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Welders vocational education: a case study of H. Cegielski – Poznań S.A. Welders education center

Профессиональное образование сварщиков на примере учебно-сварочного центра H. Cegielski – Poznań S.A.

Summary

Article presents issues of welders vocational education in Polish industry icon – H. Cegielski – Poznań S.A. It shows program and scope of welding trainings adapted to students abilities and welding methods taught in Welding Education Center. Basing on the authors' experience, article describes barriers which students of welding courses have to face as well as several proposals for Polish vocational education.

Резюме

В статье представлены вопросы профессионального образования сварщиков на примере иконы польской промышленности, которой является компания H. Cegielski – Poznań S.A. Он показывает программу и объем обучения, адаптированные к способностям студентов и методам сварки, которые преподаются в Учебно-Сварочном Центре. На основании собственного опыта авторов описаны барьеры, с которыми сталкиваются студенты сварочных курсов а также ряд предложений для профессионального образования в Польше.

Keywords: welding, vocational education, welders training.

Ключевые слова: сварка, профессиональное образование, обучение сварщиков.

Preface

Technical colleges and basic vocational schools as well as company-affiliated schools were abolished, with the Ministry of National Education decisions in the past years, what led to a shortage of suitable personnel in the labor market.

Industrial plants were not interested in the functioning of these affiliated schools because their partial funding reduced the company's economic performance. By the same token, vocational school and technical college affiliated to H. Cegielski – Poznań S.A. were abolished.

The establishment at that time of vocational secondary schools, which were to replace vocational education with secondary one, failed to achieve the planned objective, ie the upgrade of theoretical or practical knowledge of the graduates. These schools did not have adequate technical facilities to learn the profession - the lack of machinery and equipment, practical teaching aids, not to mention the basic instruments.

Changes in Polish vocational education have occurred in the era of systemic transformation and independent entry of the Polish economy into the world market. Growing competition, labor market demand for qualified workers in such professions as welder, abolition of vocational schools and mechanical technical colleges and lack of cooperation between industry and vocational education units have forced Polish companies to teach themselves from scratch welders, locksmiths, turners and operators of milling and numerically controlled machines.

A number of favorable systemic changes in vocational education would allow more effective use of the potential of young people as well as to activate and redirection of people seeking their place in the labor market.

Objective

The objective of the article is to familiarize the welder's education and to present frequent problems encountered by potential trainees on the case study of the H. Cegielski – Poznań S.A. Welding Training Center.

Company H. Cegielski – Poznań S.A. (HCP) has educated generations of welders throughout its 170-year history. Due to the industrial areas in which HCP operates, Welding Training Center was established in 2005. The primary goal of the Center is maintaining a high level of education for the welding crew and development of its competence. The Center is attended by individuals and people sent by manufacturers of welded constructions. Even the students of the Welding Department of the Poznan University of Technology who want to learn welding on the practical side constitute a small part of the trainees.

All theoretical and practical courses take place under substantive supervision and on the basis of training programs (the "guidelines") for particular welding

methods. These programs were developed by specialists from Instytut Spawalnictwa (the Welding Institute) in Gliwice who are aware of the needs and prospects for the industry.

The exams are conducted by trained examiners of Instytut Spawalnictwa according to international standard ISO 9606. At the request of the customer there is a possibility of conducting the final welder exam under the supervision of a selected classification society such as Polish Register of Shipping, Bureau Veritas, Det Norske Veritas – Germanischer Lloyd, Office of Technical Inspection, Lloyd Register, TÜV Rheinland, TÜV Nord and others.

Origin of the problem

Lack of technical staff at the primary level, requirements for direct manufacturer of welded structures have forced construction enterprises engaged especially in the demanding western and Scandinavian markets to train themselves welders, turners, operators of milling machines and others.

Therefore, H. Cegielski – Poznan S.A. and Poznan University of Technology established in 2005 the Industrial Training Center with the following tasks:

- familiarize students of the Faculty of Mechanical Engineering and Management and the Faculty of Machines and Transport with the practical aspects of industrial production,
- participation of the staff of the Poznan University of Technology in solving structural and technological problems arising during the production process by developing transitional and diploma work,
- training of welding supervision staff by the Poznan University of Technology and Instytut Spawalnictwa on International welding engineer/welding technologist courses,
- training of welders and operators of machines in various welding methods.

Unfortunately it failed to achieve all these goals. Only the last one – training of the welders – was completed. There were also transitional and diploma work.

