September 2013
Nº 2

E&M Combustion News

E & M COMBUSTION
energía y medio ambiente

Development of a gas natural burner for a biomass boiler

CORPORATE SOCIAL RESPONSIBILITY

Delia Tang and Paul Meng

E&M Combustión in China

E&M Combustión:

No limits

· Technology ·

Solutions and equipment for Explosive Atmosphere zones

E & M COMBUSTION

energía y medio ambiente

www.emcombustion.es

Burner JBD – 50.000 – G

Forging bonds


Iñigo Béjar and Aitor Jausoro, founding partners of E&M Combustión

Following the publication of our first corporate magazine in 2012, we present the second issue of the **E&M Combustion News** magazine, a unique platform as to directly reach our clients, customers, suppliers and friends worldwide.

It is published in Spanish, English and Chinese, with an aim to of showcasing the innovations and technological developments in the combustion sector undertaken by E&M, as well as the projects put into place by our company worldwide, and naturally, with the purpose of letting the public know who are the persons who make up this little family that is E&M Combustión.

It is intended with this annual magazine to continue forging bonds so as to report on the latest developments in the company and our capabilities in the development of combustion technologies, which enables us to deliver low emission rate NOx equipment, thus promoting the conservation of our environment, the development of innovative prototypes, the fitting of boilers to gas, or the support provided by our technical support service.

At the same time, **E&M Combustion News** represents an opportunity to meet our friends and colleagues, proposing opportunities for interaction in the corporate sphere, bringing people together and forging bonds, given that –as pointed out in our previous edition- “through personal knowledge builds understanding and cooperation that facilitates the growth and development of organisations”.

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E&M Combustion News

Edition:
PdC Pool de Comunicación
Design and printing:
www.vinaixa.biz

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2012 BALANCE

Despite the current economic crisis which we are enduring and which is not just affecting our country, 2012 can be considered as very positive for several reasons that are outlined as follows.

1. First of all, sales continue to grow in foreign markets, especially in the petrochemical and refinery industries, delivering the first units to new markets, with which have not worked with beforehand, such as Pakistan or Saudi Arabia.

2. We continue consolidating and establishing new contacts in the Chinese market which is considered as a priority for the expansion of the company. The high performance burner models were showcased and very well received in the Shanghai Trade Fair. These new contacts have already led to new and major contracts during 2013.

3. We continue with the installation and commissioning of thermal oil boiler burners in thermosolar power plants making us a benchmark for these types of plants.

4. We continue to develop and improve our Low NOx technology achieving increasingly better and better emissions results in our burners.

5. Personnel wise, our group continues growing and strives to improve every day its efforts also with the incorporation of new personnel making our company one of the most competitive companies in our industry and product range.

All things considered, and notwithstanding that a large number of the competitor businesses are facing major difficulties and even some of them are merging or are being taken over by others in order to survive, E&M Combustión continues to yield positive economic results at the end of the year, hiring new personnel, and has continued with new investments both in R+D as well in other corporate aspects. Therefore, we cannot but only consider 2012 as nothing but positive, as it will be a good springboard so that in 2013 the results will be much better.

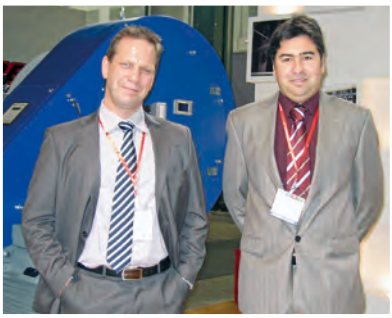
[We have continued with new investments both in R+D as well in other corporate aspects]

[ATTENDANCE AT TRADE FAIRS]

< Left. E&M Combustión's stand.
> Right. Shanghai Trade Fair.
v Below. Juergen Praest with Iñigo Béjar at the trade fair.

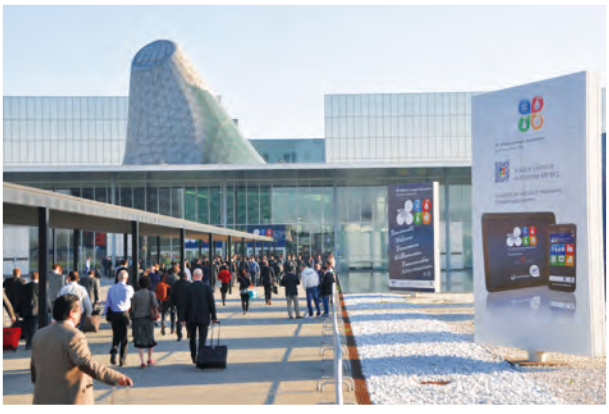
E&M Combustión at the Shanghai Heatec Trade Fair

E&M Combustión successfully participated in the 2012 Heatec Trade Fair, held in Shanghai from 31 October to 2 November. It was the first time that E&M Combustión attended a Trade Fair in China where the JBM, JBM-HP and JBD burner models were showcased. We were pleasantly surprised by the interest shown in our equipment in that country and by the large number of visits received during the holding of the



event. Without question, some of these contacts will bear fruit in the future in the establishment of business relationships with new customers.

We are also in Milan (2012 MCE- Expocomfort)



E&M Combustión took part in the 2012 MCE-Expocomfort Trade Fair, held in Milan from 27 to 30 March, 2012. We had previously attended that trade fair on prior occasions and noted that there are increasingly fewer interesting visitors for E&M. Sadly, we believe that trade fairs in Europe, unlike China for example, serve more nowadays the purposes for being visited by suppliers rather than to drum up new business. Furthermore, the high costs that trade fairs entail must be considered. Following this experience, E&M Combustión will focus in the future participation in trade fairs in other countries outside Europe.

[INTERNATIONAL]

A highly successful Havana Conference

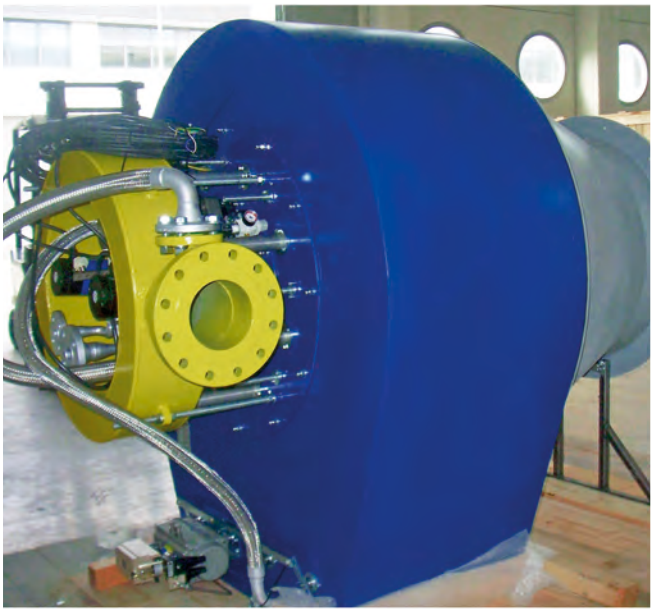
Upper left. Details of the screen with graphic depiction that underpins the conference.
Below. Conference committee wherein Iñigo Béjar and Óscar Luis García participated, in the Miramar Occidental Hotel.

A highly successful conference was held by E&M Combustión in Havana on 20 February which addressed the different technical aspects of combustion installations. The conference was conducted in conjunction with a local company, Bioenergía Caribe. This conference, held at the Miramar Occidental Hotel, was attended by approximately 60 people from different Cuban companies, some of whom travelled from different parts of the island, such as Ciego de Ávila or Santiago de Cuba. From amidst the key aspects highlighted at the conference was the unveiling of the new electronic burner control systems that E&M Combustión is currently using in its facilities around the world and which is intended to be introduced in Cuba.

