

DESCRIPTION OF THE SUPPLY

00 FIRING SHUTTLE KILN

00001	1	ASTRA intermittent Kiln AS4002/10	
		- Type of machine:	ASTRA-4
		- Number of cars in the kiln:	10
		- Load useful width on car:	4000 mm, 2 LAYERS
		- Useful loading length on car:	1400 mm
		- Load useful loading height on car:	1410 mm
		- Max temperature:	1250°C
		- Residual moisture of the inlet pieces:	lower than a 2,5%
		- Fuel:	methane

ASTRA kiln, intermittent type, is constituted by:

Carpentry modules, including:

- Bearing structure of squared tubes and section bars.
- Painted sheet panels, demountable for insulation inspection.

Kiln carpentry, composed of:

- Inside lining with plates of cordierite, installed both in the vault and in the wall, in order to avoid to the operators, during the loading unloading operations, the direct contact of fibre with the product to fire, and with the combustion products.
- Ceramic fibre and insulating materials of different densities and temperatures, according to the their position.
- Insulating bricks of different specific weight, composing the inferior bordering where the seal labyrinth between kiln and car is obtained.

Kiln walls are completely prefabricated.

1 manual door with 2 wings

Combustion plant, composed of:

- Combustion air circuit for the supply of combustion air to burners, composed of:
 - *centrifugal fan
 - *connection pipes of stainless steel, independent in the left and right side of the kiln
- Mixing air circuit for the supply of dilution air to burners in the first phase of firing and also the air for the rapid and final cooling, composed of:
 - *centrifugal fan
 - *connection pipes of stainless steel , independent in the left and in the right side of the kiln.

When the fans of combustion and mixing air are installed in the department and not outside, in a room near the kiln, the insulation of the same or the installation of an insulating cabin is required. These devices are excluded from our main supply.

-Gas feeding circuit according to the current safety measures, complete with:

- *general ramp for gas pressure regulation
- *electric valves for seal control
- *painted carbon steel piping for gas delivery to burners

High-speed burners built and patented by SITI SPA, fed by two types of air, combustion air and mixing air. Each burner is composed of a structure of aluminium and of 2 concentric independent chambers of silicon carbure and it is equipped with electrodes and equipment for

the automatic ignition and flame detection, valves for adjustment and interception of the two types of air and of gas. Each burner includes a gas filter. Each car is heated by 4 burners set under the loading flat, 2 on the right and 2 on the left.

System for control and combustion

Four measurers and electronic transmitters (2 for air and gas on the right and 2 for air and gas on the left) are installed on the lines of combustion air feeding and of gas (right and left side). In this way it is possible to obtain an instantaneous measurement and regulation of air and gas deliveries, of the air/gas ratio to burn-ers in every position of the curve, optimising the excess of air in the combustion, the percentage of oxygen in the firing chamber and the consequent consumption.

The ratio control and regulation is obtained by a safety microprocessor in order to avoid the lack of air for combustion.

Together with the above mentioned equipment, it is useless the insertion of the gas counter on the general ramp, as the gas deliveries measured segment by segment are added and evidenced at the end of cycle on the general electric board.

Pulsating combustion system

An alternative and pulsating combustion of the burners positioned on the two opposite sides of kiln , can be realized in every point of firing curve. It is possible to adjust the ascent ramp, the permanence to max. potentiality and the descent ramp of each burner. This system is employed in order to avoid concentrations of fire or cold air prolonged in time, which could cause breakages in pre-heating or cooling.

to obtain a better turbulence in firing chamber and therefore a better temperature distribution.

The pulsating systems and the pulsating times are numerous and they are chosen by the operator, according to the product features and to the firing curve. All the parameters are adjustable by computer and they can be easily modified combin-ing them to the different menus

Inside pressure regulation and exhaust evacuation

The evacuation of combustion products is obtained through openings set in the kiln vault. An automatic adjustment regulates the exhaust flow in order to keep constant the pressure of kiln in the different points of the curve, even if the deliver-ies of air and gas change.

The combustion products and the cooling air before to be introduced in the at-mosphere are diluted in the ambient air.

The hoods are positioned on the two corners of the chamber, in the upper part, and they are equipped with cordierite screens for the protection of the below pieces against possible falls of polluting substances.

Control and driving board

The cabinet for the electric equipment is made of metallic carpentry with several elements.

The equipment correctly operates with room temperature not over 35°C. For higher degrees it is better to install the board in a box with conditioned air.

