraulic valves directly manually operated. Relay-operated.
Transformer	Forced oil - water cooler design with OFF or ON load tap changer.
Secondary System	Tringulated. Current measurement with Rogowski coils and Digital regulation system.
Cooling Water Installation	Effective water-cooling of components subjected to heavy duty and exposed to furnace heat. Open cooling circuit with pressureless return.
Additional Equipment	Automation systems, steel temperature measuring system, oxy-fuel burners, oxygen lancing systems, sample-taking device on request.



Type AL
Shell Diameter : 4.3 to 6.1 m.
Nominal Capacity : 35 to 110 t.

Tiltable platform which supports both superstructure of furnace upper part and furnace shell.

Superstructure turns on an arc-shaped rail. Rail and pivot pin are mounted on the platform.

Simple but sturdy cage design with water-cooled upper rim prepared for use of water-cooled wall panels. Interchangeable split shell.

Water cooled steel structure

Conventional runner, syphon tapping system and eccentric bottom tapping device available.

Water-cooled roof with interchangeable refractory-lined center part. Fourth and fifth hole on request.

Water-cooled box section design with interior electrode clamping and release system.
Water-cooled copper clamp, pressure shoe design.
Water-cooled copper current tubes. Copper-plated electrode arms on request.

A pressure vessel is utilized as energy accumulator for all functions which is connected on-line with pump. Compact unit comprising : tank, pumps, valves and filters
Water-glycol for all functions / oil hydraulic.

Vacuum circuit breaker.

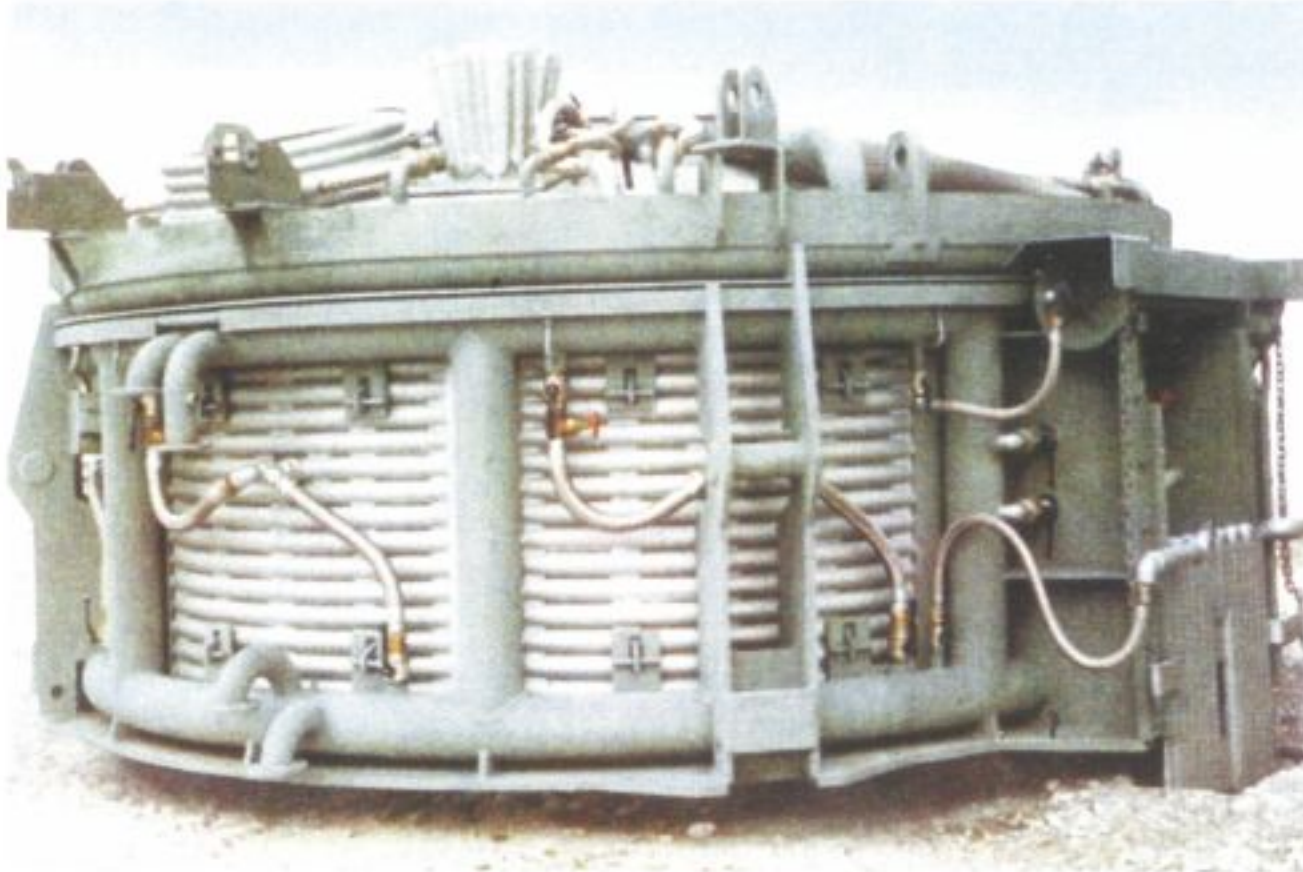
Digital Electronic Electrode system, with arc resistance calculator and logic for supervision of ignition, Arc break and short-circuit.