[NEW CONTRACTS]

E&M Combustión executes the revamping of the burners of the Repsol refinery in Tarragona

E&M Combustión was awarded the contract for the Repsol refinery in Tarragona for the execution of the revamping of the radiant zone burners of the Olefin boiler and the construction of new valve skids for that equipment. The contract includes the manufacture and replacement of the 6 existing burners for new ones whose thermal output is 37.5 MW each, operating with hot air up to a design temperature of 180 ºC. The burner models are JBD 50,000 GFO which are mixed, fuel oil – fuel gas, with vapour atomization and will include the new emission reduction systems developed by E&M Combustión.

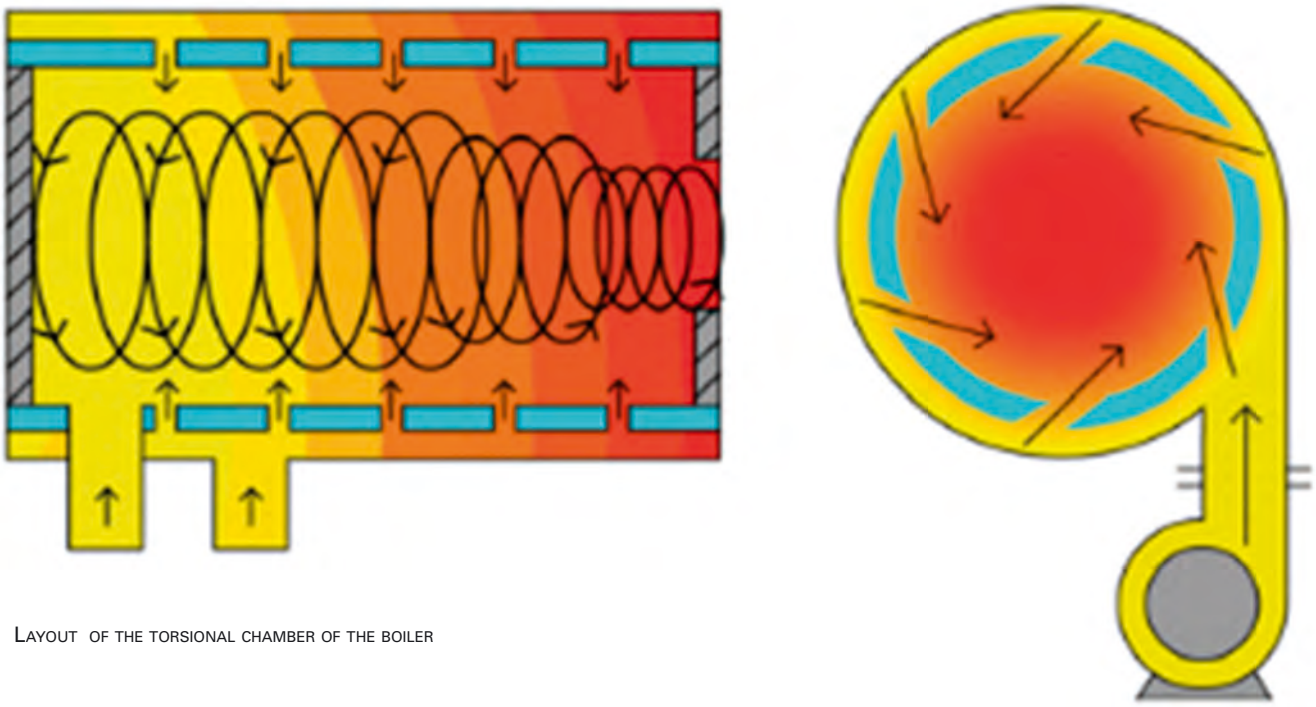


> Burners being dispatched to the Repsol plant.

Retractable combustion heads for biomass boilers

Due to the rising fossil fuel prices alternative solutions for energy needs are sought. One of these alternatives may be biomass boilers

E&M Combustión has developed a 40 MW natural gas burner to be coupled to a 45 t/h torsional chamber in a biomass boiler running on sunflower seed hull



Layout of the torsional chamber of the boiler

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The burner developed by E&M Combustión is a fully functioning model and is already installed in the sunflower oil pressing and refining plant of the Saipol company, in the Bassens plant in France.

Operating principle

The Torsional Chamber is a horizontal cylinder connected to the boiler via an inverted conical collar. Within same, the potential field created by the tangential injection of air along throughout the periphery of the cylindrical chamber induces a rotational axial field in reaction to the above. Whilst the tangential velocity of the potential field increases with the decrease of the radius, the tangential velocity of the induced rotational current increases with the radius; which are equal, a very active and turbulent boundary limit is formed, which maintains an intense combustion under the most favourable conditions.

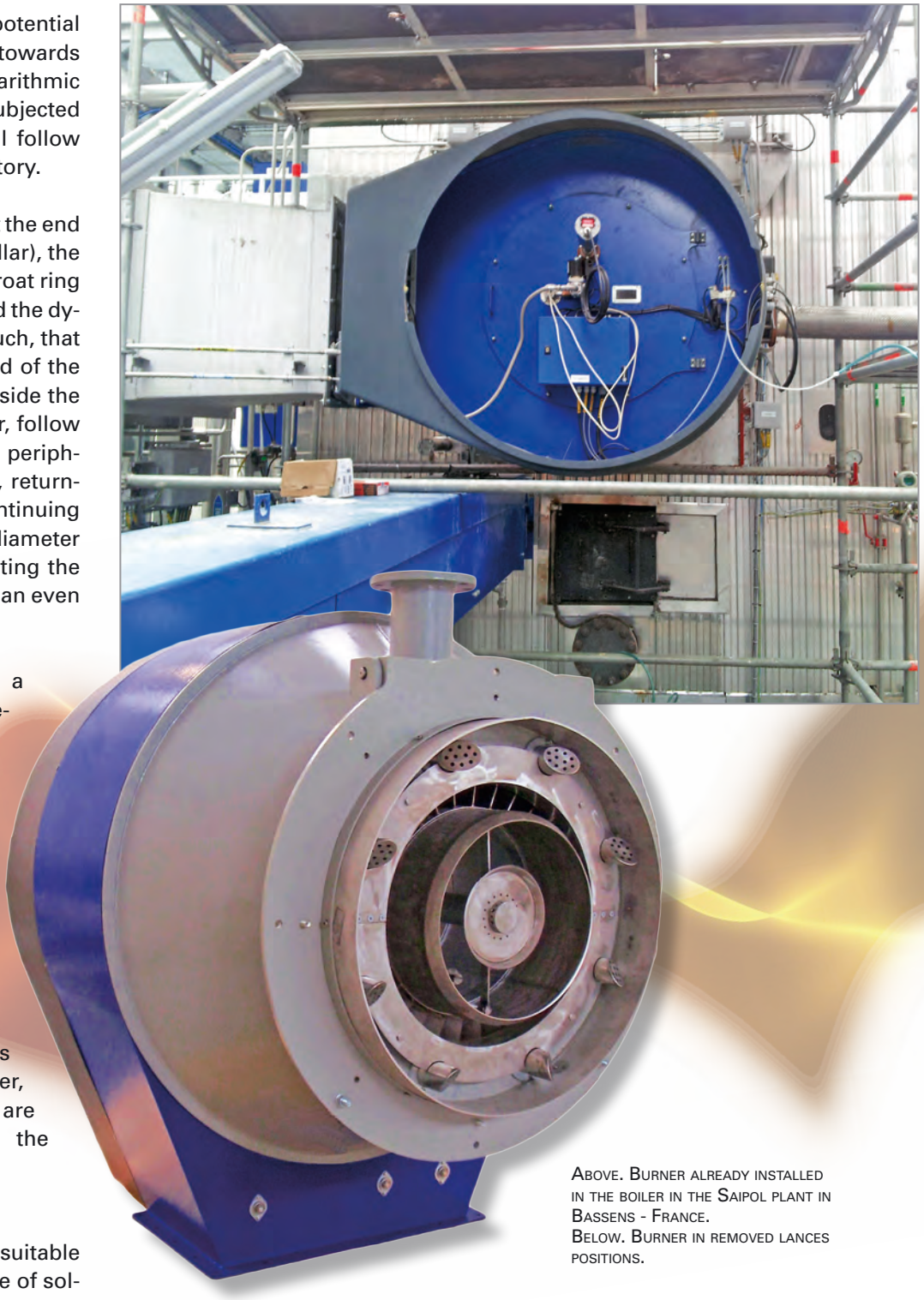
The fuel particles are also injected tangentially into the cylinder.

