

# FACTORY PRODUCTION CONTROL (FPC) AND ITS REQUIREMENTS FOR THE METALLURGICAL INDUSTRY

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The article the requirements of the Factory Production Control (FPC) dedicated to construction products (including metal, i.e. ribbed bars, steel pipes, shapes, sheets and metal constructions) introduced to the single market of the European Union, was presented. Meeting the requirements of legal regulations with regard to these products is an important issue for metallurgical companies placing their products on the EU market. These enterprises are required to effectively implement and supervise the FPC system, supervised by a party independent of the manufacturer (third party). The aim of the article is to present the requirements of the FPC and refer them to the requirements of industry standards for metal products – shapes.

*Key words:* metallurgical industry, product, control, standards, Poland

## INTRODUCTION

The requirements for factory production control date back to the end of the 1980s and were set out in Council Directive 89/106/ EEC [1], which was replaced by Regulation (EU) 305/2011 of the European Parliament and of the Council [2] establishing harmonized conditions for the marketing of products construction, which include, among others, ribbed bars, pipes, sheets, sections and metal structures obtained in the process of plastic processing. Factory production control means the documented permanent and internal control of production in a manufacturing plant, in accordance with the applicable technical specifications [2]. Its implementation is aimed at ensuring supervision over the production process and the finished product in a manner ensuring compliance with the legal provisions. The FPC is dedicated to construction products, which are understood as each product or set manufactured and placed on the market for permanent incorporation in construction objects or their parts, the properties of which affect the performance of construction objects in relation to the basic requirements for construction objects [2].

The basic reference documents covering the guidelines necessary to be met by manufacturers of construction products include: national standards, harmonized standards, as well as National Technical Assessments. The scope of the requirements to be met by the manufacturers depends on the type of product being manufactured and reference documents. The scope of the control carried out in production plants includes, among others: input material control, supervision of the pro-

duction process and process control, supervision of measuring equipment, assessment of personnel competences and confirmation of compliance with legal requirements in terms of performance. The assessment of the company in terms of the implementation of the FPC system is carried out regularly at agreed time intervals by external units, independent of the manufacturer. Supervision over the system and verification of compliance with requirements takes place through inspections at the production plant.

## METHODOLOGY

The implementation of the assumed goal of the study was possible thanks to the development of the methodology of own work. The first stage consisted in specification of legal requirements dedicated to products such as: ribbed bars, pipes and welded closed sections made of unalloyed and fine grain steels.

The second stage consisted in assigning the products which are the subject of the analyzes of the assessment and verification system for performance (system 1 +, 1, 2 +, 3 and 4). Establishing the system of assessment and verification of performance made it possible to define the scope of responsibility of the manufacturer, as well as the notified body / laboratory. The requirements of the standards dedicated to the products in question were also specified. As part of the third stage, practical activities necessary for the implementation of the FPC system for closed sections with seams were presented (activities in accordance with the legal requirements and the PN-EN 10219-1: 2007 standard [3]).

A step-by-step, structured approach to the FPC system based on the developed methodology allows for an effective assessment of products and meeting the requirements of legal regulations.

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Table 1 **Obligations of a manufacturer of metal products, including the assessment and verification of the constancy of performance [own elaboration based on 2]**