Solenoid valves operated from the control desks.
Programmable logic control.

UHP-type with forced oil-water cooler and on-load tap charger.

Triangulated. Current measurement with Rogowski-coils.

TECHNICAL FEATURES

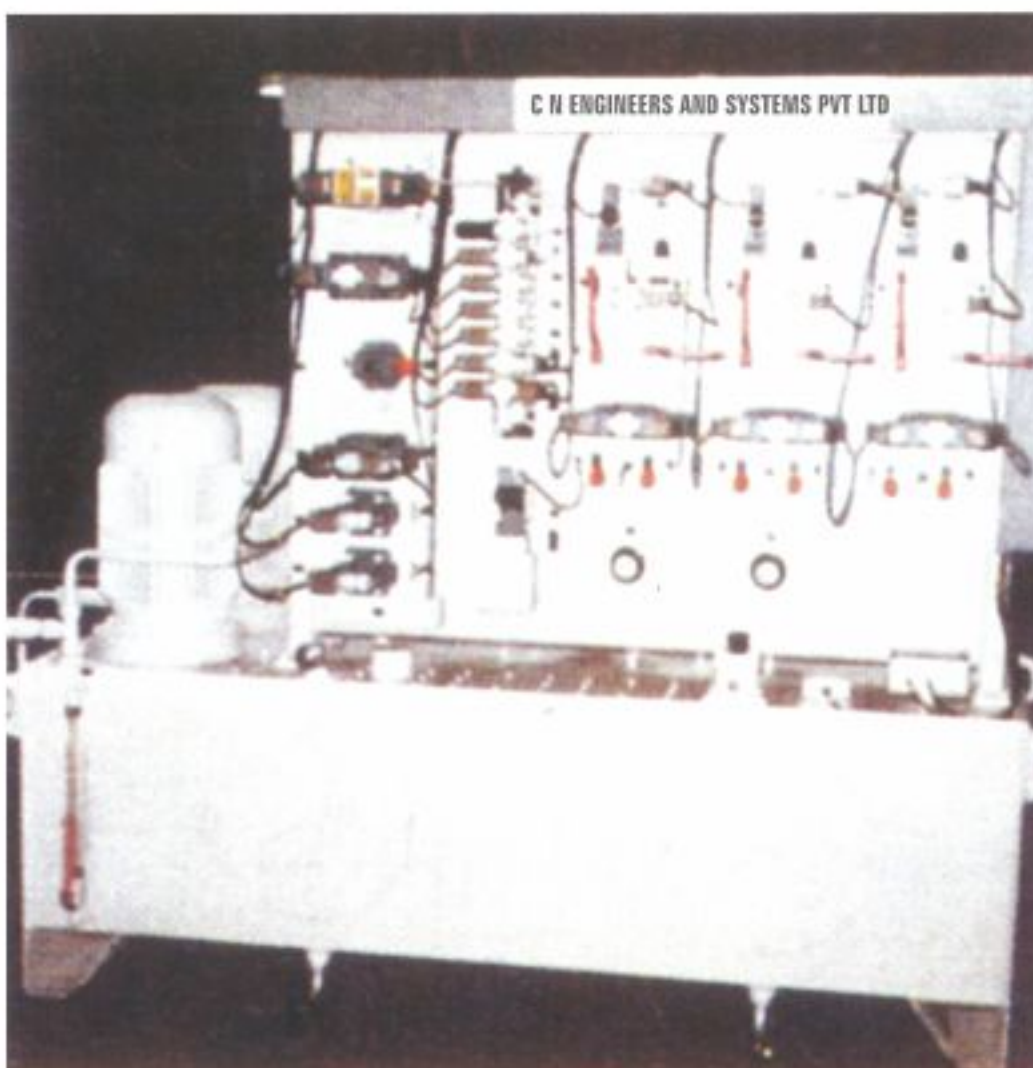


Water-cooled Shell Upper Part Cage Design

The Shell of the arc furnace will in most cases be equipped with water-cooled wall panels. The panels are of the tube-on-tube design, made of seamless steel pipes, and cover up to 85% of the wall above the slag line. Most furnaces with bigger diameters are equipped with a split shell. The picture shows, as an example, the upper part of the split shell in the so-called cage design. The water-cooled panels cover the whole upper part between the lower and upper rims, which serve as water supply and run off.

Power Pack Hydraulic Unit

All furnace motions are powered hydraulically, using just one single system with one hydraulic medium. All pumps, valves and filters are mounted on the tank for the medium, constituting a compact unit. A pressure vessel work as accumulator. Operating pressure of about 100 bar and high-capability control valves ensure quick response and attraction times. The use of oil or water-glycols as hydraulic medium is standard practice. Glycol can be used even at low ambient temperatures, is non-poisonous, and does not need special sealing material.