Those located in the potential field capable of flowing towards the centre follow a logarithmic spiral trajectory; those subjected to the rotational field will follow an arithmetic spiral trajectory.

Introducing a constraint at the end of the cylinder (conical collar), the pressure created in the throat ring generates axial forces, and the dynamics of the system is such, that the particles reach the end of the combustion chamber, outside the chamber's outlet diameter, follow a helical trajectory in the periphery of the cylinder throat, returning back to the front continuing in increasingly smaller diameter impellers , and finally exiting the chamber via the throat, in an even smaller helical trajectory.

This path implies that a longer spent time is required to ensure complete combustion. This longer spent time of the particles can be up to 60 times longer that than which carries direct air flow.

Simultaneously, the combustion fumes, with a portion of the ashes, exit the chamber via its collar and enters the boiler, whilst the ash residues are regularly removed from the torsional chamber.



Above. Burner already installed in the boiler in the Saipol plant in Bassens - France.
Below. Burner in removed lances positions.

Scope of application

The Torsional Chamber is suitable for the burning of any type of solid or liquid fuels, whenever they can be transported in pneumatic suspension.

The suspension capacity of the fuel depends of the density/average normal section ratio, but for various biomass types, this broadly means that the particles should be of a diameter of between 0.1 and 20 mm.

Some typical fuels are: sawdust, sanding dust, sunflower seed and cottonseed hulls, grape seed, olive pomace, straw etc.

Burner backup

As in most biomass facilities, due to reliability issues, require the backup of a conventional combustion boiler.

E&M Combustión has developed a 40 MW natural gas burner to be coupled to a 45 t/h torsional chamber biomass boiler of the Berkes company running on sunflower seed hull.

At the customer's request, it is required that the burner can function both single-handedly as well

COMPETITIVE ADVANTAGES

In this manner, the following advantages of the retractable head may be mentioned:

- As it is not necessary to have the fan continuously running thus achieving that the normal operation of the torsional chamber is not affected.
- Electrical savings as it is not necessary to have a fan continuously running fan for cooling the burner.
- Mechanical reliability by not having to remove the burner or fan or air duct or gas ramp whenever wishing to switch on or remove the burner.
- Quick commissioning of the burner as need whether due to a breakdown in the biomass system or due to the need to supplement the power supplied by the biomass.
- Option of using the burner to start up the biomass boiler.
- It is possible to replace or repair any element of the burner with the biomass boiler running.

as backup of the biomass, furthermore its commissioning must be fast, a maximum of 2-3 minutes from the its operating demand.

The burner is directly fastened onto the torsional chamber, reason why it would require continuous fan operation so as to ensure that there is no flashback and for the internal cooling of the burner. It was noted that this constant air flow through the burner affected the normal operation of the torsional chamber and therefore was not feasible.

Detail of the pneumatic cylinder.

The solution to assemble and disassemble the burner each time that is was required to do so was not feasible due to reliability issues and because the time required for such operation was not compatible with the maximum commissioning time of the burner.

Given the impossibility of removing the entire burner from the combustion chamber, it was decided to search for a system wherein both the burner as well as the combustion fan and the gas ramp could burn fastened to the chamber and only if the combustion head is removed.

Finally it was decided to design a burner wherein the combustion head could be removed pneumatically outside the combustion chamber to later lower a guillotine which isolated the burner from the combustion chamber. The guillotine opening operations, insertion of the combustion head and commissioning of the burner only takes a couple of minutes to do so.

A pneumatic cylinder with two limit switches, are responsible for moving the gas lances and to indicate its position to the BMS so as to proceed with the operation of the guillotine and commissioning of the burner.

The end result has been an innovative design of the combustion head which allows the removal of part of the components and to thus prevent damages in the event of that there is a flow back of gases which is common in biomass boilers. This has entailed a number of competitive advantages for the customer as it also extends the average service life of same as it is better protected from torsional chamber temperatures.

Paul Meng, Iñigo Béjar and Juergen Praest with Samuel Choi, from the DFWL company. On the day of equipment testing certification with the Shanghai inspection authority.

Conversion of coal-fired burners to natural gas

China address the environmental improvements and reductions in pollutant emissions

After 30 years of rapid growth, during which China's industrialization and urbanization has continued to progress, the pollutant emissions have exceeded the environment capacity in many areas. Meanwhile, with increased population demands concerning the environment; towards an increasingly higher number of environmental emergencies, this environmental issue has become one of the major threats to human health, public safety and social stability. Therefore, the significant reduction in the emissions of pollutants is regarded as a fundamental objective for economic and social development, which requires efforts to be made to address the major environmental problems, in areas such as awareness, policy, social competence and institutional arena, in which significant progress has been made .

"When I got the telephone call from Mr. Cai, the Dong Fang Wei Long thermal equipment Company Manager, I was aware the arduousness and urgency of the project. But I didn't expect that despite it being the world's most competitive market, and that in the Chinese burner industry, which has over 20 companies that they had to resort to a foreign company for their requirements. Is it because the technical conditions are too stringent?", states Paul, E&M Combustion China representative office sales manager.

The customer's facilities are located in the strongest growth area in southern coastal areas of China; it belongs to one of the top 500 companies in the world and one of the first to invest in China. The customer has in this a plant a 30 tonne coal-fired, a 30 tonne oil boiler and several other 10 tonne-15 tonne fuel-oil burners.

The service life of these boilers is over 20 years old. They produce steam, used primarily in textile dyeing and printing. In line with the country's decision to control nitrogen oxides emissions in printing and dyeing industry activities, the state-owned gas group decided to join forces with the company on a boilers transformation project, for those boilers which had reached the end of their service life, fuelling their burners with a cleaner energy namely, natural gas. However, the project had the following techni-

cal difficulties: first of all, the 30 tonne oil boiler, a combustion chamber diameter of 2.07m and a length of 5.3m. The combustion chamber was obviously too short for a 25MW gas burner flame. Even more serious was that the boiler's combustion chamber was extremely narrow and that the thermal load exceeded 1 MW/m3. For such a high thermal load, the customer, however, required that the boiler comply with the local government emission requirements, that is, nitrogen oxide emissions <150 mg/m3 of an excess of air lower than 12%

Secondly, the combustion air of the boiler reached a temperature of 80 °C (in practice, even reaching 100 °C).

Despite over 20 years of experience in the engineering and distribution of burners, the Guangzhou Dong Fang Wei Long thermal equipment company was also stumped by the very stringent technical requirements of the project. Mr. Cai, the General Manager of Dong Fang Wei Long company, had began to contact several burner manufacturers which many years of engineering experiences and numerous successful programs in China under their belt, but only received one positive response from an Italian burner company, which, however, did not have any offices in China. This was of significant importance, as the issues of the commissioning as well as the maintenance weighed heavily on Mr. Cai. Therefore, Mr. Cai telephoned the E&M Combustión China office with the intention of testing our equipment.

After receiving Mr. Cai's telephone call, and after a comprehensive review of the project engineering information, Mr. Juergen Praest, the General Manager of the E&M Combustión China office, with vast experience in engineering under his belt, came up with a solution immediately: on the one hand, as regards the 100 °C combustion air, given that the burner did not have an outer

> This boiler was too short and narrow but at the end of the day it is the end result that counts!

shield, the operators could easily be burned by touching the equipment. To solve this problem, we could adopt the solution applied in the burners of E&M Combustión, with lower costs as well as shorter installation time than the solution offered by its competitors, which consisted of installing a 30 mm thick calcium silicate fibreglass inside the burner and a 1mm sheet of stainless steel as a thermal insulation.

