
PLASMA ENDRGO
V.I.VEXPlasma
ENGINEERING DIVISION
PLASMA ENDRGO
Our allied
against the Pollution
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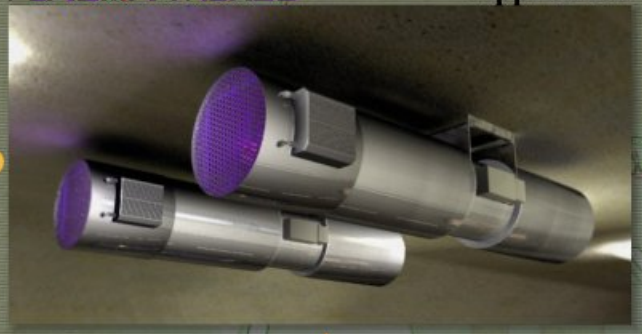
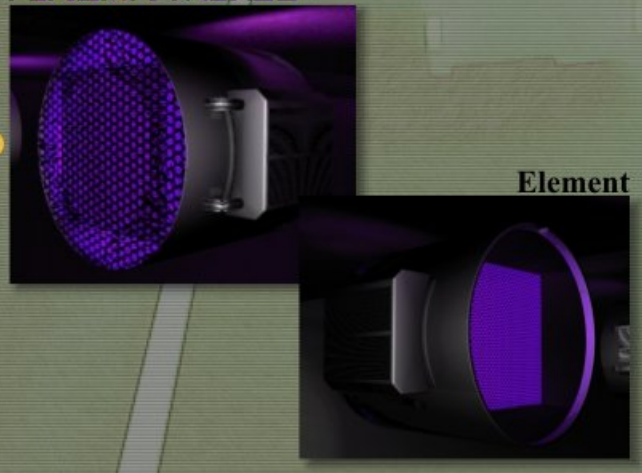
ITALY

Tunnel with PLASMA INDIGO

PLASMA INDIGO Application



PLASMA INDIGO



Element

PLASMA INDIGO

INTRODUCTION

The demolition of noxious, odorous and toxic substances has always been entrust, in depuration implants of tunnel air, to scrubber traditional implants, to electrical filters, better said, in extreme measures, to very expensive carbon active absorption or to catalytic reactors.

The advanced progresses of last years in environmental improvement, allowed our Company to develop improved efficacy and security proposals.
Cold Plasma technology is the one that has received best the attention of the most important scientists and researchers.
That technology widely studied and applied with our Plasma air machines is the core of our implants PLASMA INDIGO , with which we satisfy the so restrictive environment contamination rules, being the same the best answer of fume depuration caused by vehicles circulation.

Tests and analysis confirm the high pollution demolition ability of our Implants as follows:

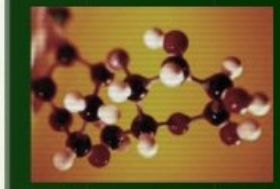
- **Carbon Monoxide dejection till 30%**
- **Nitrogen Monoxide dejection till 45 %**
- **Nitrogen Dioxide dejection till 90%**

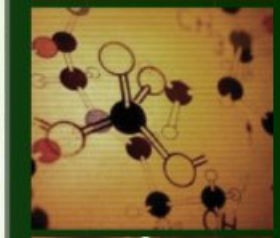
Furthermore the demolition of : total powders, Metals, Ammonia, Hydrocarbon, VOC.

Other features of our Machine are:

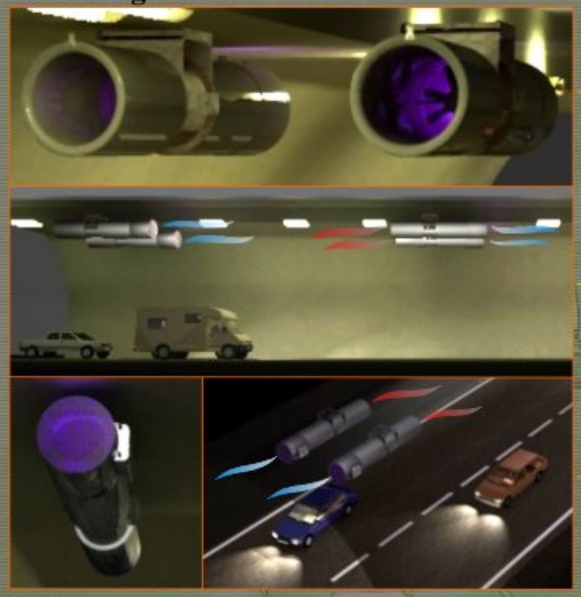
- **Absence of Filters**
- **Noisy ≤50 at 3 mt.**
- **Absence of vibrations.**
- **Very low energetic consume.**
- **Absence of rotation parts.**
- **Extremely reduced maintenance.**
- **Very reducedPressure drop≤100 Pa**
- **Resistant up to 800°C for 60 minutes**