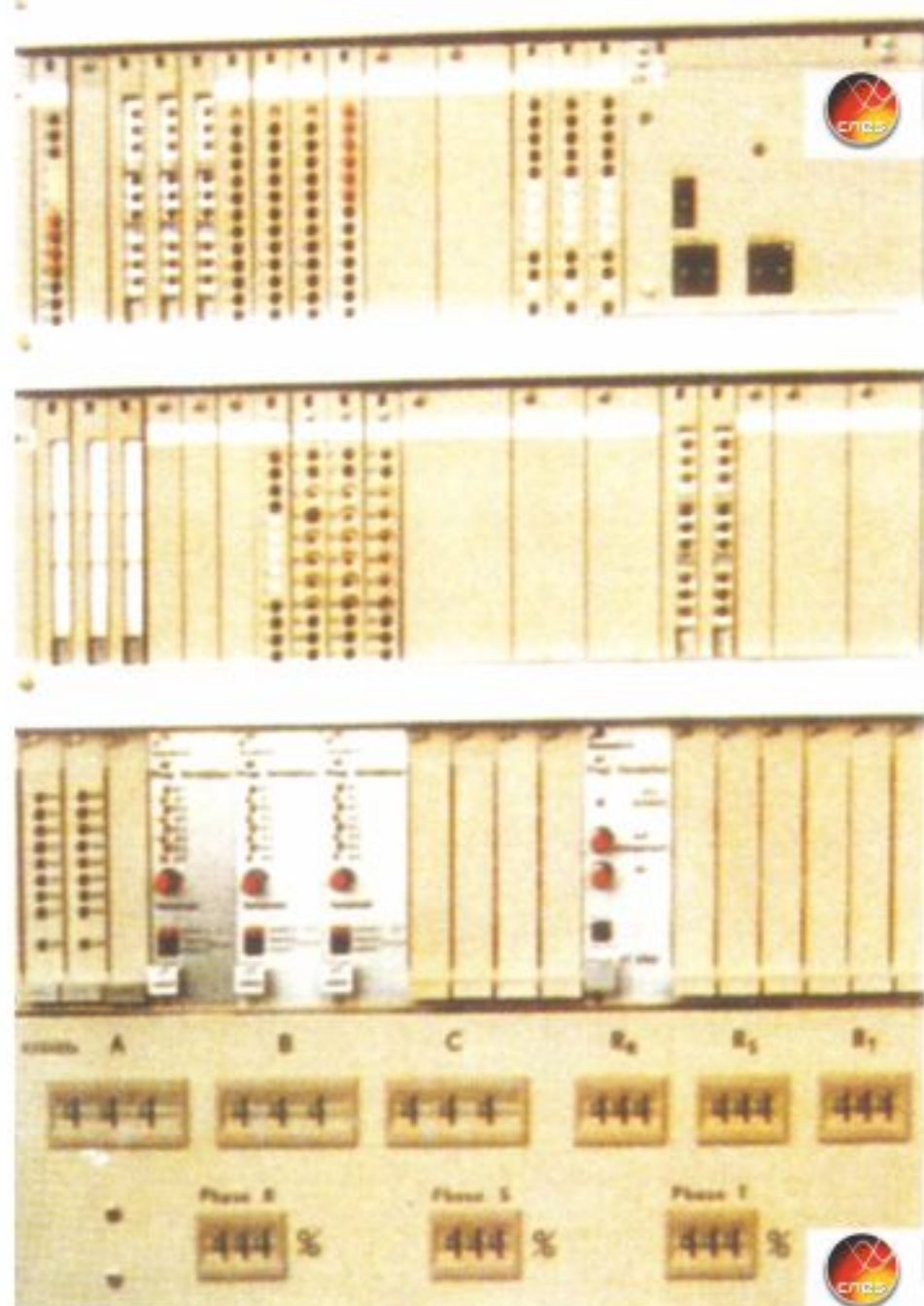
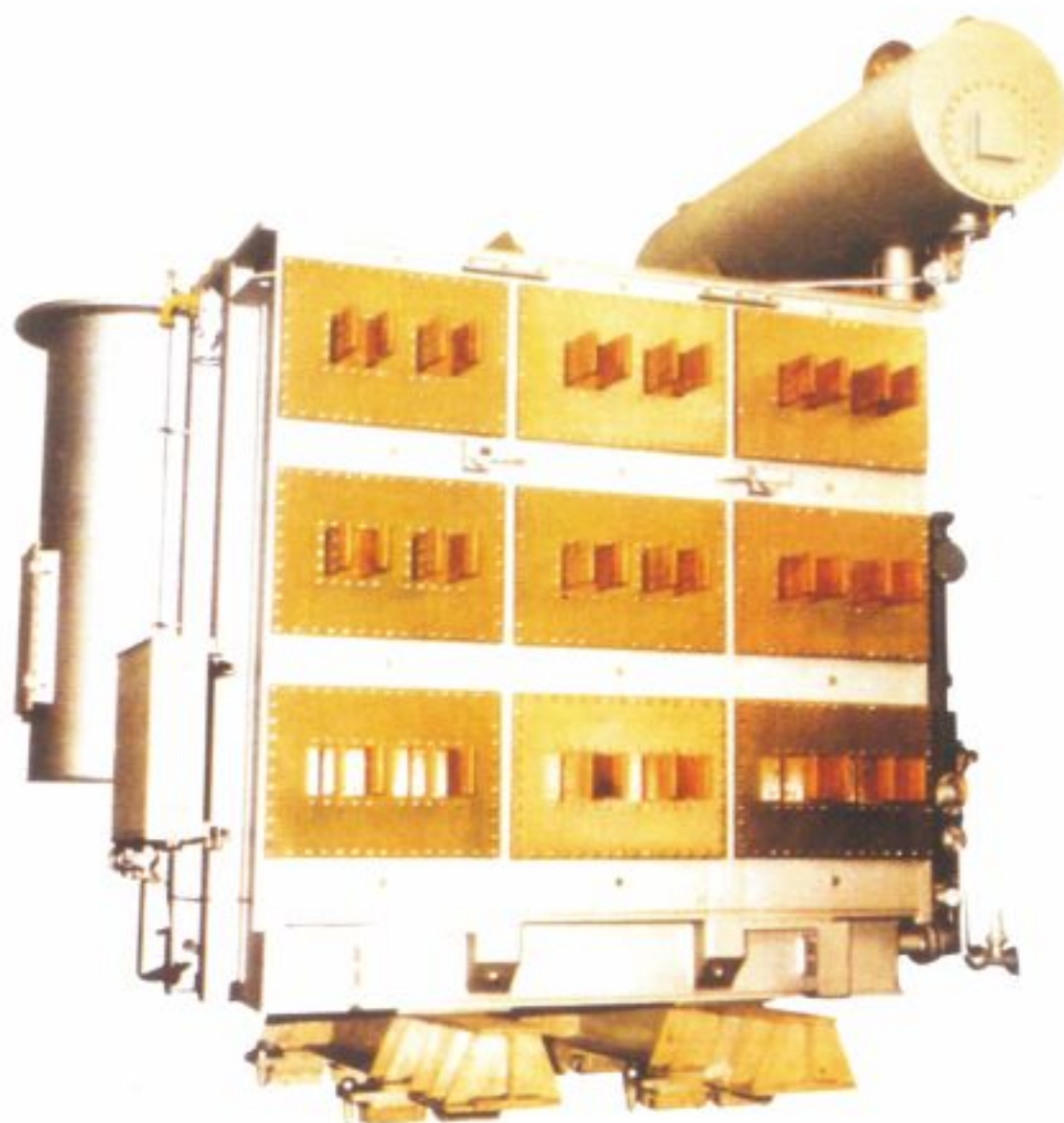