The board is functionally divided in the following parts:

- Control and drive of fans and general services including all the equipments for protection and driving of the different motors.
- Temperature control including regulators that acquire temperature values through thermocouples and drive modulating valves to control the combustion air flow. The pulse control system with alternate burners utilization on the right and left side of the kiln sets the kiln temperature during firing cycle.

Kiln control system description

The Astra supervisor consists in a high graphic performance software, installed on a PC and used for the kiln control. The main function is to provide in a user-friendly way all the necessary parameters for the kiln regulation (temperature, pressure, air/gas rate). These data are reported in both numerical and graphical way, with trends, curves and diagrams.

Additionally, the supervisor has many other functions, such as consumption and production data acquisition, plant parameters storage, firing cycles processing, and helps the user during the kiln start-up.

It is possible even to automatically start the kiln after an electric feeding stop.

The Astra supervisor improves and simplifies the production control, in order to achieve better results in industrial plant automation.

For the sanitary ware firing automation are requested three functions:

- Production cycle automation
- Regulations for pressure, temperature, air/gas rate, air and gas flows.
- User interface.

Automation

- Kiln automation

The plant automation, controlled by a PLC unit, has the following functions:

- 1.Starting of firing cycle with various actuators (fans, air and gas valves,...)
- 2.Actuators control and activation during firing cycle
- 3.Alarm signals acquisition, from the plant or the AC20 process controls
- 4.User interface with keyboard placed on control board or local keyboard
- 5.supervisor communication: the PLC is connected to the PC through a Siemens MPI line.

- Kiln doors automation

The system controls even the automatic inlet and outlet doors, if present.

This is achieved via a keyboard installed near each door.

- Regulation

The regulation of temperature and pressure, air/gas rate, air and gas flows is obtained with two multi-function AC20 process regulators.

-Temperature regulation: the temperature is read with termocouples and, by automatic valves, the combustions air flow is varied

-Pressure regulation: with pressure transducers the modulating valves are activated to maintain the correct pressure set point

-Air/gas rate regulation: these regulators vary, with a modulating valve, the gas flow depending on the air flow.

-Air and gas flow: the modulating valves are regulated by the flow rate set-point value and the flow-meter data

-Burners pulse system: the regulator alternatively actuate the burners placed on the opposite kiln walls. These regulators are installed on the kiln command panel and are connected to the PC by a RS485 serial line

- User interface

The Astra user interface is made of:

- LCD monitor
- Keyboard + mouse
- Printer

Other functional equipment installed on the kiln:

- Safety pressure switches

- Safety electric valves on gas distribution net
- Modulating valves for combustion adjustment
- Thermocouples with compensated and polarized connectors and relevant cables.
- Equipment for burners flame ignition.
- Cable-holder gangways for electric distribution.
- Ducts for feeding of flame burning devices.
- Pressure transducers

- 00002 1 Equipment for ASTRA 4 kiln guillotine first door
The supply is composed of:
- automatic guillotine door
- electric part
- 00003 1 Continuity unit UPS - 6 Kva **At Buyer's charge**
This unit allows the continuity of the work during the micro-interruptions of the power to the instruments of the kiln panel and the burner control valves.
Autonomy of continuous service: 10"
- 00004 5 Chimney for intermittent kiln **At Buyer's charge**
In stainless steel AISI 430 for smoke scavenging from intermittent kiln. A chimney every two trucks is installed.
- Total height : 5 m
 - Diameter : 800 mm
 - Thickness : 2 mm
- 00005 40 CE extra-equipment for solenoid valve for kiln burner
Insertion of a second solenoid valve on the gas supply circuit to the single burner, connected in series to the existing solenoid valve and controlled in parallel from the flame control unit.

01 CARS FOR SHUTTLE KILN

- 01001 10 Kiln Car for Intermittent Kiln
Kiln car as service to the shuttle kiln astra type
- The cars are used as follows:
- in the kilns
- outside the kiln
- The car consists of:
-Metallic parts, including:
-carpentry and rotating parts, wheels, supports and bearings
- Kiln car top, including:
- perimeter wall in cordierite hollow blocks
- ceramic fiber
- 01002 10 Deck kiln car furniture - 2 layers
Refractory furniture for car load composition.
The supply is composed of:
- supporting columns
- tubular supporting beams in SiSiC
- cordierite/mullite refractory plates
Note: Only for the necessary quantity of cars, simply by changing the upper part of the supporting columns, it is possible to load high pieces. This avoids empty spaces, which are not recommendable in any kiln



Exclusion: auxiliary firing support
Technical Specification
Nr. of charged layers: 2