The Burner already installed in the boiler.

To fit the flame to the smaller combustion chamber size, we have adopted a special combination of primary and secondary air turbulator to the burner which allowed us to accurately control the flame width and length, complying precisely with the customer's needs in this boiler.

The following point was to control the emission levels at an 88°C air temperature which we solved using a lesser amount of primary gas amount to the burner in combination with a internal flue gas recirculation of the flame in the middle of the flame where it is normally done on the outside of the flame. In case of the narrow boiler, there was simply no space for that. With our adjustable gas injectors we could tailor the flame to the combustion chamber size in order to obtain the best results without modifying the boiler.

After only a single burner readjustment, we were able to meet all requirements for this boiler with a very nice looking flame and a NOx level of around 100 mg @ 3% O2 and a CO level below 50mg @ 3% O2.

Both the customer and other burner suppliers who have visited the company have been surprised and inquired how we could do that, given that several of them had rejected manufacturing a burner for this boiler.

In compliance with Chinese laws we had to subject the burner to official testing similar to the German TÜV and it was tested by a state-owned burner testing company from Shanghai. We passed this test without any difficulty.

There is no doubt that this boiler was too short and narrow but at the end of the day it is the end result that counts!

“We provide technical assistance around the world”

Raúl Cabadas
Technical Service Manager.
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Saudi Arabia, Mexico, Romania, Poland etc. are some of the countries where E&M Combustión has provided its technical service assistance in recent to develop the proper functioning of the various industrial plants around the world.

With the objective of enhancing the technical service and strengthening assistance, E&M Combustión created in 2012 a specific department to assist from the commissioning of the equipment manufactured by the company, to the maintenance, repair, replacement and spare parts of the equipment of the institutions. Regarded as a core activity for maintaining the plants running and optimising plant operation, the regulation of many plants requires also the regular revision and verification of the equipment.

Raúl Cabadas, Technical Service Manager, relates his practical experiences: “The idea was to enhance the technical service, that we were already providing, and with the purpose of reinforcing this area and to provide better customer service, and more qualified support. Thus, attaining an improved service life of the equipment and avoid future breakdowns”.

With over fourteen years experience of in this industry, E&M Combustión has personnel in the main cities of Spain , and envisages improving this activity via the incorporation of larger number of short term technicians, in order to reduce response time and to provide an excellent maintenance service.

Field work in the customer’s facilities.

Thermo-solar power plants and refinery and industry activities in general are the most frequent of these types of services, which also includes food and beverages, pharmaceutical and automotive facilities.

In some of this facilities, the annual revisions of part of the equipment are obligatory and the regulation prescribes the monitoring of the equipment. This is for example in the case study of the Spanish thermo-solar power plants in Ciudad Real, Córdoba and Extremadura, platforms wherein the technical area of E&M Combustión oversees the maintenance service.

Amid the most complex installations is that of the biomass boiler in the Ciudad Medioambiental de Garray (Environment City of Garray), in Soria, Spain, a town where the execution of an intelligent building complex and a biomass plant capable of producing electricity for the entire residential area is planned.

As regards to food and beverages, the company provides services to best known companies in the manufacturing field of soft drinks, milk or oil and pharmaceutical products.

During this year, the different specific training courses conducted by our technicians in situ have also gained great acceptance from our customers, these courses are tailored to the needs of each installation.

We have also successfully conducted several energy savings audits, wherein we have managed to change the existing burners with other new generation electronic burners, with low NOx, incorporating a frequency inverter, fan motor, O2 and CO probe and plant communication touch screen with DCS. We have provided the customer a amortization schedule for that equipment, which, on several occasions, has been positive.

"Spanish equipment have an equal or superior quality than that of countries with a higher technological state of the art image and with more competitive costs"

Iñigo Béjar E&M Combustión Sales Manager
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Iñigo Béjar gives his vision regarding Spanish equipment and how the economic crisis is affecting our country. In his opinion, internationalization and R+D endeavours are those which are allowing levels of development and export solvency.
His recipe to better tackle with the economic crisis is market diversification and the use of new technologies and processes.

Despite what has been said about the economic crisis in Spain, a good performance of the industry and exports has been noted. What is E&M's perception?

The equipment sector is one of the sectors that is best withstanding the economic crisis and is the leading industrial export sector right now in Spain. In recent years, due to the collapse of the domestic market, many companies have had no other option but to go overseas or either foster export practices that they were already undertaking in order

to continue with the activity. Hence increased export figures. In the case of E&M, from the commencement of the business activity we have always had a strong foreign trade vocation. If the truth be told, this did not originate from the economic crisis in Spain, and now we are reaping the fruits of this international labour of several years. Currently, the domestic market is in a period of stagnation, our company is growing at a very high rate thanks to the foreign sector and especially this year, that is, 2013, thanks also to sales in China. I believe that this trend will increase over the coming years both in E&M as well as in the country, seeing that a recovery of the domestic market is not foreseen in the short term.

In Spain a very high standard has always been set for the concept of manufacturing quality, are we seen as such in foreign markets? Is our technology sufficiently well known as such in other countries?

If I had to reply to this question with a yes or no answer, I would say no, although one would have to qualify that and divide the world by areas. There are areas such as Latin America where the level of establishment of Spanish companies is very high and wherein Spanish products and technology are widely appreciated, while other areas, such as Asian countries, wherein the level of establishment or sales is as yet low and realistically we have a significant shortcoming in terms of being able to promote our equipment for several reasons. On the one hand, we have come onto the scene in these markers much later than other countries, and on the other, Spain is not seen as an Industrial Country but as a Tourist Destination when obviously we do not have the industrial level of neighbouring countries such as Germany but we are not by any means the image level that those countries have of us. However, luckily, I believe that over the last two or three years one has seen a steady increase of companies which are beginning to market their equipment in countries such as China, India, etc. This is demonstrated by the number of Spanish company personnel who travel to China by plane. Actually, when I started going to China, many years ago, one could hardly find a Spanish entrepreneur or sales representative who worked in this country. Nowadays this has changed dramatically and one finds many people who are speaking in Spanish.

What does the importer of Spanish equipment give priority to when opting for that equipment?

I believe that it is undoubtedly the price-quality ratio. I believe that in Spain one can find (and moreover right now with the economic crisis, which is increasing competitiveness in leaps and bounds) products at much more competitive prices than in Northern European countries with a similar quality or in some cases better than in the latter. We as yet have a shortcoming in terms of the technological level in some of our equipment or industrial processes as compared to countries such as Germany or France and for that reason we find it harder to compete in some areas, but actually in others the price-quality ratio is very good. I think that the economic crisis that we have at the moment can be a good opportunity to yet convert that productive sector into another one with more added value, as many of these companies are forced to close down or have to close down and only those companies that provide technological added value will remain.

E&M also subcontracts to a considerable degree components in the Spanish market, is the small and medium-sized enterprise (SME) subcontractor reliable?