UHP Furnace Transformer

The transformers are built for extra-heavy duty, to withstand the high mechanical and electrical stresses caused by arc furnace operation.

The calculation of arc furnace transformers considers the specific conditions of each plant individually. Special care is given to allow modern operation with long, stable arcs at low current, which results in high efficiency and low consumption of graphite electrode.



Digital Electronic Electrode Control

The task of the electrode control system is to maintain as closely as possible a given target working point within the circle diagram, which is determined by the secondary voltage, and by the power factor used. The quality of the system depends on precision with which working point is maintained. The degree of precision depends on accuracy of measurement of arc voltage and current. Long experience in the design and operation of arc furnace plants have resulted in the development of the CNE electronic electrode control system.

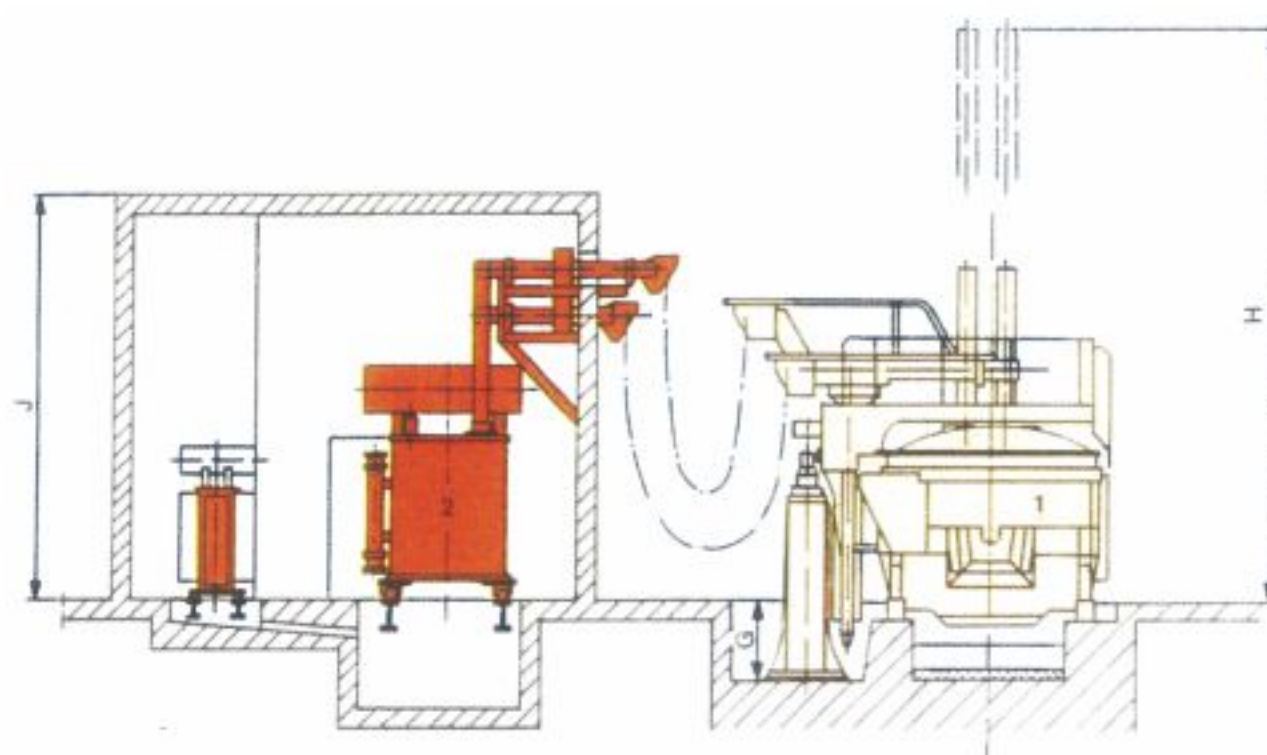
Reproducing the voltage drops between the measuring point and the electrode tip, the system calculates the actual arc voltage and resistance. The current is measured with high precision by Rogowski-coils. These values are the basis for an exact arc control. An additional logic supervises ignition, arc break and short circuit. The system works with high accuracy and stability, getting maximum active power into the furnace.