PLASMA INDIGO (patented) wants to solve the so mentioned problems with a peculiar depuration treatment cycle in one Compact and assembled unit, to install as pre-treatment to existing implants or directly to theflow-fans normally installed in tunnel ceiling.
The composition that is made of stainless steel (optional) gives to the PLASMA INDIGO the lasting along time.



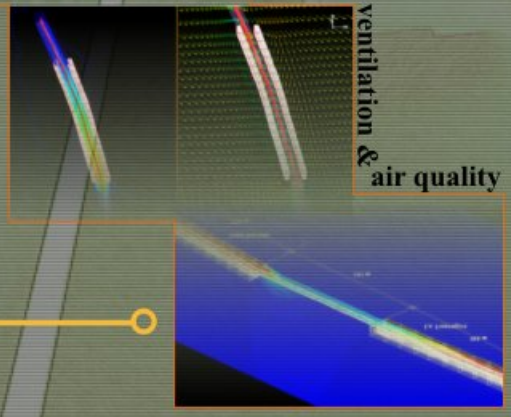


Flow Diagram



PLASMA NDRGO

3D simulation



ventilation & air quality

BENEFITS OF PLASMA NDRGO IN EXISTING IMPLANTS

In those tunnels in which is already installed an emissions depuration or a de-pulveration implant, the installation of the PLASMA NDRGO as pre-treatment improves the efficacy of gases demolition, as CO, NO, NO_2 and so the internal opacity of the air, helping to reduce the external reach of renewed air.

We can finally say that a PLASMA NDRGO installation reduces of the 40% or 50% the renewed external air flow, that it will mean an energetic saving (saved electrical powder – required electric power from PLASMA NDRGO) of the 30% or 40% .

BENEFITS OF PLASMA NDRGO IN NEW IMPLANTS

In a new tunnel a PLASMA NDRGO installation reduces cost of a ventilation implant and cost of energy.

If we consider a 1600m long tunnel, with a one carriage-way, 4,50m long and 5m high, perfectly horizontal, with a traffic volume of about 2000 vehicles/h at the speed of 50 km/h, and so a tunnel occupation of 40 vehicle/km always at the speed of 50 km/h, is widely confirmed that the external reach of the air, necessary to contain the contaminated substances according to the normative, must be of about $150m^3/s$ to reduce NO_2 presence, of about $45m^3/s$ if we want to reduce only CO presence and of about $85m^3/s$ if we want to reduce only the opacity.

In this Hypothesis is not considered the risk of fire, to simplify the case.
So if in the tunnel will only be CO or opacity problems the air reach useful to contain these pollutant would be lower than others.

NO_2 presence and its high toxicity are also responsible for the opacity of the air and so it obliges higher ventilation air quantity.

Always for the mentioned tunnel the air accelerators necessary to guarantee a reach of $150\ m^3/s$ should be 4 couples collocated at the distance of 400m between them.
These enormous ventilators should have each a reach of $75\ m^3/s$ and a power of about 100 kW.
Concluding to ensure the ventilation of the analyzed tunnel, the needed electrical power should be of about 800 kW.
The cost of the ventilation implants would be in the same case very expensive.

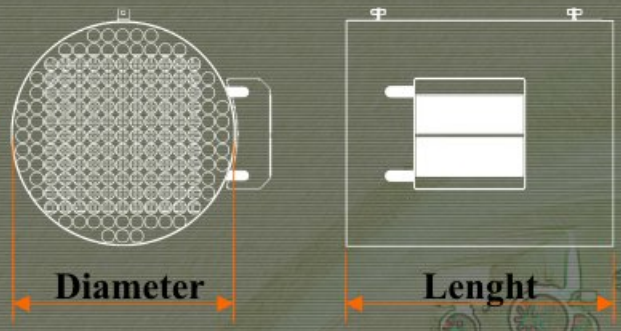
If we take in consideration the hypothesis to improve axial flow fans with PLASMA NDRGO and considering that the reduction of $N0_2$ is only of the 50% is evident that is as to say that in the tunnel only the half volume of the analyzed cars are transiting , and ventilation reach will be of about $75m^3/s$ and not more of $150\ m^3/s$.
In this hypothesis flow fans will always be 4 couples, for fluid dynamic reasons, but each of them will have a $36\ m^3/s$ reach and a power of 50 kW.

