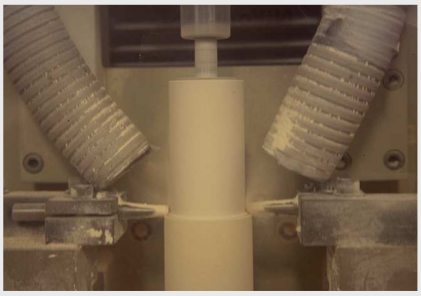
sinterall

ALLUMINA SINTERIZZATA

SINTERALL

CERAMIC TECHNIQUES






Ceramic oxide components for electrical engineering and electronics, for techniques of liquid sealants and of rotating support, for the textile industry. Anti-abrasives, nozzles for sandblasting, atomisation and welding, supports, masks and protections for thermal and superficial treatments. Ceramics for vacuum kiln technology, nozzles for industrial burners, for high temperature chemical processes in a particulary aggressive and galvanic atmosphere.

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SIALOX CERAMIC SPECIFICATIONS

SPECIFICATIONS		UNIT	Sialox 96	Sialox 98	Sialox 99
Al_2O_3 Alumina content		%	96	98	99.9
Colour		-	white	white	ivory
Water absorption		%	0	0	0
Specific weight		Kg / dm^3	> 3.75	> 3.80	> 3.90
Modulus of elasticity		Kg / cm^2	3.6×10^6	3.8×10^6	3.9×10^6
Tensile strength		Kg / cm^2	1800 - 2000	2000 - 2300	2300 - 2500
Resistance to impact		Kg / cm^2	7.15 - 8.50	8.15 - 9.00	8.30 - 9.00
Hardness		Mohs' Scale	9	9	9
		Knoop 100 gr	1700	2100	2200
Volume resistivity	25°C	Ohm / cm	$> 10^{14}$	$> 10^{15}$	$> 10^{15}$
	100°C		$> 10^{13}$	$> 10^{14}$	$> 10^{14}$
	300°C		$> 10^{11}$	$> 10^{12}$	$> 10^{12}$
	500°C		$> 10^{10}$	$> 10^{11}$	$> 10^{11}$
	700°C		$> 10^{8}$	$> 10^{9}$	$> 10^{9}$
Dielectric resistance	25°C	KV / mm	> 12	> 14	> 16
	500°C		> 4.0	> 5.5	> 7
	1000°C		> 0.8	> 1	> 3
Specific heat	25 - 700°C	Cal / Kg °C	0.175	0.02	0.02
Thermal conductivity	25°C	cal / cm °C	4.3×10^{-2}	4.8×10^{-2}	4.8×10^{-2}
	300°C		4.1×10^{-2}	4.4×10^{-2}	4.4×10^{-2}
	500°C		1.8×10^{-2}	2.7×10^{-2}	2.7×10^{-2}
	800°C		1.6×10^{-2}	2.1×10^{-2}	2.1×10^{-2}
Coef. thermal dilat.	25 - 700°C	10^{-6} / °C	6.5	6.5	6.6
	25 - 200°C		7.8	7.9	7.9
	25 - 1000°C		8.25	8.35	8.35
Thermal value		°C	800 - 900	1000	1000
Maximum working temperature		°C	1500	1600	1600
Resistance to abrupt variations of temperature		-	excellent	excellent	excellent

PRESENTATION OF CERAMIC MATERIAL

Before introducing our ceramic products, we would like to outline what is currently on offer to the market for industrial use:

Porcelain:
is the poorest quality. Its basic elements are 40% quartz and 40% clay. Its density is 2.2. Ceramics containing 20 to 60% aluminium oxide, are also classified as porcelain. When the content is between 60 and 80% the "heavy" designation is added. In these cases the increase in specific weight may exceed a density of 3.2.

Steatite:
its basic element is talc in the range of 80 - 85%. Clay, kaolin and feldspar can be replaced with alkaline soils, to obtain high frequency products. Its density ranges from 2.6 to 2.8, according to the talc content. Its colour is white if it is of excellent quality, otherwise it is greenish grey.

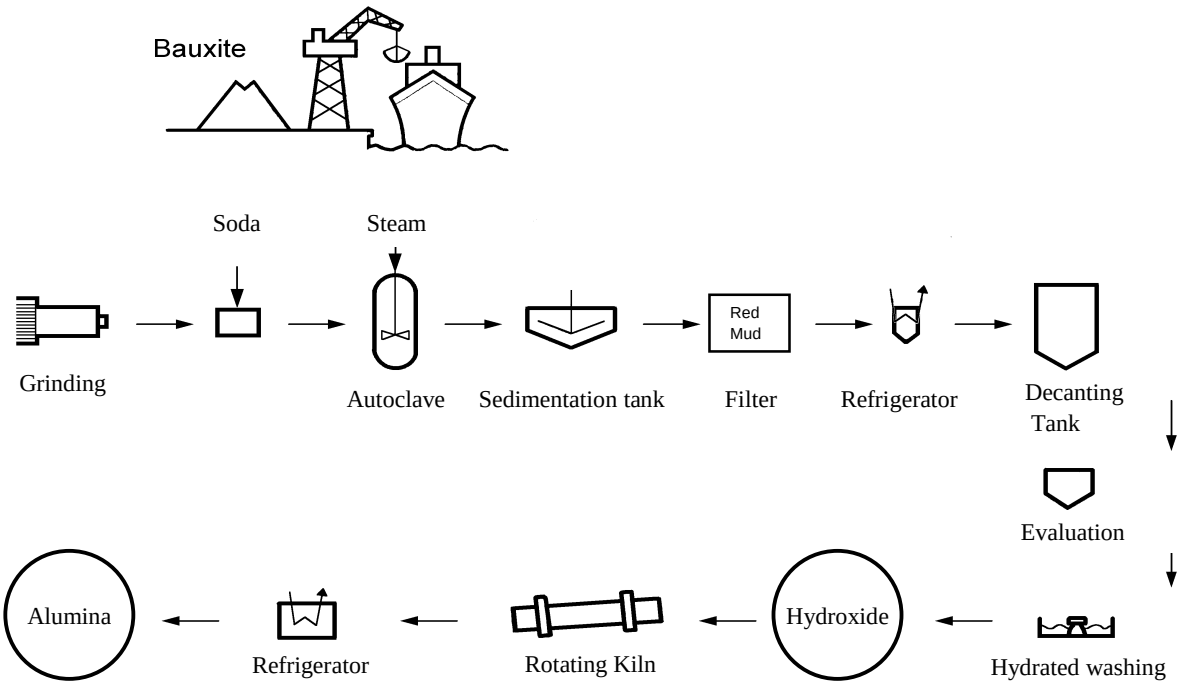
Alumina:
when the aluminium oxide content is higher than 85%, the product can be defined as alumina. It is of a low quality if the alumina content is up to 92%, but becomes better quality up to 96% and top quality over this percentage.

Given that alumina has proved to be the ceramic product with the highest reliability among the above mentioned materials, it just remains to evaluate the reason for focusing on a content of 99% instead of 96% or 98%. The relatively higher costs are due to the greater manufacturing difficulties and to higher sintering temperatures that are balanced by the important increases of dielectric, mechanical, thermal and chemical specifications to be taken into consideration depending on the final use. To test the quality of an alumina-based ceramic, there are different basic and proven tests that allow for its easy and efficient evaluation.

1) The measurement of alumina density should not be lower than 3.75 for an aluminium oxide content of 96%. This percentage is directly proportional and strictly correlated to its density, see table of specifications for SIALOX CERAMICS.
2) Test with penetrating liquid, (if this is not available a common ink may be used), to check the proper sintering, zero porosity of ceramic and absence of cracks. After some hours of immersion and careful rinsing, followed by the perfect drying of the items, an accurate inspection should show no evidence of residual marks proving undesirable cracks and porosity. In the absence of any superficial enamelling treatment this inspection should be effective.
3) Test of mechanical resistance has to be performed for comparison between different samples by breaking them with a vice or a hammer or more simply dropping them down and comparing their resistance on impact.