In general I would say that the small and medium-sized enterprise (SME) subcontractor is reliable, although increasingly we have major problems in finding companies which meet our demand and quality requirements. In order to improve this aspect, it is es-

MADE IN SPAIN

- Spain is the second country for tourism revenue after the USA
- Goods and services exports grew by 18% between 2009 and 2010
- On a technological level, France is the largest importer, followed by Germany a USA
- Spain ranks in 2nd place in the manufacture of vehicles in Europe and 8th in the being the 1st manufacturer of commercial vehicles
- The aviation industry is the fifth largest in Europe and participates in aeronautic programs worldwide: Airbus, Boeing 787 Dreamliner, Bombardier CSeries, Emb
- Spanish companies lead the widening of the Panama Canal
- A consortium of our country will construct the first high speed train in the Midd between Mecca and Medina
- A Spanish company manages airports in London, Orlando or Bogota.
- National electrical companies will construct the offshore wind farms in Scotlan
- A Spanish corporation will supply wind turbines to the world's major economie
- A constructor will construct the desalination plants in Adelaide or Atacama
- Germany commissions a Spanish technological company the control of its airsp order to save time and fuel
- A pharmaceutical of our country a vaccine against Alzheimer's
- National aeronautical groups have constructed the meteorological station of th CuriosityMarsRover
- Is the 1st country in the world as regards to installed solar energy and in 4th in v power
- The national telephone provides services to over 300 million clients in 25 countr

sential that in the most basic manufacturing industry (that is, the boilers, machining workshops etc.) that there take place a renewal and improvement in competitiveness which has to generated from improved processes and in staff training. Speaking about the immediate environment that surrounds us, as yet in many of these workshops there are people of a sufficient age who continue at the same pace as before the economic crisis and have "not changed their mindset". It is necessary that there be a bit of renovation in this regard although I fear that the renovation will be brought on by the market itself as these companies will fade and disappear by themselves. As an example of such, how it is possible that as yet most workshops are closed in August? For us August is the peak work period of work as it is when we manufacture more equipment for China for example.

"Our company is growing exponentially at a very fast rate thanks to the foreign sector and in 2013 especially due to activity in China"

"We have always had a strong foreign trade vocation. Now we are reaping the fruits of those several years of labour"

It is an example of a necessary change of mentality for small businesses.

How are exports affected by the Euro-Dollar exchange rate?
I understand that it is an important factor overall, although notably in E&M we have not noticed it. In the ordinary course of events, a distinction should be drawn here from companies who sell in Europe, herein we are not affected by that, with those companies which mostly export outside the Euro area, such as is our case. Obviously, a weaker Euro helps exports. The Euro-Dollar has stagnated for several months at approximately 1.30, but in our case it has not affected us at all.

And yet we are still exporting?
Indeed, but the reason is an improved business competitiveness due to lower wages and above all, because the most unproductive sectors such as construction have fallen flat.

What would you ask the institutions in order to boost foreign trade activity?
The logical response would be financial support to companies in order to venture overseas, but to tell you the truth, what I would ask the politicians who govern these institutions and the country that they would simply uphold a minimally ethical standards and some exemplary behaviour, which would be suffice to improve the image of the country, which is a key element for overseas sales. One of the biggest problems facing Spanish companies is the poor image conveyed by politicians and our public sector abroad, mainly due to the continuous cases of corruption and zero legal action as regards to these matters.

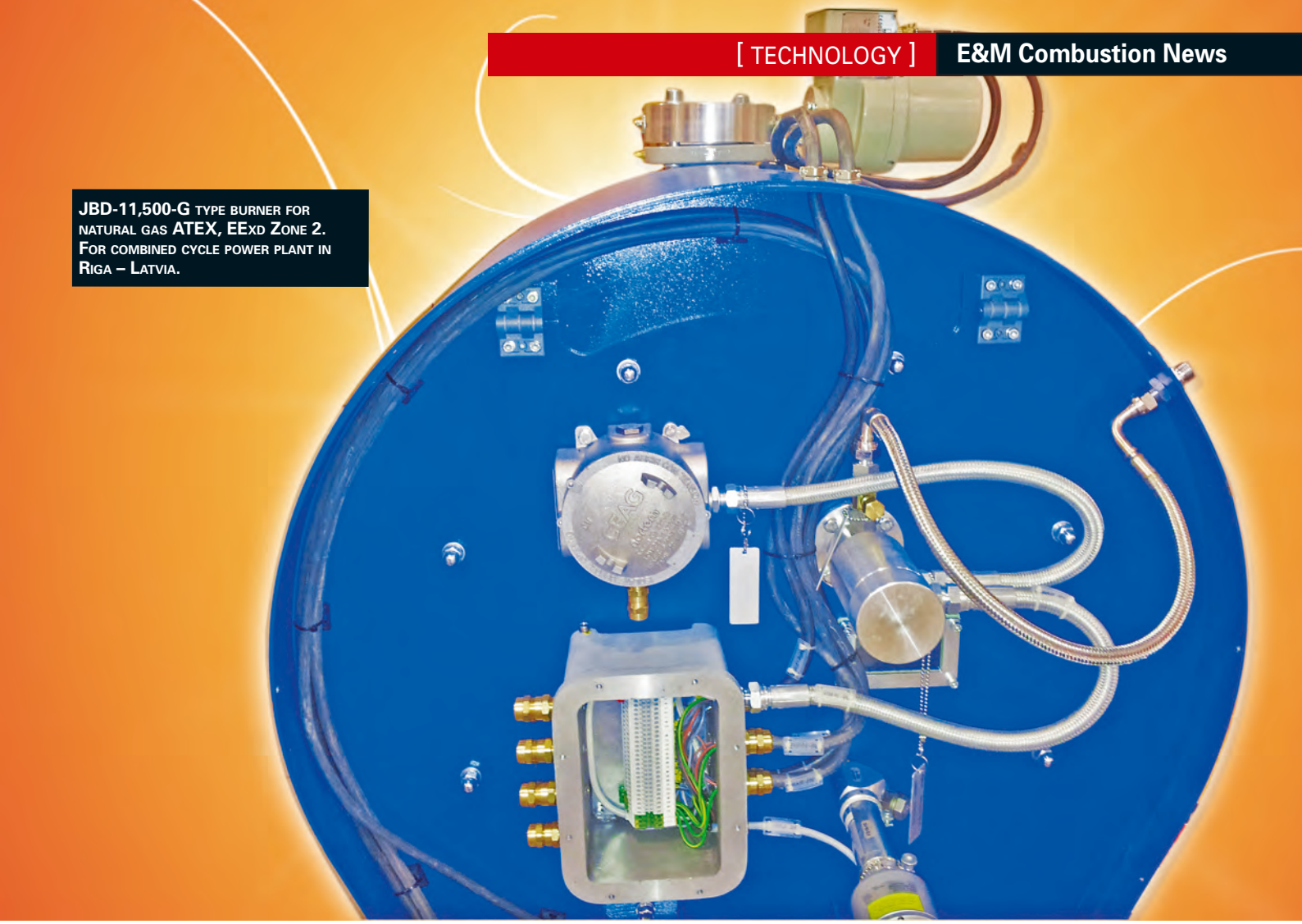
How to influence our country's image when projecting it abroad?
As a personal experience, there are countries where we have a handicap when competing, by way of example Germany and other countries, as they are considered as having a better quality image or reliability than the image conveyed by the country. In fact, one

"The commitment to innovation must be of mandatory compliance in companies"

has to demonstrate several more times to them that your product is as good and above all has to sold from the beginning at a cheaper price in order for it to be brought. Moreover, this is not actually the case, in particular I believe that our equipment delivers an equal or superior quality to that of other countries at more competitive prices, and anyone who works regularly with other countries such as Germany etc. knows that there a good, fair and pretty poor companies as is the case everywhere, which miss delivery deadlines, multinationals in particular, and in certain cases the ethics, professionalism and capacity of its professionals leaves much to be desired. All things considered, as regards the other countries, but to possess the industrial structure of more added value and above all to project an image of the country as "serious and of technology" garners better results. In the latter case, politicians bear great responsibility.

What is the role played by innovation and internationalization of Spanish companies for its exports?
Undoubtedly, innovation is a basic and fundamental factor. Without innovation one cannot compete, although in Spain the agricultural sector, for example, is a major exporter and logically, is not a sector in which innovation is as fundamental as by way of example in the industrial sector. The commitment to innovation must be mandatory compliance in companies although I have a strong suspicion that's where we will also have to improve.