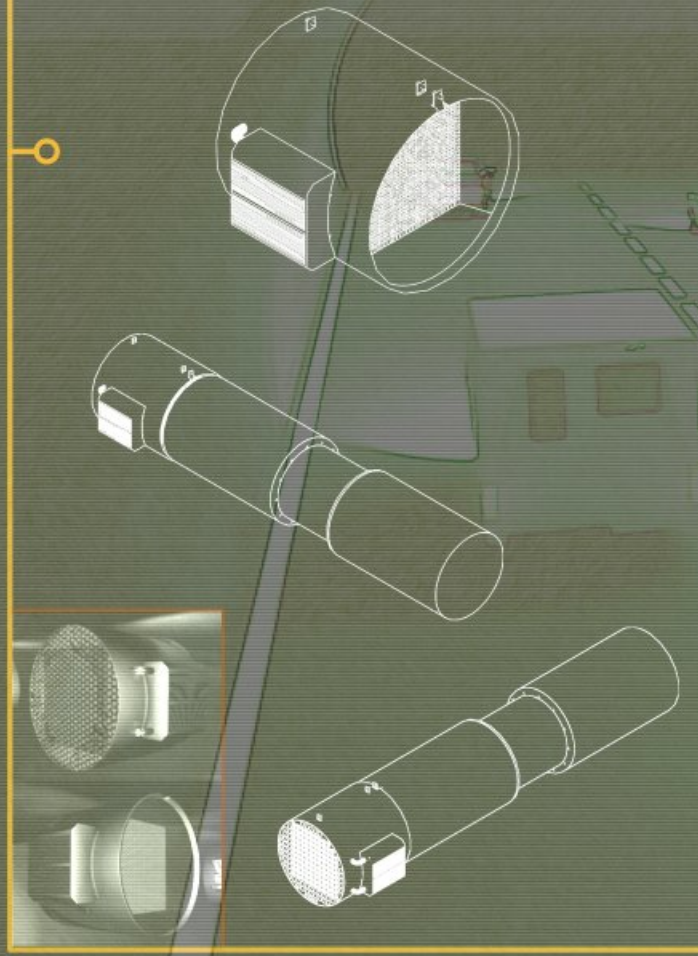
Concluding in the second hypothesis to ensure the tunnel ventilation, the electric power will fall at about 400 kW.
Instead the needed power for each PLASMA NDRGO will be of about 7 kW that in 8 modules gives 56 kW
And so the requested power will be of about 456 kW and not of 800 kW.

The installation cost of the total system will be the same or lower than the first case, since it is possible to pay the modules PLASMA NDRGO with the saved on activators and the relative electrical alimentation and running implant.

<u>Instead the saved running doesn't need any further comments.</u>

PLASMA INDIGO





COMPOSITION AND MODELS

PLASMA INDIGO , in his entirety, it is composed the following stadiums of treatment, some of them are optional:

1- Primary gross filtration (optional)
2- Chamber of Cold Plasma.

PLASMA INDIGO is produced according to sizes requested starting from the size of 5000 m^3/h

OPTIONALS:

To improve the running many options are offered:

OP-01 Sensor of the effective air movement in the machine.

OP-02 TiO_2 photocatalist with self-cleaning function.

Our machines are perfectly according with security and fireproof actual normative.

PLASMA INDIGO

Type	Diameter	Length	Electrical power consumption	Max volume flow	Max air outlet speed	Max pressure drop
	mm	mm	kW	m^3/s	m/s	Pa
TCP 500	580	2000	2,00	9,51	36	120
TCP 600	650	2000	2,50	11,94	36	110
TCP 700	730	2000	3,00	15,06	36	100
TCP 900	920	2000	4,50	23,92	36	95
TCP 1000	1020	2000	5,50	29,40	36	90
TCP 1100	1140	2500	7,00	36,73	36	85
TCP 1250	1270	2500	8,50	45,58	36	80
TCP 1400	1420	2500	10,50	56,98	36	75
TCP 1600	1620	2500	14,00	74,17	36	75