LAYOUT PROPOSAL TYPE SSKD

Legend

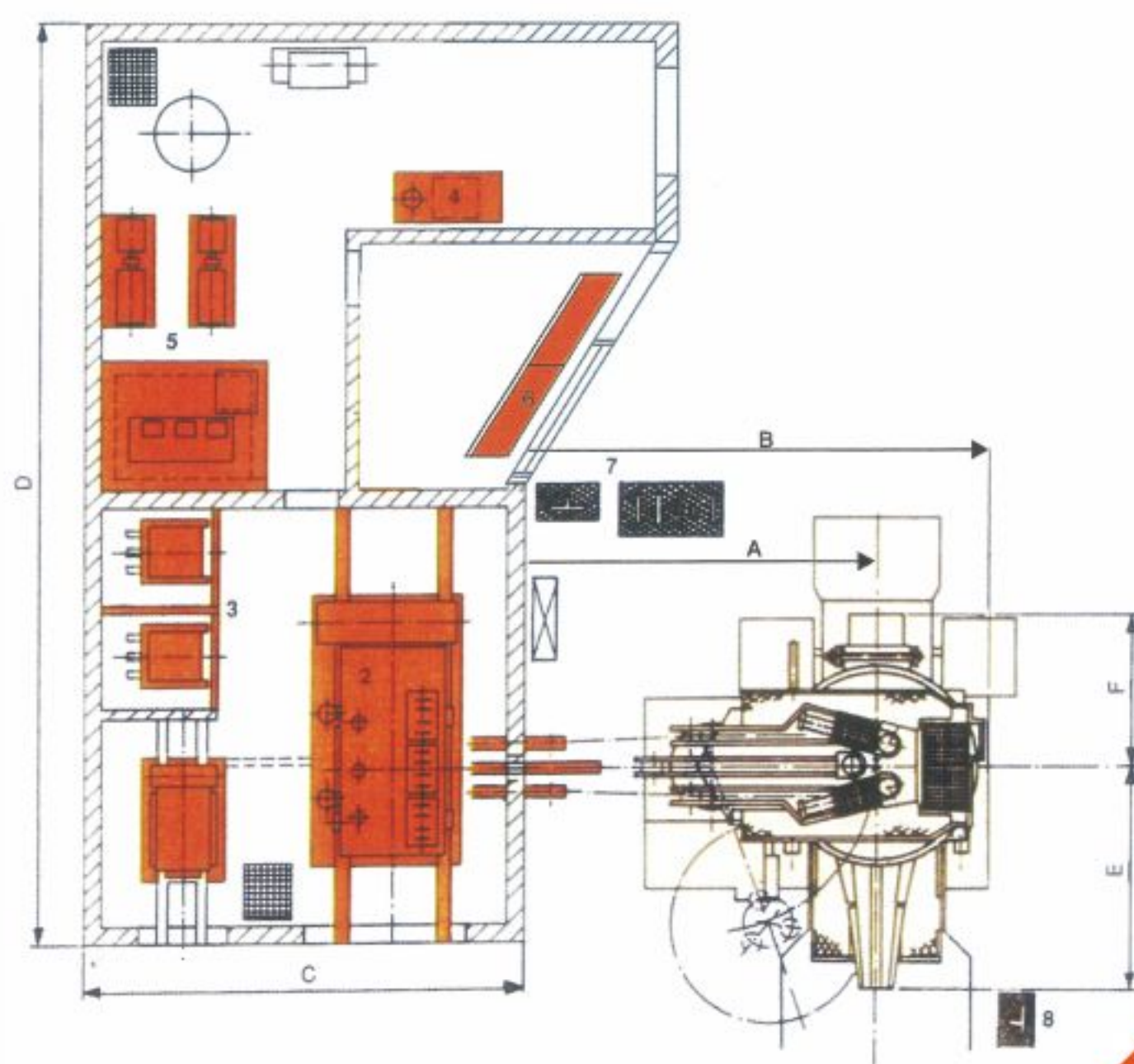
- 1 = Arc Furnace SSKD
- 2 = Transformer
- 3 = High-voltage switchgear
- 4 = Hydraulic power pack
- 5 = Pressure emulsion-plant
- 6 = Electric control desk
- 7 = Hand operated vales
- 8 = Tilting rack

* Layout shows Arc furnace SSKD with conventional Spout topping device.
Eccentric bottom Topping device is available on request.