From E&M's perspective, what markets and sectors are the most dynamic?
Right now, the most interesting markets for products such as our own are without question Asian country markets and, in particular China and India due to their buying potential. It is true that they are very difficult markets due to existing great cultural differences, but at the end of the day, we are taking about two countries which total 3,000 million people and are in full swing development wise. Nevertheless, there are also markets wherein a lot of consistency and perseverance is required and to provide added value in order to sell and to be successful.
By sectors, that of equipment shows higher demands, due to the likely replacement of much of the obsolete equipment which they have, and the new construction of different industries may have considerable potential. Elsewhere, the Persian Gulf and Russian markets, in the refinery and petrochemical sectors, are very interesting for the future, especially for E&M Combustión.



JBD-11,500-G type burner for natural gas ATEX, EExd Zone 2. For combined cycle power plant in Riga – Latvia.

Solutions and Equipment for ATEX zone

(EXplosive ATmosphere)

Aitor Fernández
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ATEX Burners

Over recent years, there has been a marked increase in the demand for specially designed burners. E&M Combustión has come up with multiple solutions in the burning of unconventional fuels and in the manufacture of equipment for ATEX (Explosive Atmosphere) zones. We will focus on the latter. However we must first define what is understood as ATEX and does this definition affect a burner.

Definition of ATEX zone

A series of European Directives is known as ATEX which regulate potentially explosive atmospheres. The directives also regulate the measures so as to ensure safety and to avoid triggering an explosion.

For an atmosphere to be explosive several preconditions must exist:

a) Presence of fuel.

b) Existence of an oxidizer (oxygen).

c) An energy source which initiates the reaction.

Mixed Natural Gas-Fuel oil burner model JBD-50,000–GFO with vapour atomization for Zone 1 with equipment with EExd classification for the Repsol – Tarragona refinery.

An explosion produces a rapid combustion, heat, noise and pressure wave due to the expansion of the gases that are produced.

Equipment has a categorised according to the level of protection provided. In general Category 1 equipment (very high protection) are installed in Zone 0; Category 2 (high protection) in Zone 1 and Category 3 (normal protection) in Zone 2.

3 types of zones are defined as potentially explosive atmospheres, for atmospheres wherein the fuel is gas type (G):

- **Zona 0**. The atmosphere is potentially explosive continuously. (Very restrictive)
- **Zona 1**. The atmosphere may be occasionally explosive.
- **Zona 2**. The atmosphere is not normally explosive. If so, it will only exist for a short time. (Less restrictive)

In the cases of atmosphere wherein the combustible is a type of powder (D –dust-), it is designated as Zone 20 (the most restrictive), Zone 21 and Zone 22.

2G/2D equipment is suitable for Zone 1 and for Zone 21.

> E&M provides multiples solutions in the burning of unconventional fuels and equipment for the ATEX zone

As regards, to the type of protection one finds different equipment, focusing on the most common, one has:

- **Intrinsic safety:** are designated as EEx ia/ib. They should prevent any emergence of an accidental flashpoint source. We shall say for example, junction boxes, cables and glands used in the connection of that equipment are blue (RAL 5010, 5012, ...). The installation of galvanic spacers on its electrical connections are necessary.
- **Increased safety,** designated EExe, are equipment that are not up to the standard of the level of protection of explosion proof/flameproof. They should prevent any emergence of an accidental flashpoint source. The packaging of an EEXe equipment should be at least IP54.
- **Explosion proof/Flameproof**, designated EExd, that equipment must withstand an internal explosion without permanent deformation. Must ensure that the explosion

Temp. Code	Max. Temp. on Surface Area (°C)
T1	450
T2	300
T3	200
T4	135
T5	100
T6	85

Table 1 – Classification of temperatures

are not conveyed to the surrounding atmosphere. Must be presented on any point of its surface area the exterior temperatures which prevent conversion into auto-ignition sources.

These temperatures are classified as shown in **Table 1**.

T6 is the most restrictive code, the temperature must be lower than 85 °C in order that an explosion to the atmosphere does not take place.

Lastly, we shall specify that the designation also of the level of protection for equipment for different groups of gases. Group I gases refer to Methane (only for equipment used in mining); Group IIA are made up by propane gas type (this is the less restrictive group); Group IIB are ethylene type gases and Group IIC refer to hydrogen gases

Special features of ATEX burners

Once the customer has defined the ATEX zone type and its characteristics, the burner shall be manufactured in a manner that the equipment that make up same are suitable.

The definition of the zone affects several components of the burner and in particular:

- Junction boxes and glands.
- Photocells.
- Servomotors.

Monobloc JBM–HP 6,000 G natural gas burner for zone classified as NEC, Class I Div 1 Groups C,D for the Pemex gas processing plant in Tabasco – Mexico.

- Pressure switches.
- Pneumatic positioners.
- Fan motors and impellers (for monobloc burners)

It is important to note that the ignition of the ATEX burners is produced by pilot burners, in which the spark that produces the ignition is located on the inside of the burner, practically at the end of the flame tube. The igniter is protected by a metal tube and the back box in which the electrical connections are made is valid for the classified zone. Of course the ignition transformer is installed on a box certified for the area in question.

The installation of pneumatic actuators may be an interesting alternative to the use of servomotors in regulating the flow of the fuel and air, since in this case the classification only affects the positioner which moves the actuator, rather than the entire equipment.

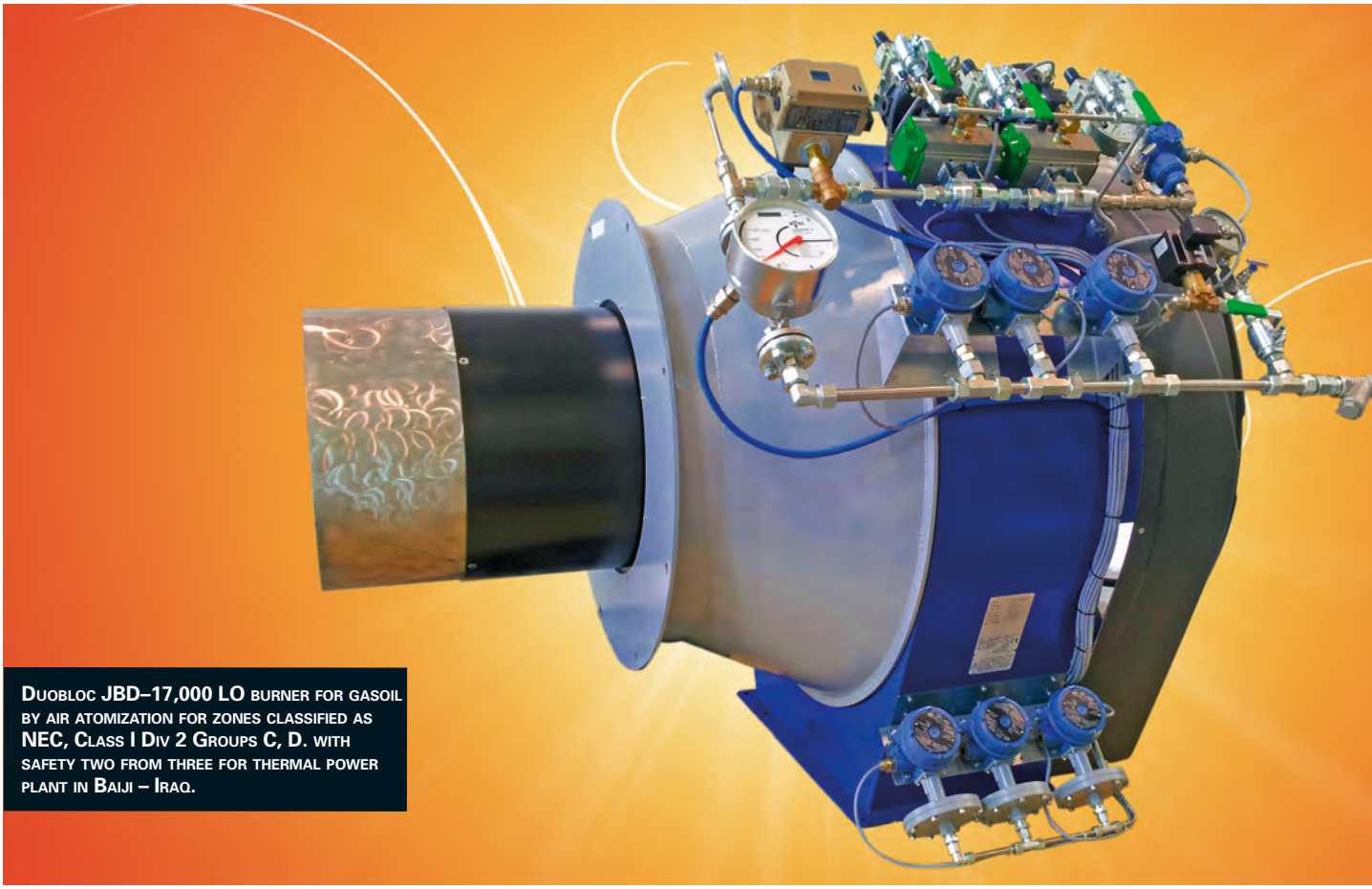
The increase of the size of the equipment must be considered. The sizes of a burner are specified by its power, to the same power of an ATEX burner, which occupies more space due to the size of the equipment which are installed in it. Price is another issue to be taken into account given that, in particular the equipment valid for Zone 1 may be considerably more expensive than equipment without the ATEX classification. Despite this drawback, it is certainly the most suitable alternative for certain facilities, taking into account that one always has above all to assess any cost regarding the safety of persons. For that reason, it is the most suitable manufacturing and required in certain industrial sectors such as refinery, petrochemical, power plants etc.

