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M E M O R A N D U M

on the implementation and execution of a steel pilot/demonstration project programme with a view to obtaining financial aid under Article 55(2)(c) of the ECSC Treaty

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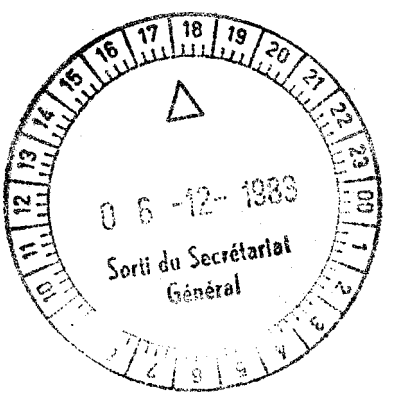
(submitted to the Council by the Commission)



COMMISSION
OF THE
EUROPEAN COMMUNITIES

M E M O R A N D U M

on the implementation and execution of a steel pilot/demonstration project programme with a view to obtaining financial aid under Article 55(2)(c) of the ECSC Treaty

I - I N T R O D U C T I O N

On the basis of Article 55 of the Treaty establishing the European Coal and Steel Community, the Commission of the European Communities has promoted technical research relating to the production and use of steel.

It has been shown that alongside the technical research as such there existed a vast field of application for the results obtained. The transposition of this knowledge to the level of pilot and/or demonstration projects, an essential stage in the development of new technologies and products, has, as a result of the grave economic crisis affecting the steel industry, become essential for Community steel enterprises. However,this has been prevented by the high cost of development, by the need for investment beyond the financial means of the companies and by technical risks too dangerous to run.

In its Communication published in the Official Journal of 24 March 1983[1], the Commission decided to grant financial support to pilot/demonstration projects in the iron and steel industry. This support has taken the form of an overall allocation of approximately 50 million ECU over a period of approximately 5 years. The Communication also lists the criteria which the projects submitted with a request for financial aid must meet :

- techniques, processes, plant and products that are innovatory in themselves or in their applications,
- major capital expenditure,
- prospects of economic viability demonst ated by previous research,
- considerable interest to the European .ommunity,
- very desirable collaboration between partners, one of which at least must be a steelmaking enterprise.

[1] OJ No C 81, 24.3.83

This memorandum presents 6 projects selected from the 41 requests received. They make up the first part of the ECSC aid programme for pilot/demonstration projects. The projects presented have been examined in detail by the Commission in collaboration with the members of the Technical Development Committee (TDC).

They have been selected as a function of the criteria mentioned above and come under the following steel industry headings :

- horizontal continuous casting : 2 projects, PP 006 and PP 027
- treatment of finished products : 2 projects, PP 004 and PP 017
- coating of finished products : 1 project , PP 018
- steel use : 1 project , PP 040

These projects meet the following criteria :

Criterion \ Project PP No	006	027	004	017	018	040
Reduction of production costs	X		X		X	
Reduction of operating costs					X	
Increased production	X					X
Lower capital investment	X			X	X	
Better product quality		X	X	X	X	
New process	X	X	X	X		X
Improved products		X	X	X	X	X
New product use				X		X
Intracommunitary collaboration			X	X	X	X

The financing currently agreed for projects PP 004, PP 017, PP 018 and PP 040 is for the initial execution phase only. Additional financing may be granted subsequently as a function of the technical and/or economic results obtained and the annual budget situation.

With the aim of stimulating intracommunitary collaboration and taking into account the additional costs involved, it is proposed to award a financial aid of 50% of total costs for the collaboration projects undertaken jointly by organisations coming from two or more Member States, while the aid conceded to other projects would be only 40% of total costs.

The financial support granted to the 6 pilot/demonstration projects presented amounts to 7 572 100 ECU to which must be added a sum of 121 300 ECU for ancillary expenses and the cost of disseminating information, i.e. a total financial commitment of 7 693 400 ECU.

II - PILOT/DEMONSTRATION PROJECTS

PP 006 : Development of a horizontal continuous casting process for steel

The technology of continuously casting steel was developed after the 1950s using patents held concurrently by Rossi and Junghaus. Since then the process has developed little, the continuous casting of steel being effected in machines in which the jet of steel at the entry to the mould is vertical and the axis of the mould very close to vertical. In the case of several semi-products (slabs and large blooms) current plant has attained remarkable degrees of productivity and is able to match the output of electric furnaces or oxygen convertors. However, for small sections (blooms and especially billets), output per strand is such that it is necessary :

- either to limit the specific dimensions of the steelworks production plant,

- or to multiply the number of strands to an inordinate degree.