Plant Dimensions in mm

Type	A	B	C	D	E	F	G	H	J
SSKD 240	5100	6600	6500	13,000	2900	1980	560	6000	5000
SSKD 260	5350	7000	6500	13,300	3250	2190	900	6300	5200
SSKD 320	6500	9000	10,000	16,000	3800	2800	1000	8000	10,000
SSKD 340	7500	9500	10,500	16,000	4000	3300	1000	8500	10,000
SSKD 370	8360	10,500	11,500	14,000	5000	4300	-	8190	16,000
SSKD 390	8400	11,100	16,000	15,000	5300	4600	-	8600	16,000
SSKD 420	9000	12,000	16,000	16,000	5500	4800	-	8800	16,500

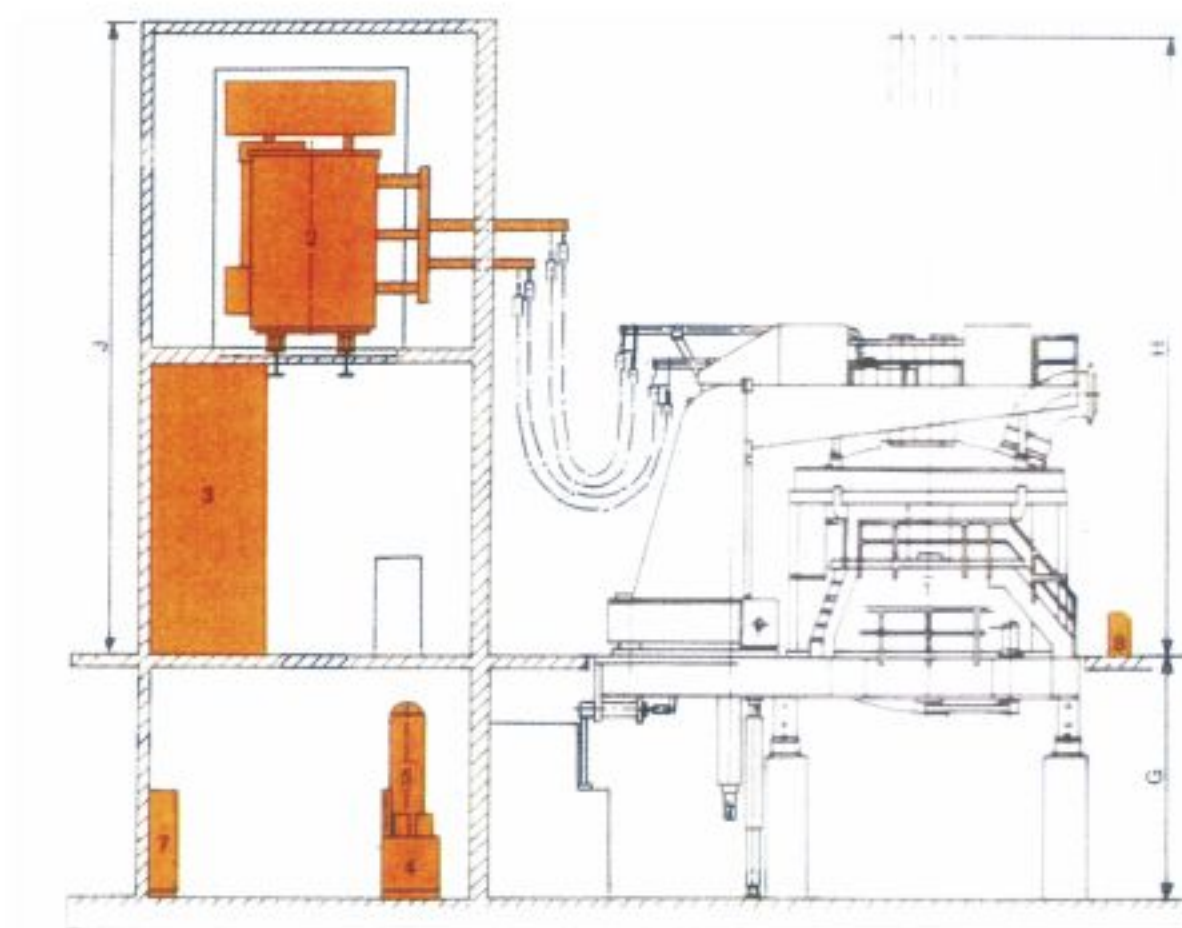


LAYOUT PROPOSAL TYPE AL

Legend

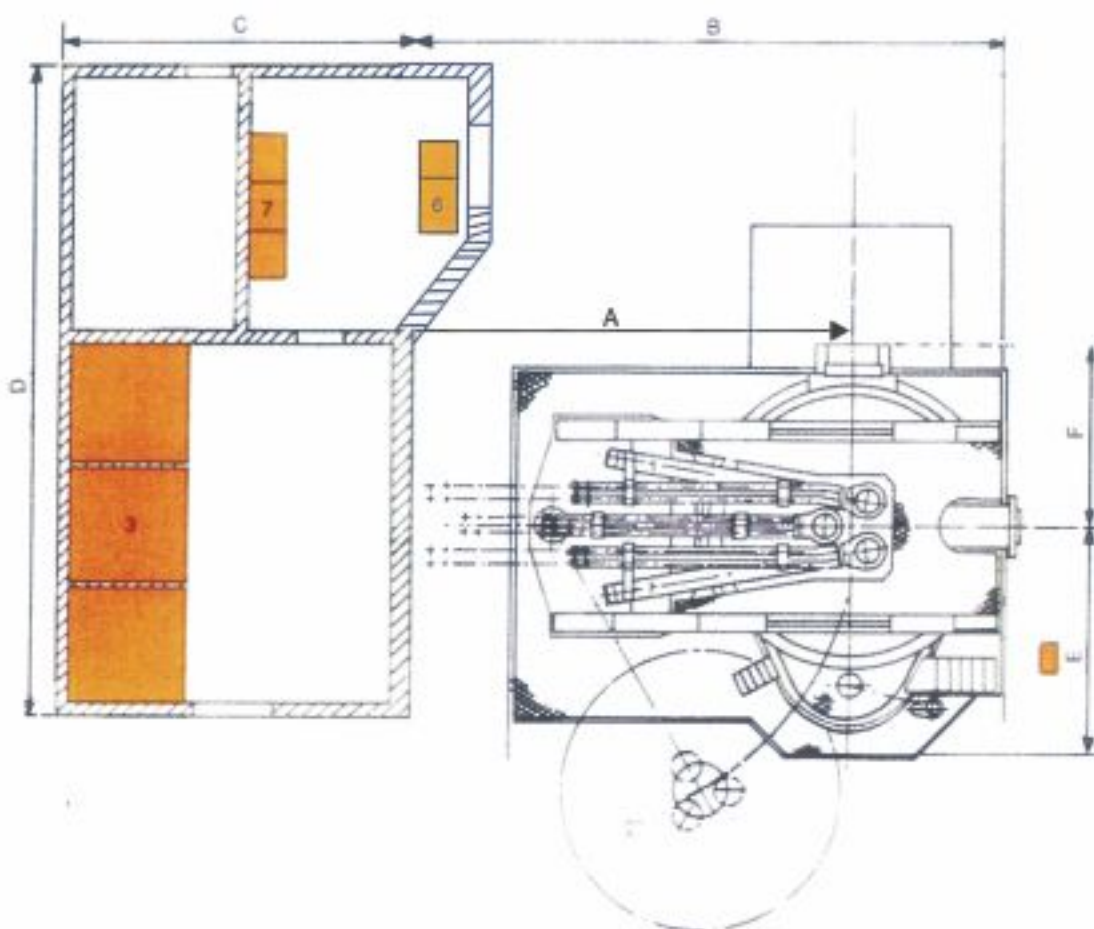
- 1 = Arc Furnace AL*
- 2 = Transformer
- 3 = High-voltage switchgear
- 4 = Hydraulic unit
- 5 = Pressure vessel
- 6 = Main control desk
- 7 = Electric control desk
- 8 = Tilting console

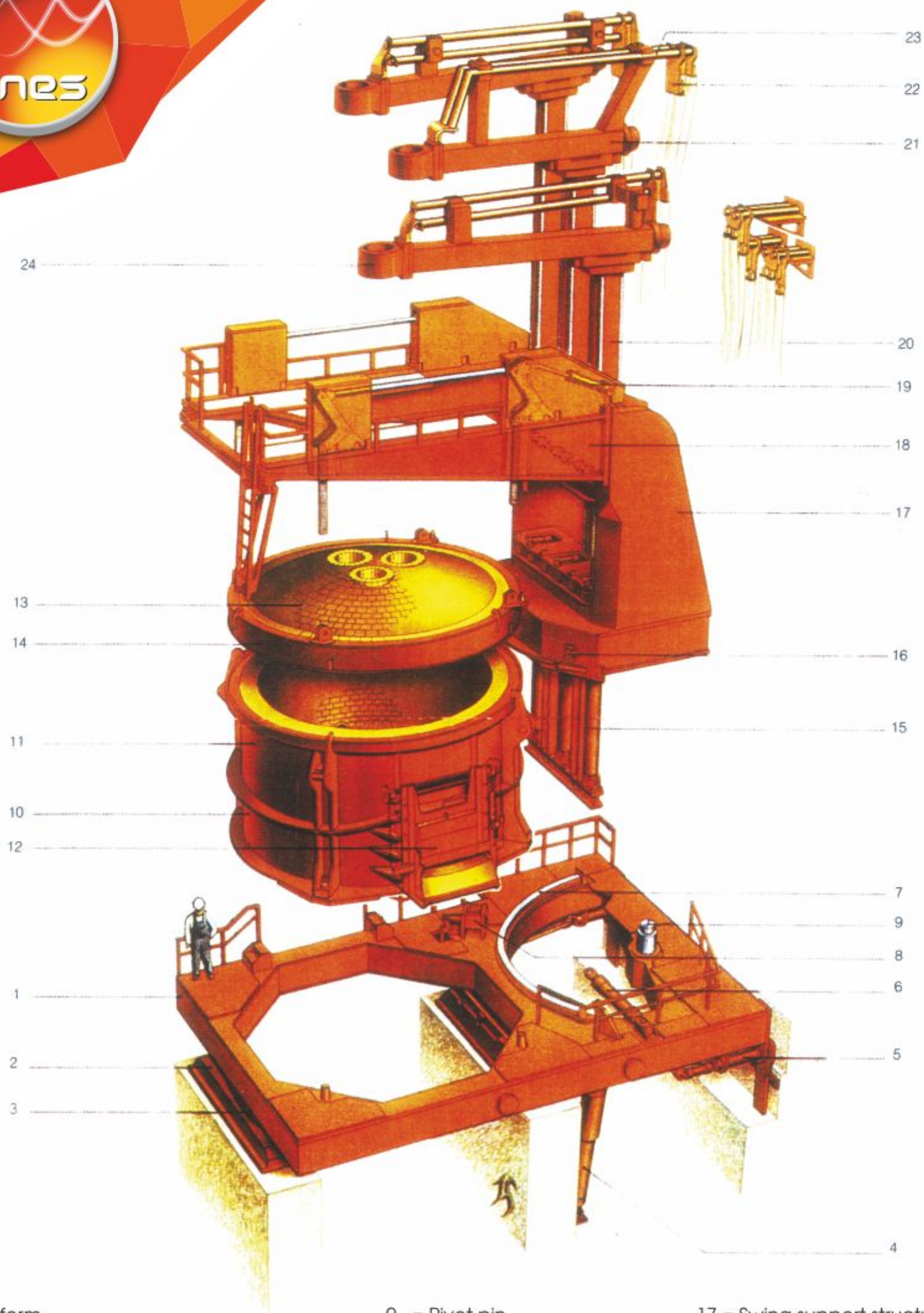
* Layout shows Arc furnace AL equipped with Eccentric Bottom Tapping Device. Design with conventional spout is available on request.