SINTERALL has for some years specialized in manufacturing products in high quality (96 - 99.9%) sintered alumina, based on the designs and specifications of their clients worldwide. Thanks to the specifications being suitable for use in diverse working environments that present simultaneously different elements of a critical nature the company has been very successful. High dielectric resistance, even at high temperatures, high thermal conductivity and low dilatation coefficient, excellent mechanical specifications, impermeability and chemical inertia, make SIALOX 96/99 alumina, an ideal product for innovative, rigorous and high resistance applications.

ORIGINS

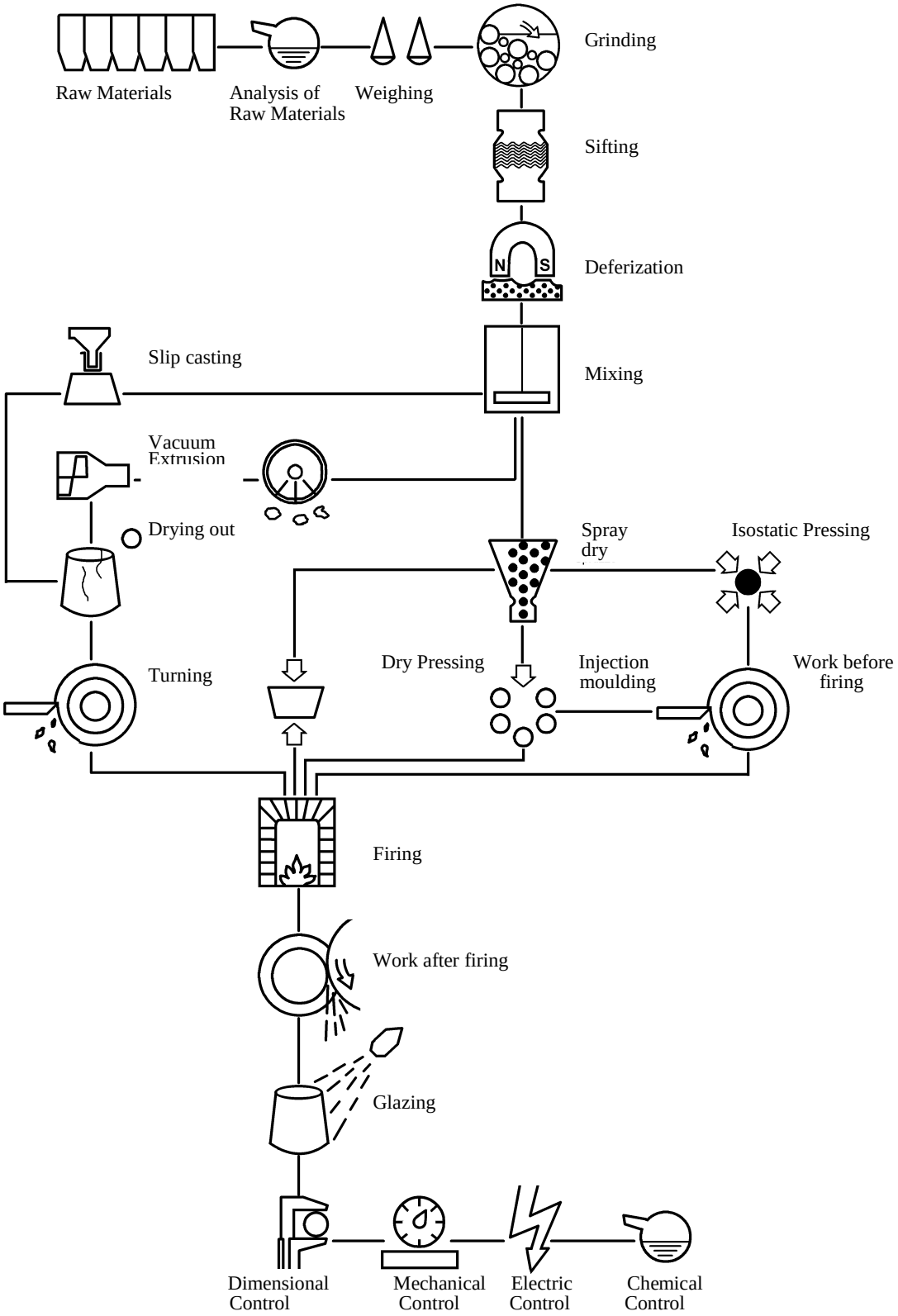


Alumina is mainly extracted from bauxite. Mining began in Villeveyrac, France, in 1873 and since then it has become available worldwide; in particular in the tropical areas where it is present in high concentrations: in Guyana (particularly pure and therefore suitable for ceramic utilization), Brazil, West Africa, India, Indonesia and Australia and also in Russia and China.

The highest use of alumina is the production, through oxidation-reduction, of aluminium.

Extraction of the raw mineral is carried out by means of different chemical treatments, the most common of which is the Bayer process based on the treatment of bauxite with caustic soda at various pressures and temperatures. Under these processing conditions, accurately controlled, alumina contained in the bauxite (approximately 50%) evolves into a solution, while all other components remain in the solid state. The main process flow, rich in aluminium hydrate solution, is separated from the solid phase that cannot be extracted (red mud), filtered and subsequently discarded. Separated from the mother mud, the hydroxide is conveyed to the calcination kiln, at the temperature of 1.400 degrees centigrade, to eliminate crystallized water so transforming itself from hydrate into oxide (alumina).

PROCESS OF CERAMIC MANUFACTURING



TECHNICAL ADVICE TO USERS

The purpose of the following notes is to guide the design to achieve better ceramic specifications. Significant savings may be obtained when the particular design has been defined with the prior consultation of the manufacturer, allowing the largest dimensional tolerances and the most geometrical simplicity possible, in compatibility with the final use. A consultation at the design phase, with the ceramic manufacturer, results in the highest returns in terms of both costs and technical and delivery reliability.

TOLERANCES: Sinterall ceramics are produced with “sintering” dimensional tolerances ± 2%, according to the table UNEL 03711-73. For maximum cost containment, the ceramic specification should be designed with the largest possible tolerances and the other components should be designed around them. Where strict tolerances are unavoidable, recourse is made by working on the sintered product with diamond grindstone, but with a significant increase in costs. Sometimes the necessity of such changes are questionable and can be avoided if the application is evaluated before production with the ceramic manufacturer.

GEOMETRY: avoid abrupt changes to carving the diameter and section to limit sagging, deformities and cracks and at the same time increase the mechanical specification. Thickness of walls should be the maximum possible to reduce sagging and curves to a minimum. The thin-walled items often require supplemental works and particular care during their handling.

CORNERS: small radii, chamfers and connections are preferable to sharp edges, limiting possible splinters and splitting during the successive handling process and the utilization phase.

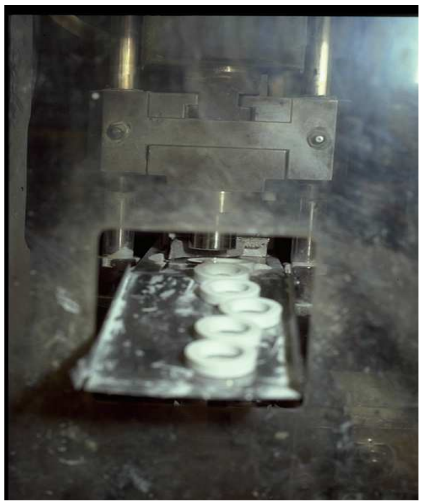
FINISHINGS: those available are: rough (as it comes from the kiln), barrelled, polished, low or high melting glazed , rectified, polished, “over fired”.