Characteristics of participants

After 12 years of continuous training of welders it is possible to make classification of the participants into the following groups:

- with basic education,
- basic vocational, eg cook, baker, confectioner, mechanic, electrician,
- secondary high school – vocational, such as carpenter, electrician,
- secondary general education,
- higher, eg psychologist, geographer,
- higher technical, eg mechanical engineer,

Those with higher education had the aim of broadening their welding-related practical skills at the future workplace.

Such diversity of participants level of education causes some complications and difficulties in teaching the profession of the welder. For example, chef, geographer and psychologist had difficulties with understanding certain technical issues and reading drawing documentation.

Persons willing to acquire welder permissions in many cases were unaware of their own educational needs in selected welding methods. The problem is not only the lack of knowledge about welding methods, materials and technical aspects, but also about perspectives and demand at potential workplaces. There is a similar lack on the employers side. Those who send workers for training make mistakes in the selection of methods and range of entitlements which are often incompatible with their production profile. All these issues are corrected and explained by the engineering and technical staff of the H. Cegielski – Poznań S.A. Welding Training Center.

Programme of the welding course

Conditions to attend the welding course are as follows:

- minimum basic education,
- minimum age 18,
- medical certificate of the possibility to attend the welding course,

Welding Training Center trains welders in 8 welding methods according to PN-EN ISO 4063 standard:

- 111 – Manual metal arc welding (metal arc welding with covered electrode)
- 121 – Submerged Arc welding with solid wire electrode
- 131 – Metal Arc inert gas welding: MIG-welding
- 135 – Metal Arc active gas welding: MAG-welding
- 136 – Flux-cored arc welding with active gas shield
- 138 – Metal Arc active gas welding: MAG-welding
- 141 – Tungsten Inert Gas (arc) welding (wolfram electrode) with solid -wire or -rod and inert gas
- 311 – Oxy-acetylene Gas welding

On the first day the person admitted to the course is undergoing occupational health and safety training and receives protective clothing - a suit and gloves. There are soundproof earplugs, dust masks, leather aprons, shoe covers, welding helmets, and more. The instructor familiarizes the participant with welding workplace and puts together the first steps in welding. These include:

- presenting the welding station,
- turn-on the welding machine, its maintenance and operation,
- installation of welding wire or tungsten electrode,
- electric arc ignition,
- discuss welding parameters and their impact on the quality of the joint.

- turn on and off the welder,
- replacement of gas cylinders and reducer operation,
- set welding parameters,
- basic maintenance and operation,
- potential hazards,

Practical and theoretical classes are conducted in parallel by the qualified staff of H. Cegielski – Poznań S.A7.:

- 2 welding instructors with IWP (International Welding Practitioner) qualifications,
- 4 welding engineers with IWE (International Welding Engineer) qualifications

Theoretical classes are given by welding engineers in a multimedia room.

Fig. 1. View of the lecture room



In addition to the basic theoretical knowledge, students are acquainted with the current HCP production profile. Specialists from various production departments are invited to lecture and exchange their welding and other technology experiences and discuss with the students. Moreover, participants are provided with a variety of welding technical solutions based on the current production of HCP and the technical problems they may face at the future workplace. Such diversification of the course increases its efficiency.

Fig. 2. View of welding stations



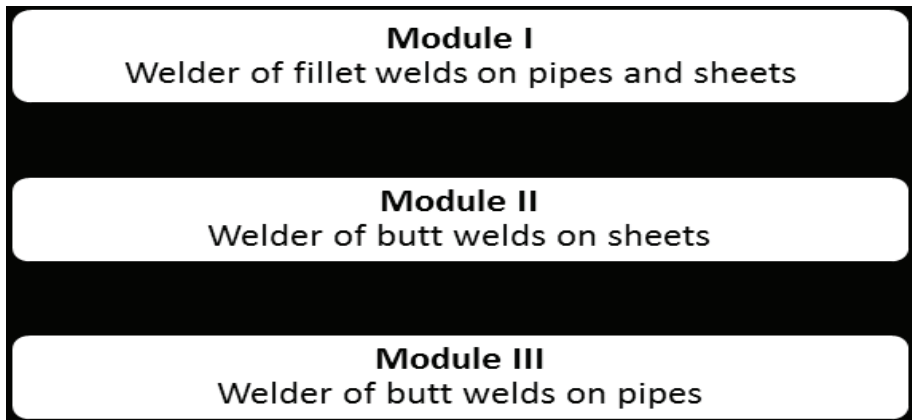
Fig. 3. Learning to cut steel with oxygen



Practical classes are held at the Welding Training Center welding plant. There are welding stations for welding processes: 111-E (covered electrode), 131-MIG, 135-TIG and 311-G (acetylene-oxygen). Training of welding machine operators in process 121-UP (Submerged Arc welding) takes place on a modern mechanized station directly in the HCP welding plant.