In the first case the maximum size of the oxygen convertors is limited to approximately 150 t. In the second case, monsters equipped with 8 parallel strands have to be dealt with.

The research started by Krupp in 1980, with financial support from the ECSC Steel Research budget[1] in the first two stages, is aiming at developing an almost horizontal casting process for steel such as is currently used in the non-ferrous metals industry : the HAZELETT process.

This consists basically in casting metal between two parallel, mobile steel strips and between two side walls, the whole device being water-cooled.

In contrast to the normal extraction rate of 2 m/mn with conventional machines, Krupp hopes to achieve a rate of 10 m/mn which, given the experimental section selected (70 x 180 mm), will enable it to supply a small section mill working at a rate of approximately 60 t/h with a single strand.

The previous studies (7210-CA/127 and 133) have shown that the process is theoretically valid. There are however important points to be resolved at the pilot scale which would, therefore, be a logical follow-up to the two steel research projects. The problems are as follows :

(1) The supply of molten steel shielded from the air to prevent oxidation of certain components which would produce microscopic and macroscopic inclusions in the final steel product.

(2) Coating of the mould to avoid steel adhesion.

(3) Scientific operation of the machine.

(4) Free contraction of the steel in the mould.

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[1] Total ECSC aid of 870 700 ECU / total research costs 3 384 500 ECU

(5) Monitoring and control of secondary cooling.

(6) Synchronization of the exit speed from the machine and the equipment downstream.

Subsequent research could, if necessary confirm the results of this third phase.

The work will be carried out at the Bochum steelworks of Krupp Sthal.

Applicant : Friedrich Krupp GmbH - Essen
Budget : 2 410 000 ECU
Probable duration : 1 1/2 year

PP 027 : Method for horizontal continuous casting with vibrating mould for alloy steel and super alloys

The production of these steels and alloys is normally carried out in a vacuum furnace. Casting into a conventional mould poses very complex problems with regard to the vacuum or protective atmosphere. In addition, the homogeneity of the ingots is not certain because of segregation phenomena during solidification.

The hot mechanical strength of these steel puts a strict limit on the use of the normal curved-mould continuous casting process. It would be possible to use vertical continuous casting with a vertical bloom but the investment costs would be such as to make this process uneconomic for the quantities of steel involved.

Krupp Stahl AG (including Krupp Industrie und Stahlbau AG) is hoping to develop :

- a laboratory-scale horizontal casting machine,

- subsequently, a pilot-scale horizontal casting machine.

The initial machine would cast blooms 100 mm square while the other machine would be developed with a view to the industrial production of other sections (300 mm squares and 400 mm diameter rounds).

The innovatory aspects of these machines are as follows :

(1) the concept and developemnt of a "liquid metal Tundish reservoir" under vacuum or under protective gas,

(2) the development of a mould oscillating at a frequency to be determined,

(3) the development of a connection between the Tundish and the mould which is both leak-tight and capable of operating at the temperature of the liquid metal.

In addition, the use of a flux or a rotating process (for the casting of rounds) could be envisaged.

The theoretical and practical work would comprise the following simultaneous or successive phases.

(1) Theoretical study of casting parameters (speed, frequency and amplitude of the oscillations, geometry and material of the casting nozzle) and of the solidification parameters (variation in metal temperature in the Tundish-mould connection, cooling in the mould and downstream).

(2) Engineering study, development and commissioning of a laboratory-scale machine, and subsequently a pilot machine.

The work will be carried out at the Siegen-Gesweid steelworks of the Krupp Stahl company.

Applicant : Krupp Stahl AG - Bochum
Budget : 6 419 000 ECU
Probable duration : 4 years

PP 004 : Production of high-strength rails by heat treatment from rolling heat

The MMRA has played a part in the development of the TEMPCORE process (quenching and hardening in line with rolling) for reinforcing steels. The process consists in carrying out the heat treatment on rounds at the exit from the hot rolling mill in such a way as to make it :

(1) automatic and repetitive,

(2) regular from the point of view of results,

(3) does not impair the output of the rolling mill.

The MMRA (in cooperation with the CRM) is proposing to transpose the TEMPCORE technique to the production of high strength rails so as to avoid having to have recourse to the simplistic solution of changing the composition (addition of Cr etc.) (cost over 2 500 FB per tonne) with the associated risk of reducing weldability. The MMRA also wishes to avoid recourse to heat treatment outside the normal rolling cycle (cost over 4 000 FB per tonne).