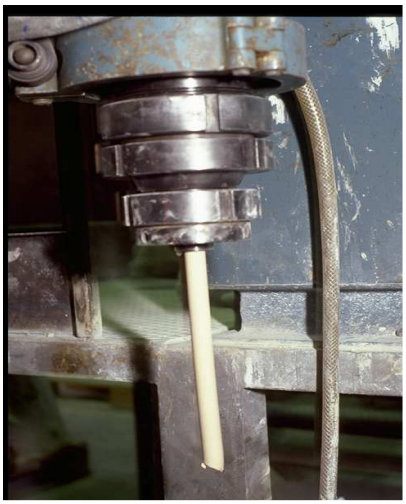
ALUMINA

Nowadays alumina is the element most commonly used in ceramic techniques for its abundance, savings, physical properties and production adaptability. The primary condition and starting point for the successful production of alumina high content ceramics is the proper choice and preparation of the powder. Aluminium oxide powder together with the appropriate additives necessary for the final specifications of the product, are mixed and ground to avoid contamination, within large mills lined with alumina bricks and partially filled with milling balls of pure ground alumina. The action of the milling balls reduces the load into a granulated powder suitable to obtain optimal compactness during the processes of mould preparation and at the same time, the highest possible reactive area for the subsequent sintering. A higher density during the shoping process, as powders do not have any plasticity, can be obtained through addition of plasticizers of between 1 and 15%, according to the manufacturing process.

SHAPING PROCESSES

Slip casting, extrusion at low or high pressure injection, dry longitudinal pressing, isostatic pressing are the most used methods for preparation green bodies.





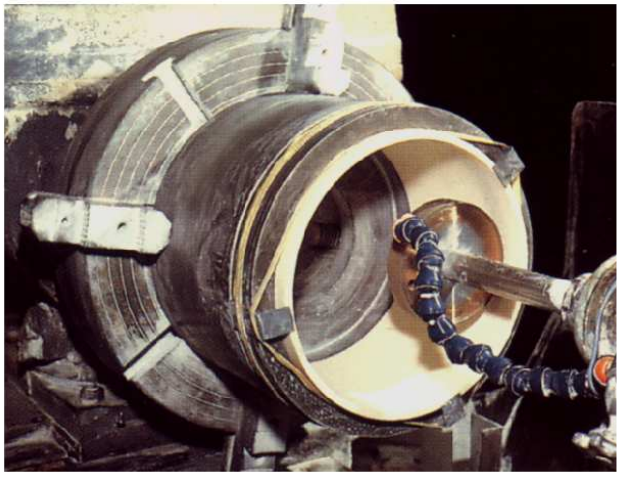
For economic reasons, the trend is to compact and mould the semi-manufactured product at the same time, within the same process.

This is not always technically possible and therefore there are two phases: compacting and moulding one to obtain the final geometry before sintering.

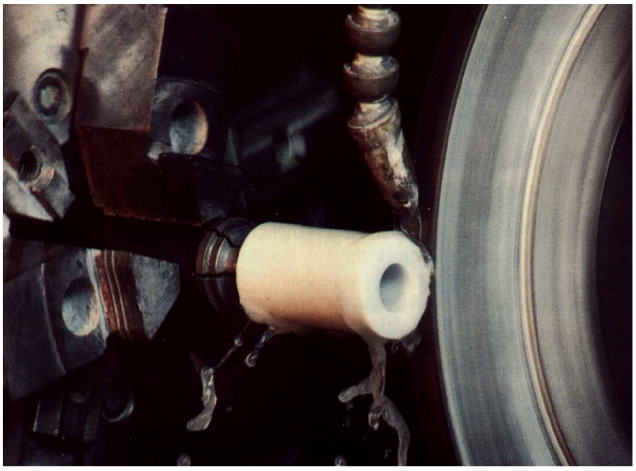
SINTERING

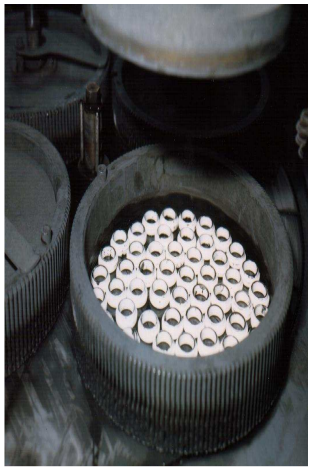
Sintering is carried out in kilns at a temperature between 1650 and 1720 °C, depending on the alumina content of the oxide-ceramic. During the sintering, the crystals become joined together, filling in cavities left by air that remained entrapped during the process of mould preparation. During this phase, a shrinkage of 20% occurs, corresponding to an increase in density thus obtaining a sintered ceramic with optimal quality.

FINISHING PROCESS



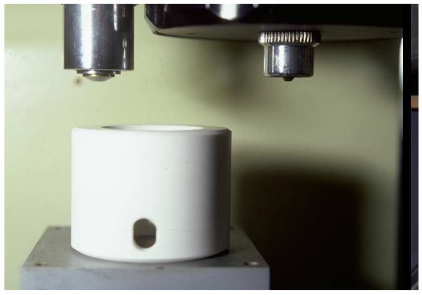
At the final stage, after sintering, the product undergoes an abrasive tumbling treatment to eliminate rough edges and possible manufacturing marks. If the final usage requires it, the ceramics may be submitted for aesthetical finishing work such as glazing or refining by diamond grindstones to obtain perfect geometrical forms and more rigorous tolerances. Rectification, external and internal cylindrical polishing, rectification and flat polishing, are the workings most commonly requested for the mechanical applications.