Product	Manufacturer's obligations		
Construction products (metal)	<ul style="list-style-type: none"> <li>- Obligation for the manufacturer to draw up a declaration of performance.</li> <li>- Obligation to mark the product placed on the market with the CE mark.</li> <li>- Obligation to prepare technical documentation describing all essential elements of the applied system of assessment and verification of constancy of performance.</li> <li>- Obligation to keep the declaration of performance and technical documentation for a period of 10 years from the moment the product is placed on the market.</li> <li>- Obligation to ensure that the declared performance of the product is maintained in series production.</li> <li>- Obligation to test products in accordance with the requirements of reference documents.</li> <li>- Obligation to consider complaints (register of complaints), non-conforming products and products withdrawn from users.</li> <li>- Obligation to mark the product (batch, type or serial number, or other information allowing for their identification).</li> </ul>		
Product type (Assessment system)	Assessment and verification of constancy of performance		
	Responsibilities of the manufacturer	Responsibilities of the notified body	Sample reference documents
Ribbed bars (system 1 +)	Implementation and maintaining the Factory Production Control Tests of ribbed bars / tubes as required by the reference document	Defining the product type Initial Assessment of the Manufacturing Plant and Factory Production Control Constant supervision and evaluation of the FPC system Control testing of samples	PN-EN 10080:2007 Steel for concrete reinforcement. Weldable reinforcing steel. General provisions [4] PN-H 93220:2018 Steel for concrete reinforcement - bonding reinforcing steel B500SP [5] PN-H 93250:2018 Steel for concrete reinforcement - B500SN bonding reinforcing steel [6] National Technical Assessments
Pipes (system 1)		Defining the product type -Preliminary assessment of the production plant and factory production control. -Permanent supervision and evaluation of the FPC system	PN-EN 10216-1:2014 Seamless steel tubes for pressure purposes [7] PN-EN 10217-1: 2019 Welded steel tubes for pressure purposes [8]
Sections (system 2 +)	Determining the product type Implementation and maintenance of the FPC Examination of sections in accordance with the requirements of reference documentation	Initial Assessment of the Manufacturing Plant and Factory Production Control Constant supervision and evaluation of the FPC system	PN-EN 10219-1:2007 Cold formed welded hollow sections of unalloyed and fine grain structural steels [9]

## FACTORY PRODUCTION CONTROL - STEEL PRODUCTS

The basic legal act in the field of Factory Production Control is the regulation [2], which lists the basic requirements for manufacturers of construction products, including ribbed bars, pipes, sheets, sections and steel structures. Table 1 lists the obligations of the percentages in relation to: preparation of the declaration of performance, technical documentation, CE marking and product marking.

In the case of ribbed bars (system 1 +), the manufacturer was obliged to implement and maintain FPC, as well as test ribbed bars in accordance with the requirements of reference documents. In terms of testing, depending on the steel grade, manufacturers should ensure compliance with the following standards:

- PN-EN 10080: 2007 [4], which summarizes the general requirements for ribbed steel,
- PN-H 93220: 2018 [5], which defines general requirements and performance properties for weldable reinforcing steel - type B500P,
- PN-H 93250: 2018 [6], which specifies general requirements and performance properties for weldable reinforcing steel - type B500N.

In terms of this type of products, the role of a notified body (third party) independent of the manufacturer is important. The third party within the FPC: defines the product, performs the initial assessment of the produc-

tion plant and FPC control, supervises and evaluates the system, and takes samples for testing.

For pipes covered by system 1, the manufacturer was obliged to implement and maintain the FPC system and to test in accordance with the requirements of sample reference documents (Table 1). On the other hand, the third party defines the product type, conducts its initial assessment of the production plant and FPC. The external unit also conducts constant supervision over the implemented and documented system compliant with the reference documentation (Table 1). Sections

Table 2 **Manufacturer's activities and FPC requirements for closed sections with a seam [own elaboration]**

Process step	Actions taken	FPC requirements
1	Input material control in accordance with the assumed requirements	Control plan
2	Continuous control of the parameters of the production process	Control plan Technological documentation with specified process parameters
3	Performing tests in accordance with the control plan and the requirements of point 7.3 of the PN-EN 10219-1: 2007 standard [9]	Protocols from tests confirming product compliance
4	Determining the methods of storage and protection of the surface in a manner ensuring against surface damage and appropriate marking - point 10 of the PN-EN 10219-1: 2007 standard [9]	Procedure

Table 3 Mechanical properties for hollow sections of unalloyed and fine grain structural steels [3]