Currently there is no industrial plant working to the system proposed by the MMRA because of the problems of controlling the quenching and tempering stage or large deformations due to the inequality of distribution of the masses in a conventional rail.

The process which Rodange wishes to develop comprises a heat treatment applied to a rail with a conventional composition and, at the exit from the final pass in the rolling mill, a treatment as a function of several factors which are known to influence the mechanical properties of steels.

To summarize, the main stages in this developemnt are as follows :

(a) finalization of the theoretical study of heat treatment proposed by the CRM,

(b) engineering development, ordering, installation and commissioning of the pilot plant.

Subsequent phases are already envisaged.

The pilot tests will take place at the exit from the section and rail mill (mill A) at Rodange.

Applicants : Métallurgique et Minière de Rodange-Athus - Rodange
Centre de Recherches Métallurgiques - Liège
Budget : 1 547 500 ECU
Probable duration : 2 years

PP 017 : Stress relieving and straightening of rails by traction

Heavy sections, including rails, have for a long time been straightened in the cold state in roller straighteners after hot rolling, a process which can be supplemented by local straightening with a hydraulic press.

This process has many advantages (productivity, quality of work, compactness, etc.).

The quality of products finished in this way have met the requirements of the railways for a very long time.

However, the increase in axle loads and in particular the increase in train speeds have given rise to new requirements which cannot easily be satisfied by the conventional process.

The current trend is :

(1) To increase rail straightness so as to enable butt welding to be carried out, to avoid the creation of internal defects or stresses at rail ends, and to eliminate "periodic waves", which are likely to cause vibrations which may damage permanent way and rolling stock.

(2) To reduce residual stresses which, when added to service stresses, may be sufficient to give rise to fatigue and brittle fracture phenomena.

Straightening by traction has been studied over the last decade. It would appear from tests carried out by Sacilor that this process will make it possible to satisfy the new requirements mentioned above fairly easily.

In particular, fatigue strength will be improved by straightening by traction. In addition it has been found that this straightening process can improve the yield point of rails by an order of 10% (elongation 0.2%).

The practical problems to be resolved by these studies are as follows :

(1) the study and installation of a traction machine on a demonstration project scale,

(2) the study of feed-in and feed-out problems within an industrial-scale shop.

Subsequent phases have already been scheduled.

The straightening machine will be installed in the rail and beam mill at the Saint-Jacques works at Hayange.

Applicants : Sacilor - Hayange
Métallurgique et Minière de Rodange-Athus - Rodange
Budget : 2 038 000 ECU
Probable duration : 2 1/2 years

PP 018 : Pilot plant for high-current-density radial-jet electroplating

The electroplating of steel strip is being more and more widely used to increase the service life of steel or to enable it to receive additional coatings suitable for various types of use.

The cost of these primary coatings and the need to save energy and coating material require the development of processes providing for the deposition of thinner and thinner layers of metal on the steel and/or the coating of only one side of the strip or yet again the deposition of coatings of different thickness on the two sides of the strip.

The container industry is particularly interested in coatings based on zinc, chromium or nickel, whether alloyed or not : the automotive industry is looking for coatings of zinc and its alloys .

These coatings obviously need to be able to stand up to the shaping of the sheet in subsequent stages.

Finally, it would be of interest to make the electroplating lines more compact and thus more economic.

Of the electrolysis cells currently in existence, the so-called radial-jet appears to meet the requirement best.

In this process the strip is guided round a cylindrical conductor roll (cathode) surrounded by a cylindrical consumable anode. The distance between the two electrodes is of the order of 20 to 30 mm (minimum energy loss). The guiding principles of this cell are as follows :

high turbulence + high mass transfer + high current density + compact cell + compact line

The work will be broken down into three stages :

(1) study and construction of the line,

(2) study of the coating of can-type material (Sn, Cr, and Ni),

(3) study of the coating of automotive material (Zn and Zn alloys)
(N.B. : this phase is not currently envisaged).

The work in phase 2 will consist of the following :

(1) determining the effect of strip width variations,

(2) minimizing the pumping energy required for high turbulence,

(3) studying the shape and type of the cathode roll,

(4) examining the importance of the risk of spark formation.

Each phase would last one year.

The work will be carried out within the Hoogovens works.