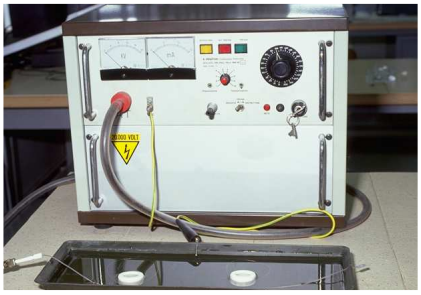




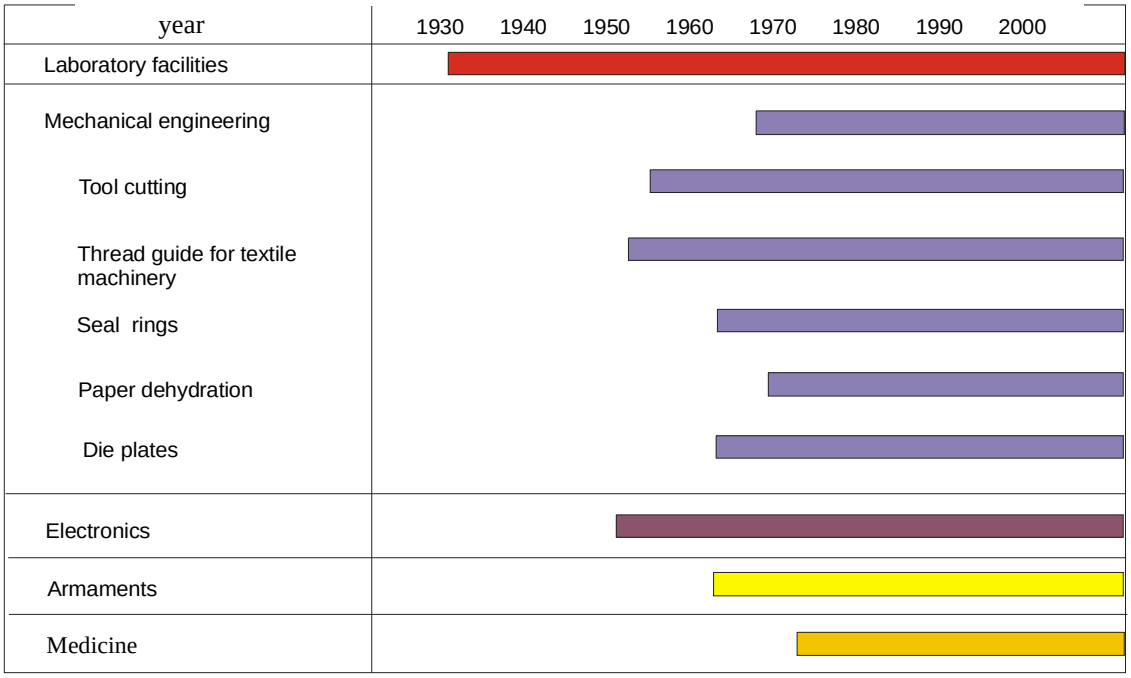
QUALITY ASSURANCE

The monitoring system of SINTERALL quality starts with the delivery of the raw material. The parameters for the powder responsible for the final crystalline structure of the ceramic body, are constantly monitored during the phases of mixing, grinding and subsequent successive processes of mould preparation: samples taken from the various production lots are tested before they undergo the working cycles. The manufactured specifications are taken and evaluated during the different phases of the compacting process and mould preparation. In the sintering kiln, temperature, atmosphere and times are electronically monitored and recorded constantly. As well as these tests, the SINTERALL laboratory is organized and equipped to thoroughly perform any extra inspections requested by the client. In addition to the usual dimensional surveying, it is possible to carry out tests for hardness, superficial roughness, flatness, dielectric rigidity, thermal cycles, assembling tightness and statistical processing of recorded data.

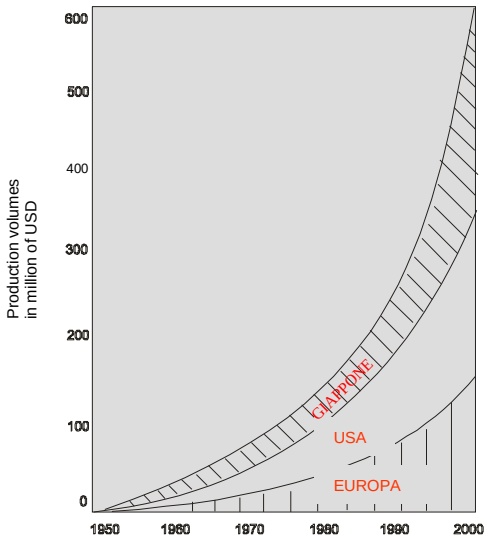




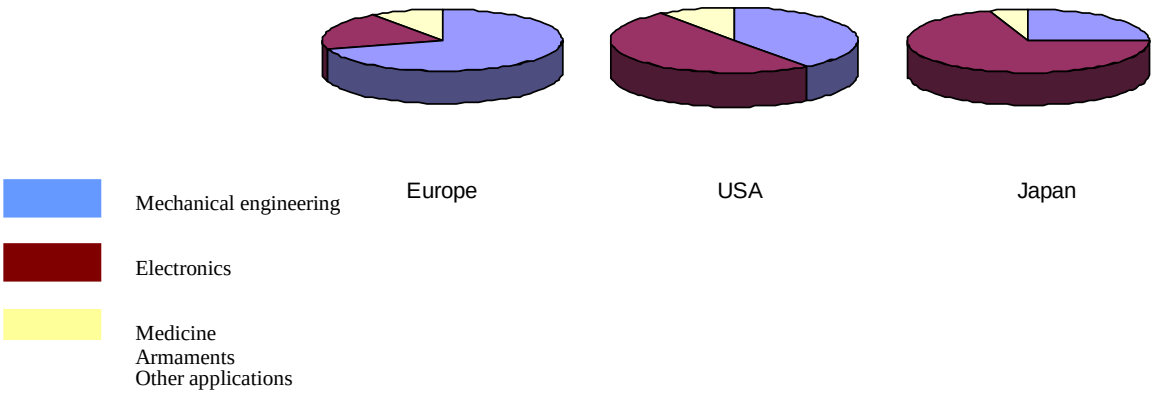
The progress of the use of high quality alumina ceramics in various sectors

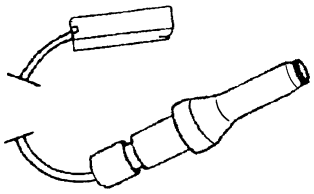


Development in terms of volume in world production



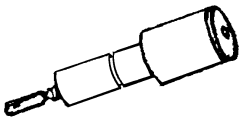
Development of worldwide production volume





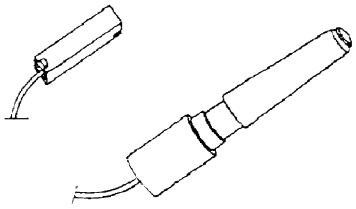
SA 001

Ceramica:
lunghezza = 42
diametro = 6 - 8 -10



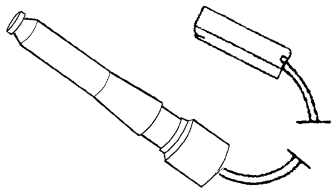
SA 003

Ceramica:
lunghezza = 32
diametro = 7 - 10



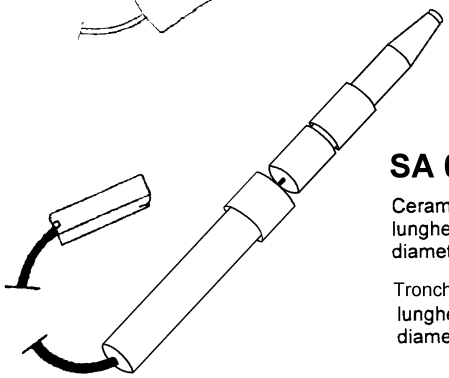
SA 004

Ceramica:
lunghezza = 50
diametro = 6,5 - 8



SA 005

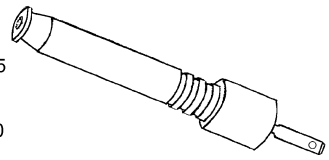
Ceramica:
lunghezza = 50
diametro = 6,5 - 8



SA 006

Ceramica:
lunghezza = 40.5
diametro = 6 - 7.5

Tronchetto:
lunghezza = 55 - 80
diametro = 12



SA 007

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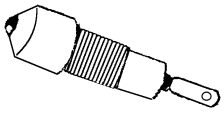
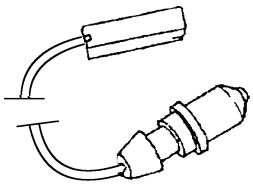
diametro = 7 - 10



SA 010

Ceramica:
lunghezza = 31
diametro = 5 - 8
filetto = M8 x 0,75



SA 011

Ceramica:
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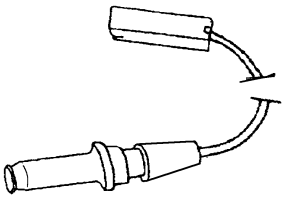
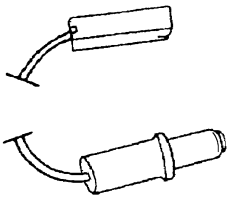
diametro = 6 - 7,5



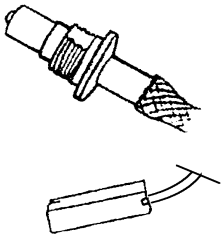
SA 012

Ceramica:
lunghezza = 33
diametro = 5,5 - 7,5



SA 013

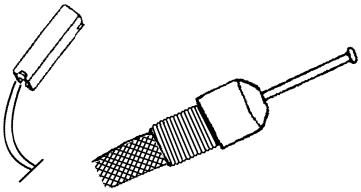
Ceramica:
lunghezza = 27
diametro = 6 - 8



SA 014

Candeletta forno

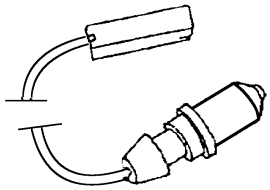
Ceramica:
lunghezza = 35
diametro = 7
filetto = 12 MA