NEC Regulation

The American equivalent to the European ATEX standard is the NEC (National Electric Code) Regulation, one can say that both are equivalent regulations with its own, but the philosophy is similar, as is shown as follows.

The NFPA (National Fire Protection Association) 70 Regulation, NEC, and CEC define three categories of hazardous materials that are designated as Class I, Class II or Class III. The classes specify the type of explosive or flammable substances present in the atmosphere, such as

- **Class I** are those zones wherein



Duobloc JBD–17,000 LO burner for gasoil by air atomization for zones classified as NEC, Class I Div 2 Groups C, D. with safety two from three for thermal power plant in Baiji – Iraq.

the vapours and flammable gases may be present.

- **Class II** are those zones wherein combustible dust may be found.
- **Class III** are those zones which are hazardous due to the presence of easily ignitable fibres or particles.

Each of the three classes is divided in turn into two divisions:

- **Division 1**: The risk of concentration of flammable substances existing under normal conditions and maintenance and/or repair works must be made, given than breakdowns in the equipment occur frequently.
- **Division 2**: There is a risk of concentration of flammable substances. They are processed or used, but normally are found in closed containers or systems of which can only escape through accidental breakage or rupture of such containers or systems.

The division defines the probability that the hazardous material that may be present in an flammable concentration. The explosive properties of the mixtures of air and gases, vapours or dusts vary with the specific involved material.

The materials are classified in groups according to its ignition temperatures and explosion pressures.

The definition of the group subdivides the hazardous materials. The groups define substances by classification of its flammable nature in relation with other known substances. The combustible and flammable gases and vapours are divided into four groups.

A - Acetylene. (More restrictive)

B - Hydrogen.

C - Ethylene.

D - Propane.

The temperature classes are used to designate the maximum operating temperatures on the surface area of the equipment which must not exceed the ignition temperature of the surrounding atmosphere. The ignition temperature is the required minimum temperature, of the normal atmospheric pressure in the absence of a spark or flame to ignite or cause spontaneous combustion independently of the element subjected to that temperature.

As is the case for ATEX equipment depending on the type of protection one finds equipment with "Explosion-Proof" (flameproof) packaging, of intrinsic security, etc. Whose definitions are the same as those specified for ATEX equipment.

Notwithstanding, that the fabrication of ATEX or NEC equipment is becoming increasingly more widespread, and it should be noted that few companies are capable of manufacturing custom burners according to specific customer requirements with respect to the definition of the zones with risk of explosion. E&M Combustión is, without question a leader company and truly competitive in this regard and we are capable of manufacturing in a relatively short space of time custom equipment taking into account the different options offered by the ATEX and NEC regulations at attractive prices for the customer.

Allowable Surface Temperature of the Electrical Equipment		Temperature Class
450°C	842°F	T1
300°C	572°F	T2
280°C	536°F	T2A
260°C	500°F	T2B
230°C	446°F	T2C
215°C	419°F	T2D
200°C	392°F	T3
180°C	356°F	T3A
165°C	329°F	T3B
160°C	320°F	T3C
135°C	275°F	T4
120°C	248°F	T4A
100°C	212°F	T5
85°C	185°F	T6

Delia Tang / Paul Meng E&M Combustión Workers in China
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"European and American companies must place [DELIA] more emphasis on value and responsibility, in the win-win strategy"

"Chinese clients are surprised to discover that a Spanish company is also able [PAUL] to manufacture equipment"

How long have you worked at E&M Combustión?

- ***Delia Tang.*** I started to work at E&M since the opening of the Nanchang office, in 2010. I was the company's first Chinese employee, where I have been for almost three years.

- ***Paul Meng.*** I joined E&M two years ago, after two interviews with my supervisor, Mr. JD. I never really thought about working in Nanchang, until I decided to take a look at the company, located some 1.5 hours by plane from my city.

Have you previously worked for another foreign company?

- ***D.T.*** My first experience was on an American show called "Survivor" as a bilingual assistant, then the NBC Olympic program of NBC in Beijing as logistics office manager. Both experiences were crucial, not only requiring spoken fluent English on a daily basis, but also a spirit of teamwork and high concentration under pressure.

Paul Meng in our offices.

American teams are comparatively tense, with greater efficiency demands with regard to overseas programs. My contribution went beyond translation, which was a flexible task, very similar to business negotiation, coordination and emergency management tasks. The first two jobs played a significant role on opening my mind to an international working environment.

- ***P.M.*** I have had experience working with certain foreign companies and nationals from other countries. Each company and every country are different, with distinct hierarchies and degrees of efficiency, but have a common goal, to succeed in the Chinese market.

The training that you have received in your country, has it made it possible to work in the company?

Nanchang

Headquarters of E&M Combustión in China. It is the capital of the province of Jiangxi, in the south-eastern part of the country and has over 5 million inhabitants.

> The Star of Nanchang, is one of its main attractions, It is the third largest ferris wheel in the world.

Delia walking around Nanchang.

- ***D.T.*** Before the NBC Olympic program, I had to participate in an in-house training course to get familiarised with the system, although all manner of tests. The training required a great deal of effort from my work skills as well as the language fluency.
- ***P.M.*** I have trained to work in a modern company. When I worked in my first company I was trained in business correspondence and sales skills. Given that I had been working as a sales person for over 10 years, I am qualified for my current position in E&M. But I still need time to learn about the technology behind our products.

What are the main foreign languages studied in China?

[DELIA]

When working for a Spanish company what is surprising is the decent respect towards the team"

- ***D.T.*** English is the main foreign language studied in China. I studied English in secondary school. Nowadays children start to learn to English in primary school, but some even do so beforehand as many parents believe in "winning from the starting line".
- ***P.M.*** Yes, normally in primary school people start to learn English.

What is the official language spoken in the company?

- ***D.T. Basically in English, but some day I hope to get by speaking in Spanish.***
- ***P.M.*** I normally speak English with my European colleagues and Chinese with the locals. Of course, most of the correspondence is in English.

How do you manage to adjust to the time difference between China and Spain?