- 01003 10 Car covering plates for Intermittent kiln
- 01004 1 Mechanical stock for the cars assembly

02 SHUTTLE KILN CARS HANDLING

- 02001 14 Rail for transfer shuttle kiln (Length in linear meters).
- 02002 45 Complete rail for cars on shuttle kiln track (length in linear meters).
- 02003 1 Cars lifting platform for 'ASTRA 4' kiln - 2 layers
For lowering and lifting the 'ASTRA 4' kiln car during the loading and unloading of pieces

The platform is composed of:

- structure in steel sections
- rotating pins made of high resistance steel
- self lubricating bushes on all movement points
- over dimensioned hydraulic lifting cylinders
- chromium plated steel stems
- descent adjusting valves
- safety retainers for inspection and maintenance with lifted platform
- hydraulic station fed by electric motor
- electric box built according to C.E.I. norms
- raise descent drives by means of movable push-buttons, low tension
- anti-accident safety perimeter
- raise limit switch by means of micro-switch
- N. 2 double stem cylinders for car blocking with microplace on the rear stem
- N. 2 micro switches for car positioning signal
- micro switches for upper and lower limit switches
- protection sheets on the table

- 02004 1 Manual transfer for transport of intermittent kiln trucks
The transfer is composed of:
 - Steel bearing structure;
 - Axles groups with wheels in forged steel;
 - set of accessories to house the box "on board"
 - Transfer centering group in harmony with the work positions.



PROJECT DATA OF THE PLANT

Ref. Layout: L151071B

Introduction

The solution proposed in the plant reference layout and described in this document has been produced in cooperation with the Customer, designed on the basis of the data provided by him, and conform to his production requirements.

This project study is finalized to the supply of equipment and services for the construction of a sanitary ware production plant, whose specifications are listed below.

We anticipate the following definition with respect to certain terms below herein.

Department efficiency otherwise defined as performance, it expresses the department actual production availability during a fixed timespan, and it's expressed as a percentage of the same period: it is normally indicated by the customer, otherwise it's established on the basis of average parameters dictated by the experience. Unless other specifications, the values set out below will be deemed to meet the requirements for a correct system functional verification.

Specifications; basic data

TYPE OF PRODUCT: fine fireclay washbasins

According with Customer requirements, the list of system components may exclude items considered as most appropriate for his direct purchasing or execution:

for example those related to auxiliary services, as well as complementary carpentry frames for machinery.

To provide assurance about supply completeness and full compatibility with the production process, above items will be present in components and services list, including the clear endorsement "at customer charge."

Specifications; complementary plant information

Complementary plant specifications are listed below, mainly related to geographical location, logistics and available services

Altitude above sea level: 0 m

Max local temperature: 35 °C

Voltage electric power line (Volts): 380 +/-5%

Voltage Aux (Volts): 220

Frequency (Hz): 50 +/-5%

Available fuel types and specifications

	Fuel type	Lower calorific power	u.m.
Kiln	Methane gas	8300	(kcal/Nm ³)

Specifications; Working shifts

The plant has been designed considering the following man labour organization model (shifts), and its related actual working times resulting from the efficiencies (or performances) set for each department

	Day/week	Shift/day	Hour/Shift	Eff. %	Daily useful minutes	Daily useful hours	Shift useful minutes
Firing	7	3	8	100	1440	24	480



PRODUCTIVE MIX: FFC washbasins from 800mm to 1200mm (TO BE DEFINED)

Production Dept.; Firing

Kiln

Nr. 01

Type: Astra AS4002/10

Number of cars in the kiln:	10
Number of car floors	2
Useful car loading width 1 st floor	4000 mm
Useful car loading width 2 nd floor	4000 mm
Useful car loading length:	1400 mm
Useful car loading height:	1410 mm
Useful car loading surface:	11 m ²
Number of pieces per car:	55
Pieces density:	5 pcs/m ² (TO BE VERIFIED)
Average dried piece weight:	20 kg
Max moisture content at kiln entry:	1%
Foreseen firing temperature	1220 – 1230°C
Fuel	Natural Gas
Installed electric power	62 kW

Kiln production: 550 pcs/day

NOTE:

- The actual number of pieces loaded on each car will depend on the pieces dimensions, shape and load assortment.
- The actual firing cycle will depend on ceramic body, glazes and pieces characteristics.

Reference Standards

Tolerances on finished product geometric parameters must be defined by ISO international standards.

Unless different written agreement between the parties, above standards and rules enshrine in unquestionable form geometric and quality parameters limits for finished product acceptance.