SA 015

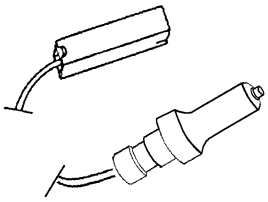
Candeletta forno

Ceramica:
lunghezza = 28,5
diametro = 6 - 9
filetto = M8 x 0,75



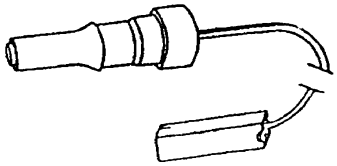
SA 016

Ceramica:
lunghezza = 25
diametro = 6 - 7,5



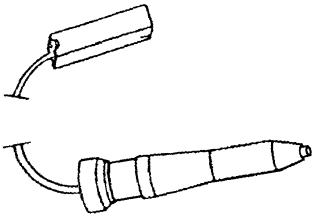
SA 018

Ceramica:
lunghezza = 27,5
diametro = 6 - 9



SA 019

Ceramica:
lunghezza = 37
diametro = 6 -10



SA 020

Ceramica:
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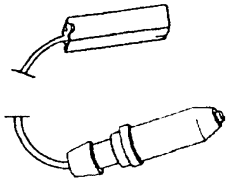
diametro = 6 - 8



SA 021

Ceramica:
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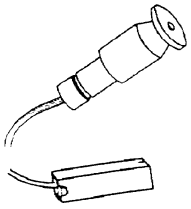
diametro = 6



SA 025

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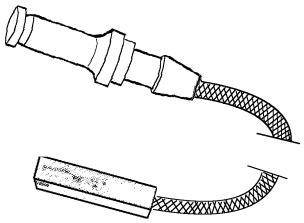
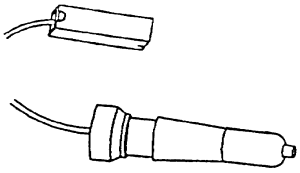
diametro = 6 - 8



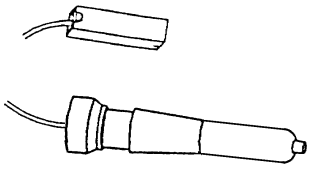
SA 030

Ceramica:
lunghezza = 32
diametro = 6 - 7,5 - 9



SA 036

Ceramica:
lunghezza = 35
diametro = 6 - 8



SA 037

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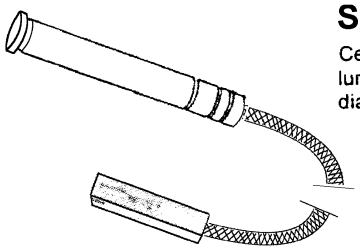
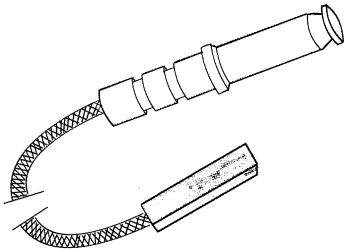
diametro = 6 - 8



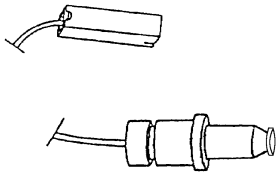
SA 041

Ceramica:
lunghezza = 56
diametro = 7



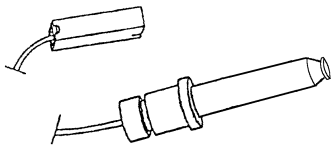
SA 042

Ceramica:
lunghezza = 49
diametro = 8



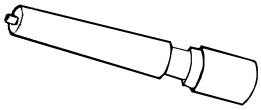
SA 047

Ceramica:
lunghezza = 27
diametro = 6 -7,5



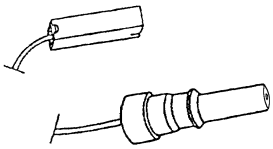
SA 048

Ceramica:
lunghezza = 40
diametro = 6 -7,5



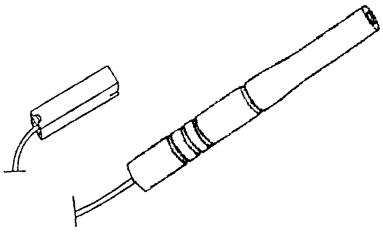
SA 051

Ceramica:
lunghezza = 52 o 55
diametro = 6,5 - 8



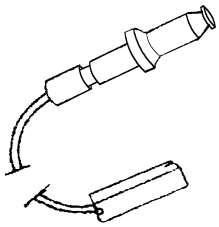
SA 053

Ceramica:
lunghezza = 30
diametro = 6 - 10



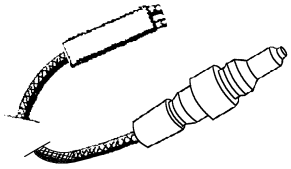
SA 054

Ceramica:
lunghezza = 59
diametro = 6,5 7,5



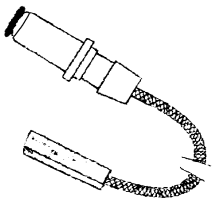
SA 055

Ceramica:
lunghezza = 37
diametro = 6 - 9,5



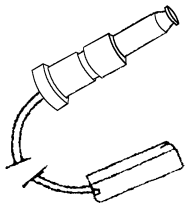
SA 057

Ceramica:
lunghezza = 33
diametro = 5 – 7,5



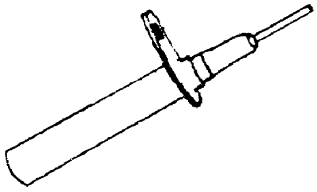
SA 060

Ceramica:
lunghezza = 26,7
diametro = 6 -7



SA 065

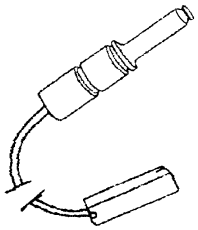
Ceramica:
lunghezza = 32
diametro = 5 – 7



SA 066

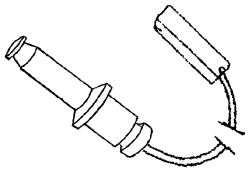
Candeletta forno

Ceramica:
lunghezza = 55
diametro = 6 - 8,5



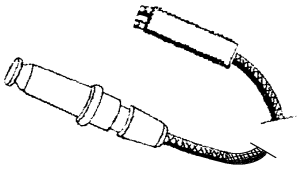
SA 067

Ceramica:
lunghezza = 35
diametro = 4,5 - 8,5



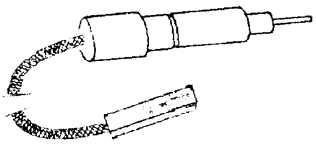
SA 068

Ceramica:
lunghezza = 30
diametro = 5 – 7



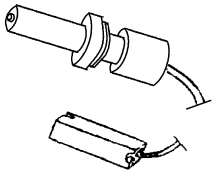
SA 071

Ceramica:
lunghezza = 32
diametro = 6 - 7,5



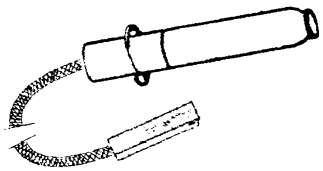
SA 072

Candeletta forno
Ceramica:
lunghezza = 40
diametro = 5 - 8 - 10



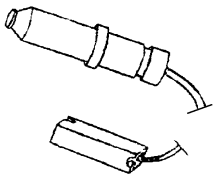
SA 075

Ceramica:
lunghezza = 30
diametro = 5,5-9-10,6



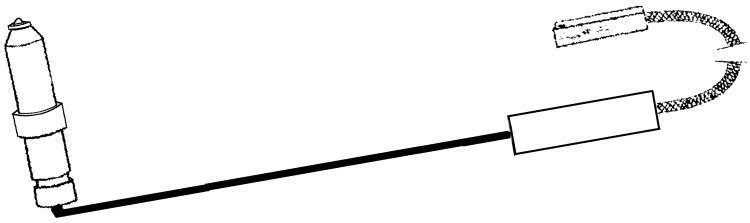
SA 080

Ceramica:
lunghezza = 49
diametro = 9



SA 081

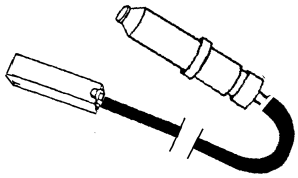
Ceramica:
lunghezza = 32
diametro = 7,5



SA 082

Candeletta forno

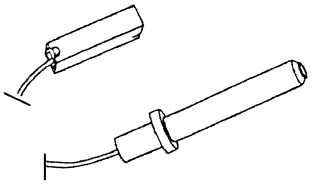
Ceramica superiore:
lunghezza = 38
diametro = 8
Ceramica inferiore:
lunghezza = 32
diametro = 8,5
Elettrodo = 185