Steel grade		The minimum yield strength Rm / MPa		Minimum yield strength Re / MPa		Minimum elongation A / %	Minimum breaking energy KV / J		
Mark	Number	Nominal thickness / mm				Test temperature			
		≤ 16	> 16 ≤ 40	< 3	≥ 3 ≤ 40	≤ 40	-20 °C	0 °C	20 °C
S235J	1.0039	235	225	360 - 510	360 - 510	24	-	-	27
S275J0H	1.0149	275	265	410 - 580	410 - 560	20	-	27	-
S355J0H	1.0547	255	345	510 - 680	470 - 630	20	-	27	-

are subject to the 2+ system, under which the manufacturer was obliged to determine the product type, implement and document the FPC system, test the product in accordance with the requirements of reference documentation (Table 1).

## REQUIREMENTS FOR PRODUCERS IN THE FIELD OF FPC (CASE STUDY)

In the case of closed sections with seams made cold from structural steels subject to the 2+ rating system, the manufacturer at individual stages of the production process implements the production process and product quality assessment system, in accordance with the requirements of PN-EN 10219-1: 2017 [3]. The activities carried out under the FPC system are to lead to the reproducibility of the obtained parameters of the finished product. The production process of hollow sections covered by the FPC system concerns, among others: material acceptance and control (1), production process (2), finished product inspection and testing (3) as well as marking and storage (4). The activities of the manufacturer and the requirements for the FPC as part of the production process of sections are summarized in Table 2.

In order to identify inconsistencies of the input material or discrepancies in its chemical composition, a documented control of the supply of the input material is necessary. The manufacturer prepares documentation describing the parameters of the manufacturing process in order to ensure the repeatability of the manufactured product in accordance with the control plan. It also carries out tests of the finished product in order to verify compliance with the requirements described in the reference documentation, i.e. PN-EN 10219-1:2017 [3] (Table 3). The manufacturer defines the requirements for the method of storing finished products and implements a uniform system ensuring proper labeling of the product, enabling its traceability. Ensuring the repeatability of the activities carried out in the field of storage and labeling of the product should be described in the FPC documentation in the form of a procedure.

In addition, the manufacturer is obliged to provide appropriate equipment necessary for the implementation of the production process and its control. Measuring instruments should have a valid calibration certificate. Production personnel responsible for the implementation of FPC tasks should have appropriate qualifications (education, training). The scope of the manufacturer's obligations as part of the FPC system also includes: activities related to the supervision of a non-conforming product, corrective

actions, production equipment and the design process. According to the adopted definition of the FPC, all areas should be documented.

## CONCLUSIONS

The introduction of metal products such as: steel pipes, ribbed bars, sections to the single EU market is related to the fact that manufacturers have an implemented and documented system of Factory Production Control. The implementation of the system is focused on the production of products compliant with the requirements of reference documents, as well as full supervision of the product, including the non-compliant product. The Factory Production Control System ensures orderly and consistent activities within the realized production tasks. Depending on the type of product, the requirements on the manufacturer differ and regular third party inspections ensure adequate supervision of the proposed system solutions.

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## REFERENCES

- [1] Council Directive of 21 December 1988 on the approximation of laws, Regulation and administrative provision of the Member States relating to construction product (89/391/EEC).
- [2] Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonized conditions of the marketing of construction product.
- [3] PN-EN 10219-1:2007 Kształtowniki zamknięte ze szwem wykonane na zimno ze stali konstrukcyjnych niestopowych i drobnoziarnistych - Część 1: Warunki techniczne dostawy.
- [4] PN-EN 10080:2007 Steel for concrete reinforcement. Weldable reinforcing steel. General provisions.
- [5] PN-H 93220:2018 Steel for concrete reinforcement - bonding reinforcing steel B500SP
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- [7] PN-EN 10216-1:2014 Seamless steel tubes for pressure purposes.
- [8] PN-EN 10217-1: 2019 Welded steel tubes for pressure purposes.
- [9] PN-EN 10219-1:2007 Cold formed welded hollow sections of unalloyed and fine grain structural steels.

**Note:** Szymon Pawlak is responsible for English language, Katowice, Poland