Applicants : Hoogovens - Ijmuiden
British Steel Corporation - London
Rasselstein AG - Neuwied
Budget : 2 352 500 ECU
Probable duration : 2 years

PP 040 : Ring pull-lids of steel for drink cans

Most metal cans which contain drinks are made up of a steel body (tin plate or similarly coated steel) and an aluminium lid.

This metal was selected for its stability and its resistance to corrosion by acidic drinks as well as for its mechanical properties which enabled the design of the well-known ring-pull to be developed.

Demonstration project No 040 is based on the possibility of showing that tin plate (or one of its steel-based substitutes) can replace aluminium for the manufacture of these lids if certain precautions are taken.

If this could be achieved there would be a potential extra market of 10 000 t/year for the manufacturers of tin plate. The recycling of drinks cans would also be facilitated.

While the techniques for the protection of tin plate are very well known, certain new problems arise here :

(a) the container is often under pressure,

(b) the liquid contained may be acidic,

(c) the impression to be "printed" on the lid must make it possible to open the container easily without the aid of special tools,

(d) the containers must be capable of being stored easily for a sufficiently long time without problems of corrosion or leakage.

The work must therefore cover :

(a) the design of the lid, its connection to the body of the can, the "printing" of the impression, the shape and location of the opening.

(b) the internal protection of the lid by a product to be determined (plastisol), so that the drink does not deteriorate, so that the properties of the can are not changed by the drink, and that the drink can be kept for a sufficiently long period. Subsequently, the attachment of the lid and the opening of the lid will have to be studied.

(c) the external protection of the lid and, in particular, the impression against corrosion.

All these developments are dominated by the desire to maintain the productivity of the manufacturing lines currently in existence.

Phase 1 : Installation of a pilot plant for the production of lids - associated work.

Phase 2 : Start up of the demonstration line and the development of the shape of the lid and the protection products, and development of can filling.

A third phase is envisaged for tests by users.

The work will be carried out at the Andernach Works of Rasselstein AG.

Applicants : Rasselstein AG - Neuwied
Hoogovens - Ijmuiden
British Steel Corporation - London

Budget :

Probable duration : 2 1/2 years

Communication from the Commission of the European Communities to companies in the ECSC

(Article 48 of the ECSC Treaty)

In the letter to the chairman of the Consultative Committee of the ECSC, the Commission asked the Committee to undertake the consultation laid down in Article 55 (2) (c) of the Treaty concerning the desirability of allocating the following sums from the levies laid down in Article 50 of the Treaty for financial aid aimed at facilitating the following ~~technical research~~ projects.
pilot/demonstration)

Under Article 48 of the Treaty, associations of companies in the ECSC are entitled to submit to the Commission the observations made by their members concerning the undermentioned subjects of consultation.

Any observations should be received by the Commission not later than 10 January 1984.

(in ECU)

1 -	Development of a direct strand reduction method for steel	964.000
2 -	Horizontal continuous casting with oscillating mould for high-alloy steels and superalloys	2.567.600
3 -	Production of high-strength rails by heat treatment from rolling heat	773.750
4 -	Stress-relieving and straightening of rails by traction	1.019.000
5 -	Pilot plant for electroplating at high current densities	1.176.250
6 -	Ring-pull lids of steel for drink cans	1.071.500

Annex

S U M M A R Y T A B L E

Project No. PP	Title of project	Project proposed			Financial aid	
		by	Probable Duration (years)	Budget ECU (30.9.83)	%	Amount ECU (30.9.83)
	ORE REDUCTION					
006	Development of a direct strand reduction method for steel	Krupp	1 1/2	2.410.000	40	964.000
027	Horizontal continuous casting with oscillating mould for high-alloy steels and superalloys	Krupp	4	6.419.000	40	2.567.600
	TRANSFORMATION					
004	Production of high-strength rails by heat treatment from rolling heat	MMRA CRM	2	1.547.500	50	773.750
017	Stress-relieving and straightening of rails by traction	Sacilor MMRA	2 1/2	2.038.000	50	1.019.000
018	Pilot plant for electroplating at high current densities	Hoogovens Rasselstein BSC	2	2.352.500	50	1.176.250
	UTILIZATION					
040	Ring-pull lids of steel for drink cans	Rasselstein Hoogovens BSC	2 1/2	2.143.000	50	1.071.500
	Sub-total			16.910.000		7.572.100
	Ancillary costs and dissemination of information					121.300
	TOTAL					7.693.400