SA 083

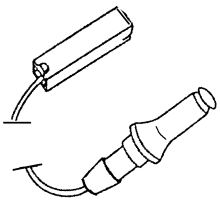
Candeletta forno

Ceramica:
lunghezza = 35
diametro = 7,5



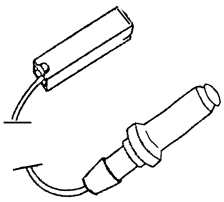
SA 090

Ceramica:
lunghezza = 47
diametro = 6



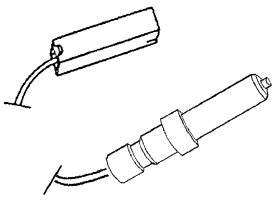
SA 091

Ceramica:
lunghezza = 30,5
diametro = 5



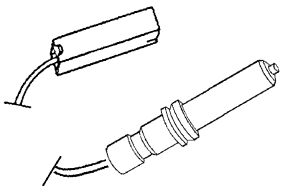
SA 094

Ceramica:
lunghezza = 30,5
diametro = 6



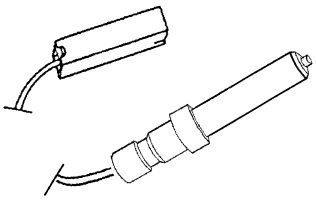
SA 095

Ceramica:
lunghezza = 33
diametro = 5,5



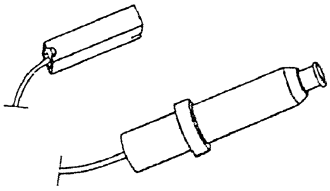
SA 096

Ceramica:
lunghezza = 37
diametro = 5,5



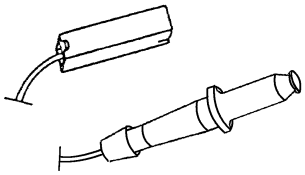
SA 097

Ceramica:
lunghezza = 39,4
diametro = 5,5



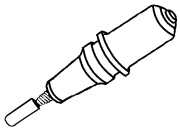
SA 100

Ceramica:
lunghezza = 40
diametro = 8



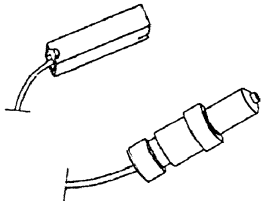
SA 105

Ceramica:
lunghezza = 37
diametro = 6 - 7



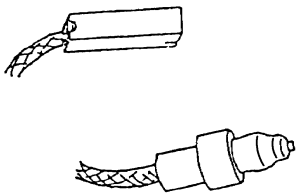
SA 109

Ceramica:
lunghezza = 26,2
diametro = 7-8



SA 110

Ceramica:
lunghezza = 27
diametro = 6 - 10

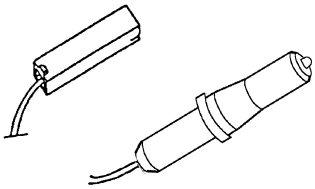


SA 111

Ceramica:
lunghezza = 23
diametro = 8 - 10

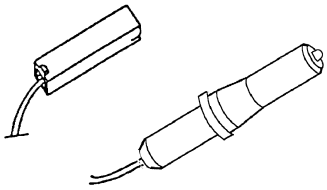
SA 112

Ceramica:
lunghezza = 22,5
diametro = 6 - 7,5



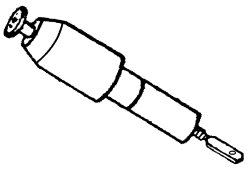
SA 113

Ceramica:
lunghezza = 34,5
diametro = 6,4 - 9,5



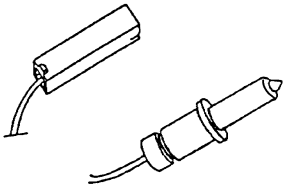
SA 114

Ceramica:
lunghezza = 39,5
diametro = 6,4 - 9,5



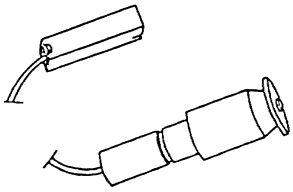
SA 116

ceramica:
lunghezza = 36
diametro = 7,5 - 10



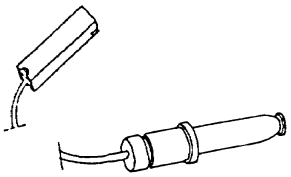
SA 118

ceramica:
lunghezza = 26
diametro = 5,5 - 7,5



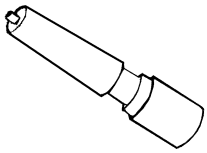
SA 121

Ceramica:
lunghezza = 36
diametro = 7 - 10



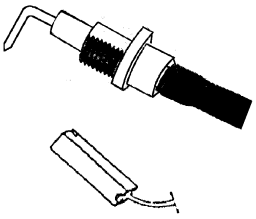
SA 122

Ceramica:
lunghezza = 36,5
diametro = 6 - 7,5



SA 126

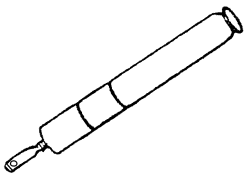
Ceramica:
lunghezza = 40
diametro = 6,5 - 8



SA 127

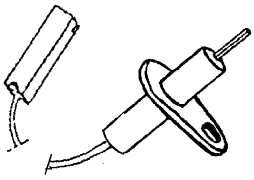
Forno con cavo silicone

Ceramica:
lunghezza = 30
diametro = 9,5
filetto = M10 x 0,75



SA 128

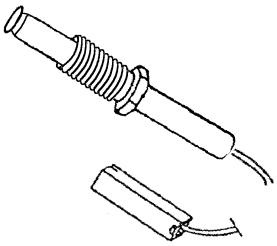
Ceramica:
Lunghezza = 49
diametro = 7



SA 129

Candeletta forno

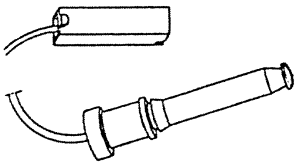
Ceramica:
lunghezza = 25
diametro = 6



SA 130

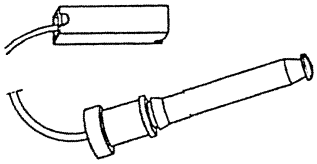
Candeletta grill

Ceramica:
lunghezza = 60
diametro = 6
filetto = M 8 x 0,75



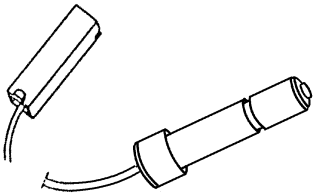
SA 131

Ceramica:
lunghezza = 37
diametro = 5 - 7



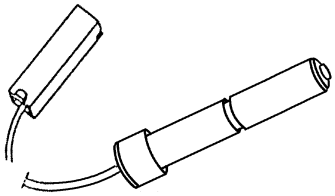
SA 132

Ceramica:
lunghezza = 42
diametro = 5 - 7



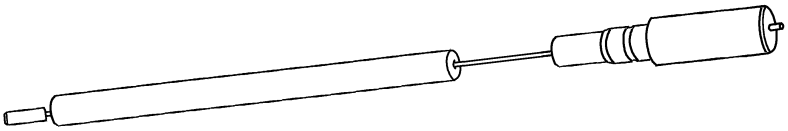
SA 133

Ceramica:
lunghezza = 28,6
diametro = 6 - 8



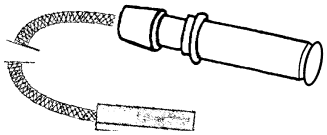
SA 134

Ceramica:
lunghezza = 39,1
diametro = 6 - 8



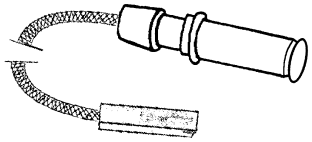
SA 135

Ceramica superiore:
lunghezza = 37
diametro = 5,5 - 6 - 8 8
Ceramica inferiore:
lunghezza = 68
diametro = 5,5
Elettrodo = 80