- ***D.T.*** My working hours are from 9 a.m. to 6 p.m. and I'm free on the weekends, similar to that used in China. The company is adjusting to the Chinese public holidays, which is good. The only adjustment for us consists in the time difference. Normally we can only get in touch after 3 p.m.
- ***P.M.*** I specifically work in the local working hours of 9 a.m. to 12 p.m. Let me explain. Generally Chinese clients usually start work at 8.30 a.m. and then make inquiries. From a Chinese perspective clients expect to obtain a response the following day. To that end I have to work with my colleagues in Spain until 12 midnight, the time difference with Spain, to resolve problems. Thus I can notify the Chinese clients by mail the following day.

What has been the hardest thing when working for a foreign company?

- ***D.T.*** I suppose that the difference in

languages and the adjustment to the cultural diversity plays a key role in these cases. Being able to speak and write in English fluently is the first hurdle to overcome, in addition to other basic job skill requirements. Apart from that, to learn to appreciate the cultural differences is also very important.
- ***P.M.*** Normally it is easier to work with a foreign company as the working environment is more complicated in China because essentially, the hierarchy is more complex and office politics is not so easy to handle. But when working with a foreign company, there are no problems. Believe me, I have worked in a State company and it was a nightmare.

Are there differences in the manner of working in Chinese and foreign companies?
- ***D.T.*** The administrative management is the same as in other Chinese companies
- ***P.M.*** When I worked in a Chinese company one noted that your colleagues worked with different agendas. That is the biggest difference. I would not say that they are disloyal, but they have lots of things to consider. That distracts one.

What is the overall vision of Chinese professionals who work in foreign companies?
- ***D.T.*** According to the version of some friends who work in foreign companies as managers or interpreters, I think that European and American companies must place more emphasis on value and responsibility, in the win-win strategy for the company and the employees. In this case, the employees obtain better benefits and are promoted, and the brain drain is comparatively lower than in other foreign companies.
- ***P.M.*** I know lots of people who work for foreign companies and many of them have lost their work motivation. My wife works with a Japanese company and feels that she has no hopes for promotion as the managing posts are given to persons usually from Japan. We call that the "glass ceiling" phenomenon. This means that there are not many options for promotion.

[PROFILE]

Paul Meng is from Guangzhou, the largest city in southern China, with 16 million inhabitants. It is noted for its rich gastronomy and different languages.
Paul likes to play football every week. Furthermore, he likes to travel and has even been to Spain. Paul works in E&M Combustión since 2011.

[PROFILE]

Delia Tang comes from a small mountain village in the province of Hunan. The closest most famous place is Shaoshan, the birthplace of Chairman Mao Zedong, which is now a tourist area.
Delia likes to read, hanging out with friends and to dance jazz, cha-cha, belly dancing. She has worked at E&M Combustión since 2010.

What has been the most surprising thing working for a Spanish company?
- ***D.T.*** It is a new experience. I am surprised with the decent respect towards the team, as well as the flexible working environment that it provides
- ***P.M.*** I feel like I am a member of the family. That is what has surprised me the most. I am not sure about the same thing in other companies in Spain, but I must stay that it has never happened to me before. My colleagues are very nice and are eager to help me. I think that the scale of the company makes people to feel more tight knit.

What did you know about Spanish industry before starting to work for E&M Combustión?
- ***D.T.*** My impression of Spain before was that it was a beautiful company, well known for its tourism, olive oil and red wine industry.
- ***P.M.*** To be honest I had no idea about Spanish industry before starting to work at E&M Combustión. All I knew was football and bulls. Actually when I visit the clients and introduce our products they are surprised to discover that a Spanish company is able to manufacture equipment.

What else do you know about Spanish culture?
- ***D.T.*** Spain is known for its cuisine. I also know its fashion, Zara, Mango all are my favourite trademarks. Years ago I could only access Zara via the Internet or in large cities such as Beijing or Shanghai, but nowadays, these trademarks are very easy to find in China and more people are becoming familiar with Spanish fashion.
- ***P.M.*** I have tried lots of kinds of Spanish food during my visit to Spain. Before I only knew of paella, but now I really like tapas. Fashion trademarks such as Mango, Zara or Massimo Dutti, even Tous, all are good. I bought my wife a Tous wallet last year. I also know of football players: Torres, Mata, Iniesta… I have watched La Liga matches for many years.

What do you think will be the most interesting sectors in the future for China?
- ***D.T.*** Without doubt, China is undergoing a rapid economic development in recent years. Not only is the GDP is growing steadily, China is also the largest producer of energy, construction industry products and some machinery area products. In my opinion, industry will continue to grow, the current developing sectors will continue to expand and deepen, and furthermore the creative industries of China, with an enormous potential, have just started to commence developing and eventually in the future will become a very large industrial sector
- ***P.M.*** In the future, the most interesting sectors will be the agricultural, tourism and renewable energies.

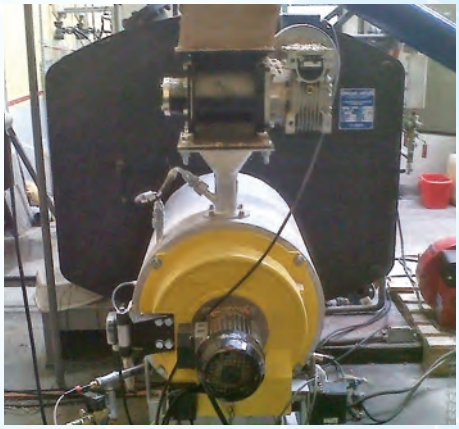
Overviews and detail of a JBD-17.000 LoEx type burner, fitted to a boiler of the company Cerney

Thermal power plant in Baiji-Iraq

E&M Combustión was awarded the contract, by the company Cerney, for the delivery of 6 special burners of 17 MW models JBD-17,000 LO Ex for operating with gasoil, through air atomisation. The equipment will be installed in superheated water boilers manufactured by the same company and will be installed in the thermal power plant in Baiji - Iraq. The burners were manufactured to meet the American NEC anti explosion regulations for the classification grade 1, Division 2, Groups C and D and also comply with a safety level 2 from 3.

Development of pellet burners

E&M Combustión has installed in a laundry in Zamora the first prototype of modulating pellets industrial burner with satisfactory results. The burner is installed in a 750 kg/h conventional steam boiler and functions in a 1:8 modulation range with a low emission levels. E&M Combustión will undertake the final tests and certifications in the LITEC combustion investigation centre in Zaragoza in the coming months awaiting its launch onto the market in 2014. The intention of E&M is to create a range of high performance industrial burners with alternative biomass combustion, such as pellets, which can be installed in traditional boilers without any modifications to the latter.



"Our people like to...."

A GREAT TEAM

In **E&M Combustión** we believe that what matters are the people who make up our team. Without them, our project could not continue and move forward.

They are our true capital.

SKATING, ALL TOGETHER NOW...

"I like to spend my leisure time with my family and to make plans that everybody likes." But **Irene Carranza** states that "When the weather is bad, we make plans to go skating".

A FAMILY HOBBY

Aitor Fernández tell us: "I have played since I was 10 years old, first at school and then as a federated player in a couple of clubs. My sons (Telmo, 7 and Aimar, 4) have approached this world with curiosity. I would love that one day we could all play together in a team".

TRAVELLING AND THE KING OF SPORTS

Paul Meng: "I play football each week and I love to travel".

"THE MEN IN BLACK"

David Quintana enjoys with his family basketball, a fan of our "men in black" of Bilbao Basket.

I'M OFF TO THE MOUNTAINS

Nothing more traditional than going for a mountain hike on Sundays, is what **Raúl Gil** enjoys doing, here we see him accompanied by his son in Ganekogorta.

TOURISM AND SPORTS

And even better both at the same time, as it what happens with the mountains, comments **Ainhoa Moreno**.

SKIING

For **Eduardo Salazar** skiing down mountainsides is his hobby.

BALLERINA

"I like to read, hanging out with friends and in particular dancing is my first choice, jazz, cha-cha, and belly dancing" tells us **Delia Tang**.

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