In accordance with the applicable regulations welders are trained in three successive modules.

Fig. 4. Weld training modules



Exam

Each course ends with a theoretical and practical exam in accordance with PN-EN ISO 9606 for welders and PN-EN ISO 14732 for operators of automated welding methods.

Examination specimens are subjected to a visual testing and ultrasonic or radiographic testing and destructive weld testing: break or bend tests depending on the type of joint. Examination specimens must meet the criteria of PN-EN ISO 5718 standard in quality level B. After successfully passing the exam, the student receives a certificate and a welder's book issued by Instytut Spawalnictwa in Gliwice.

The welder, after obtaining module I qualifications, can only perform fillet welds on sheet and pipe joints. It is recommended that the welder has acquired practical experience by performing fillet welds for 3 to 6 months before starting the next training module. The welder could gain experience and get gradually prepared to perform increasingly difficult joints on increasingly difficult constructions.

Vocational training and industry needs

The high demand for welders training was presented in the 2014 report of the Department of Labour Market of the Ministry of Labor and Social Policy¹. Authors of the aforementioned study have presented a number of shortage occupation. The parameter describing the deficit is the deficit intensity index in occupation k described by the following formula:

$$W^k = \frac{O^k}{B^k}$$

where:

B^k – number of unemployed registered in occupation k for a given year,

O^k – number of job offers in occupation k for a given year.

The authors of the study assume that depending on the calculated value of W^k index, the occupation is defined as deficit or surplus:

$W^k < 0,9$ – surplus occupation,

$0,9 \leq W^k \leq 1,1$ – balanced occupation,

$W^k > 1,1$ – deficit occupation

In 2014, from 30 occupations with the highest occupational deficit intensity index in Poland 3 occupations were connected with welding².

Tab. 1. Welder occupations in the ranking of 30 occupations with the highest value of occupational deficit intensity index in 2014

Place in the ranking	Occupation	Deficit intensity index W^k
14	Welder in TIG method (141)	11,32
19	Welder in MIG method (131)	8,94
29	Welder in MAG method (135)	7,11

Source: Report *Zawody nadwyżkowe i deficytowe w 2014 roku*, <https://www.mpips.gov.pl/analizy-i-raporty/raporty-sprawozdania/rynek-pracy/zawody-deficytowe-i-nadwyzkowe/rok2014/>.

Despite the large number of training centers for future welders, the labor market deficit is still very high.

People who attend courses at the Welding Training Center, with a variety of professions (confectioner, chef, psychologist) despite good intentions and diligence, lack basic skills, such as reading simple technical drawings, using caliper or weld gauge. Unfortunately, vocational education in Poland has had a period

¹ Report *Zawody nadwyżkowe i deficytowe w 2014 roku*, <https://www.mpips.gov.pl/analizy-i-raporty/raporty-sprawozdania/rynek-pracy/zawody-deficytowe-i-nadwyzkowe/rok2014/>.

² Ibidem, p. 9.

of recession, but it slowly comes out from it. There is a lack of qualified workers, teaching staff with practical workshop experience and adequate technical background in active vocational schools. For this reason, a large number of vocational training centers have filled the existing gap.

Conclusions

Authors claim that units which undertook the vocational training of employees and incurred costs associated with the purchase of very expensive facilities of machines, testing equipment, health and safety and fulfillment of all requirements and regulations should be an active element of the state vocational education system and assisted financially from the state budget.

To improve the situation the following steps should be undertaken:

- to carry out a nationwide information campaign aimed at providing reliable data clearly indicating the need for deficit occupations,
- targeting young people entering the labor market for deficit occupations,
- establishing co-operation of newly-established vocational schools with existing vocational training centers where practical training could be provided,
- simplifying the procedures of Labor Offices related to financial participation in the training of workers in deficit occupations,
- realignment of Labor Offices requirements related to the hourly scope of training programs of welders which are incompatible with the guidelines of Instytut Spawnictwa in Gliwice.

Taking into account the above mentioned proposals would undoubtedly contribute to the restoration of vocational education in Poland.

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