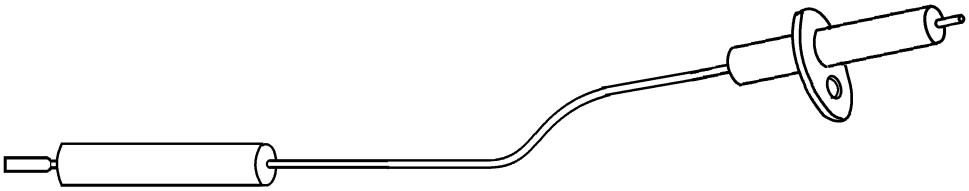
SA 136

Ceramica:
lunghezza = 37
diametro = 6 - 7 - 9



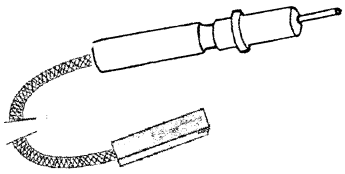
SA 137

Ceramica:
lunghezza = 32
diametro = 6 - 7 - 9



SA 138

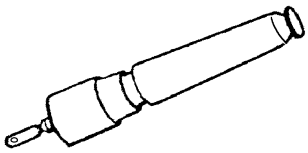
Ceramica: 2 x
lunghezza = 35
diametro = 7