Plant Dimensions in mm

Type	A	B	C	D	E	F	G	H	J
AL 430	8400	11,000	7000	12,700	4150	3100	5400	11,000	10,600
AL 460	8800	11,550	7100	12,900	4300	3250	5500	12,100	11,200
AL 490	9200	12,150	7200	13,100	4450	3500	5600	12,500	11,700
AL 520	9400	12,500	7400	13,400	4600	3650	5700	12,800	12,100
AL 550	9800	13,050	7600	13,700	4800	3900	5800	12,800	12,600
AL 580	10,100	13,550	7700	13,900	4950	4000	6000	12,900	12,800
AL 610	10,600	14,200	7800	14,200	5150	4250	6400	13,000	13,000





1 = Platform

2 = Rocker track

3 = Rocker

4 = Tilting cylinder

5 = Platform locking mechanism

6 = Hydraulic cylinder for swing Support structure

7 = Rail

8 = Swing structure locking mechanism

9 = Pivot pin

10 = Bottom section of shell

11 = Top section of shell

12 = Slagging door

13 = Arched roof

14 = Roof ring

15 = 'Electrode raising cylimders

16 = Rail wheel (bearing)

17 = Swing support structure

18 = Roof suspension arm

19 = Roof lifting cylinder

20 = Electrode positioning columns

21 = Electrode arm

22 = Cable connection

23 = Power tube

24 = Electrode Clamps

Revamping of Arc Furnaces

CNES also offer their engineering know-how and the ability to modernize existing arc furnaces with the latest technology, with minimum investment and disruption of operation

The specific areas for revamping include : shell and roof, transformer and secondary system, hydraulic, electrode control system, control functions.

Series reactor concept

For 100% scrap application in EAF steel making has introduced the use of series reactors with UHP furnaces reducing Electrode and Energy consumption.



45 Tonne, UHP 36 MVA
Arc Furnace type AL-460



HIGH PRODUCTIVITY BETTER ECONOMY

Scrap Preheating

Direct preheating of scrap by utilizing the heat energy of the waste gas saves electrical energy and speeds up meltdown.

Water-cooled Shell

Using water-cooled wall panels on the furnace shell saves refractory material. Higher availability of the furnace because of longer refractory campaigns and reduces fettling times. Long arc-low current technique can be applied, resulting in shorter meltdown time and less electrode tip consumption. Heat recover from the cooling water is possible.

Water-cooled Roof

Important cost savings for refractories, higher furnace availability through reduced roof changing times. The water-cooled roof also allows the furnace to be equipped with a supersonic oxygen lance.

Oxy-Fuel Burners

Originally used to substitute lacking electric energy, Nowadays the main purpose of oxy-fuel burners is to obtain a more symmetrical meltdown of the scrap in the hot and cold spots of the furnace shell, resulting in shorter meltdown time.

Supersonic Oxy-lance

Increase of oxygen efficiency, compared to consumable lances, resulting in a significant reduction of specific oxygen consumption and shorter lancing time.

Optimized Reactance

With reference to the use of water-cooled wall panels and the modern foaming slag technique, the reactance of the furnace installation will be adapted in such a way that the furnace can be operated with a high power factor, with long arc and low current. This results in high energy transmission to the scrap and low electrode consumption.

Programable Logic Control

The use of programmable logic control system is prerequisite for up-to-date furnace operation, supervision and visual control of all operating data.

Process Control System

The high productivity and the required cost-efficiency of modern arc furnace plants call for the application of computerized process system. To keep the plant under rigorous control – an essential factor for economical operation – various levels of process control are available, from microprocessor-based systems for programmed power input control, up to a microcomputer-based online control system of the furnace.

Auxiliary Equipment

Manual operation at the arc furnace often exposes the operating personnel to a dangerous situation. For this reason, various auxiliary equipment has been developed, such as semi- automatic temperature measurement and sampling, automatic feeding of additive and alloys, and mechanized deslagging.

Environmental Protection

In most countries, protection of the environment has become an important issue : arc furnaces have to be connected to a fume dedusting system, and often have to be equipped with noise protection. Various fume capturing and dedusting systems as well noise protection installations are available.

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- AC Arc furnace for steelworks – with ultra high power & platform design
- Ladle refining furnace with state of art digital electrode regulation.
- Auxilliary and automation for Arc and ladle furnace.
- Revamping of Arc and ladle surfaces.

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- Production planning

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