SA 141

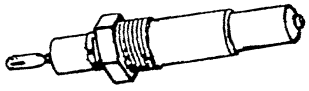
Candeletta forno

Ceramica:
lunghezza = 38
diametro = 5 - 6,5



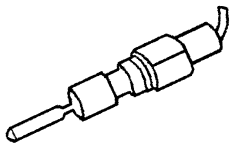
SA 142

Ceramica:
lunghezza = 50
diametro = 7 - 8



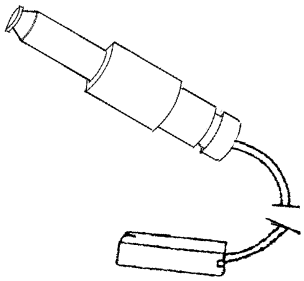
SA 143

Ceramica:
lunghezza = 50
diametro = 7
filetto = M 12x1



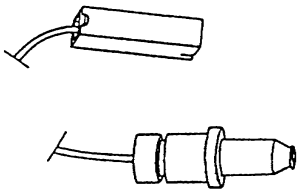
SA 144

Ceramica:
lunghezza = 23
diametro = 4 - 5 - 6



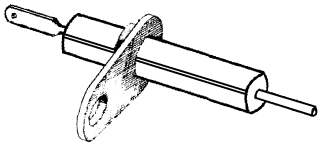
SA 151

Ceramica:
lunghezza = 44
diametro = 6 - 7,5 - 10



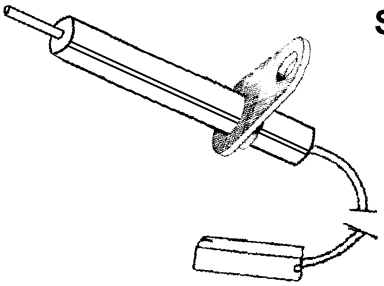
SA 152

Ceramica:
lunghezza = 25
diametro = 6 - 7,5



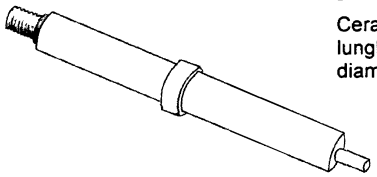
SA 501

Ceramica:
lunghezza = 35÷80
diametro = 7÷9.4



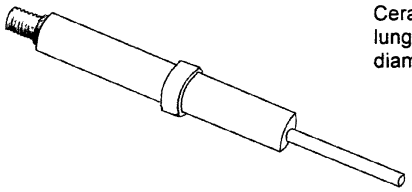
SA 510

Ceramica:
lunghezza = 35÷80
diametro = 7÷9.4



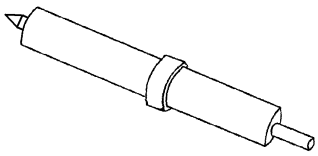
SA 520

Ceramica:
lunghezza = 54
diametro = 7-8.5



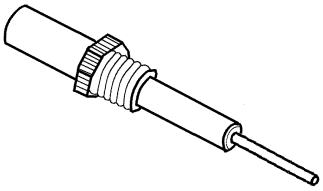
SA 530

Ceramica:
lunghezza = 43
diametro = 7-8.5



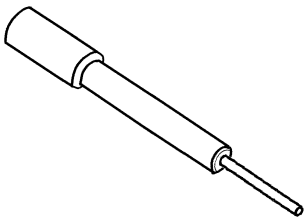
SA 540

Ceramica:
lunghezza = 43
diametro = 7-8.5



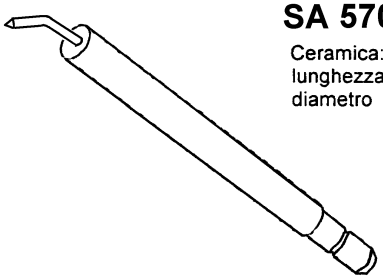
SA 550

Ceramica:
lunghezza = 44
diametro = 6-8
filetto = M10 x 0,75



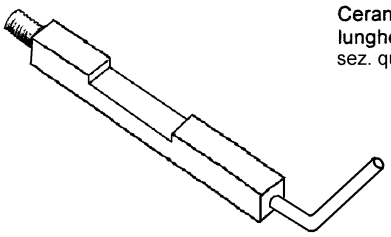
SA 560

Ceramica:
lunghezza = 44
diametro = 6-8



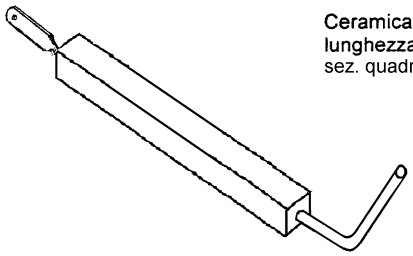
SA 570

Ceramica:
lunghezza = 50
diametro = 5÷7



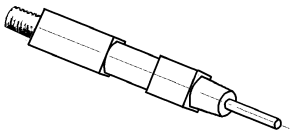
SA 580

Ceramica:
lunghezza = 50
sez. quadra= 6x7



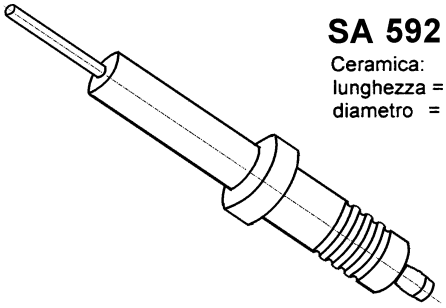
SA 590

Ceramica:
lunghezza = 38÷58 8
sez. quadra= 7x7



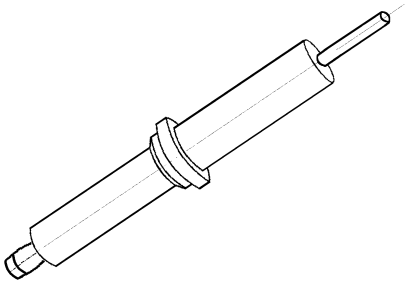
SA 591

Ceramica:
lunghezza = 34
diametro = 6,5
sez. quadra = 7x7



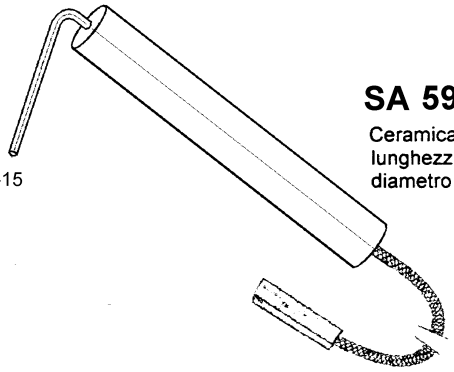
SA 592

Ceramica:
lunghezza = 61
diametro = 9-11-15



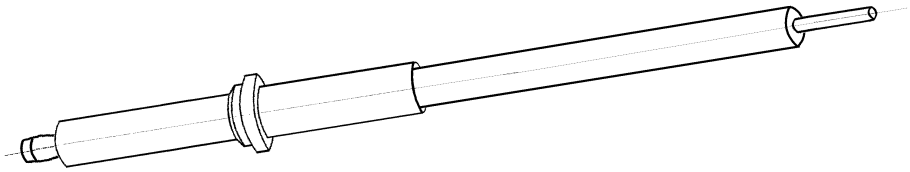
SA 593

Ceramica:
lunghezza = 56 / 68
diametro = 9-10-12-15



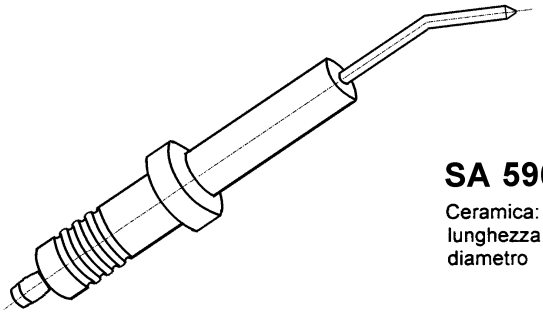
SA 594

Ceramica:
lunghezza = 55
diametro = 8.5



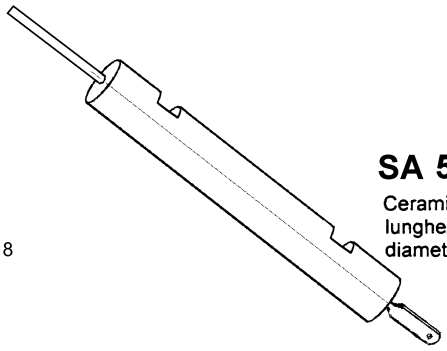
SA 595

Ceramica:
lunghezza = 72
diametro = 9-10-12-15
Tubetto:
lunghezza = 60
diametro = 6



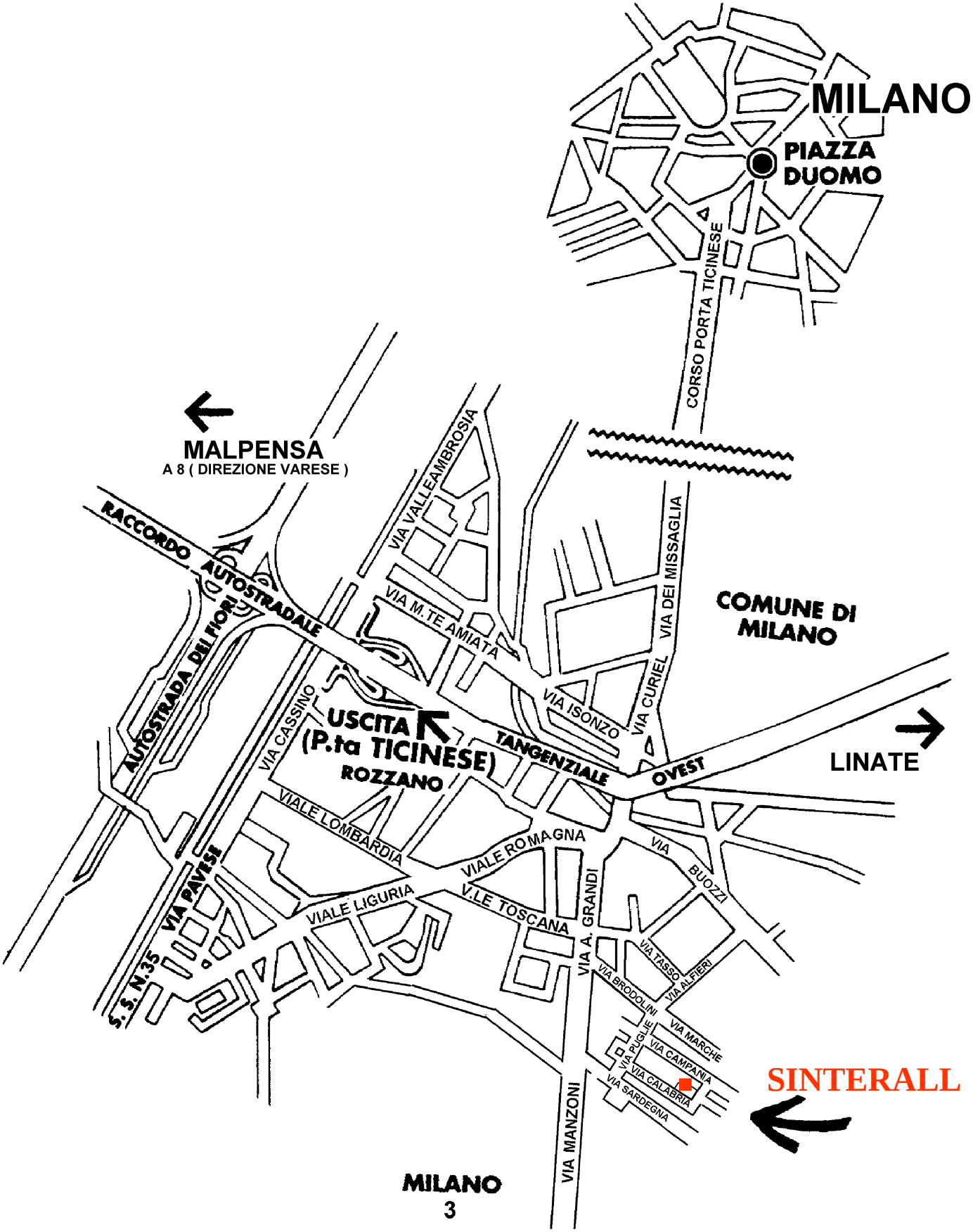
SA 596

Ceramica:
lunghezza = 65
diametro = 11-13-18



SA 597

Ceramica:
lunghezza = 60
diametro = 8.5


MILANO
PIAZZA DUOMO
CORSO PORTA TICINESE
MALPENSA
A 8 (DIREZIONE VARESE)
RACCORDO AUTOSTRADALE
AUTOSTRADA DEI FIORI
VIA VALLEAMBROSIA
VIA M.TE AMIATA
VIA DEI MISSAGLIA
COMUNE DI MILANO
VIA CURIEL
VIA ISONZO
VIA CASSINO
USCITA (P.ta TICINESE)
ROZZANO
TANGENZIALE OVEST
LINATE
VIALE LOMBARDIA
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