



SAFE WORK WHEN WELDING IN A SEALED VESSEL

1. Case metadata

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C25.2.9 - Manufacture of other tanks, reservoirs and containers of metal

C33.1.2 - Repair of machinery

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47321C Work accidents

57521C Chemical plants

57801C Confined spaces

55261D Maintenance workers

60601D Welding

2. Organisations involved

- BIS Czech s.r.o.
- Hexion Speciality Chemicals Pardubice s.r.o.

3. Description of the case

3.1. Introduction

BIS Czech s.r.o., with registered offices in Most, has approximately 900 employees and performs very varied and extensive activities in the field of equipment maintenance in the chemical and petrochemical industries and in the energy sector, as well as many other activities.

The BIS Czech Group has implemented a certified integrated management system, which includes:



- Quality - ČNS EN ISO 9001
- Environment - ČSN EN ISO 14001
- Occupational Health and Safety - OHSAS 18001
- Safety Enterprise
- Welding - ČSN EN ISO 3834-2
- Steel Structures - ČSN 73 2601

A quality system has been implemented in each separate company department, beginning with contract checking, monitoring of quality of the supplied materials and services, up to finally providing all parameters of products or services that are requested by customers and documented by controlling activities, including the check by special experts, independent inspections and authorised organizations.

Regarding the environment, they provide an open and frank communication with employees, customers, business partners, target groups, public and state government and administration bodies. Their aim is to minimize the negative influence on environment, including material economy.

The maintenance activities in the chemical, energetic and other similar industries are highly risky; the work safety and the security systems have therefore the highest priority in the company. A lot of effort is devoted to safety at work. Their main aims are to minimize safety risks and to increase health protection of the employees and the surrounding public. Along with the provision of protective tools and clothes, regular training systems, above standard medical services etc., the basic and fundamental pillar of the Work Safety and Security System is to locate and monitor risks during work and their preventive removal.

The equipment operator, Hexion Speciality Chemicals Pardubice s.r.o., has performed a planned shutdown of the duplicator apparatus and cleaned the vessel. During the subsequent pressure testing it discovered a leak in the cooling coil pipe and a leak at the flange seal at the valve on the cooling water inlet pipe. They contacted the contractual partner BIS Czech s.r.o. and asked them to perform the repair. The hereafter described activity is an example of good practice for maintenance procedures, based on the established OHSAS 18001 standard.

3.2. Aims

The main aim for the integration of the OHSAS 18001 in the quality system of BIS Czech s.r.o. was to enable the organization to control its OH&S risks and improve its safety performance. The following more detailed objectives have been set with the introduction of the OHSAS 18001 Occupational Health and Safety Management system:

- Definition of occupational health and safety policies, programs and objectives appropriate for BIS Czech operations;
- Identification of occupational health and safety risks and legal requirements;
- A proactive approach to occupational health and safety risks and involvement of employees in the development and implementation of procedures;
- Controlling or eliminating risks to prevent accidents;
- Monitoring of occupational health and safety system performance;
- Regular reviews, evaluation and improvement of the system.

3.3. What was done, and how?

Based on the established system and through the mechanisms provided by the OHSAS 18001 standard, repairs in the Hexion company had been performed by the BIS Czech company.

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After BIS Czech was engaged to carry out the maintenance for the Hexion company the following tasks were identified:

- Reparation of a leak in the cooling coil by flame welding of the crack inside the duplicator No 9 with a volume of 30 m³ serving for the manufacture of special resins,
- Replacement of the flange seal at the valve on the cooling water inlet pipe inside the vessel.

According to the standard for such maintenance activities the procedure had several steps:

Risks identification

The leak in the cooling coil inside the vessel was approximately 1.30 m above the floor of the vessel. Workers could be at risk when entering, moving around and working in the confined space of the sealed vessel. The risk of slipping and falling, the risk of hitting something with the body, the risk of being burnt, the risk of damaging eyes and the risk of breathing noxious substances during the welding process have been identified.

Workers could be at risk when replacing the seal at the valve on the cooling water inlet pipe located at a height of 3.60 m as a result of work at height and in the confined space. Following risks have been identified: the risk of falling from height, the risk of hitting something with the body and the risk of head injuries when working in the confined space in close proximity to pipes and fixtures.

All identified risks served as the basis for the register of risks.

Planning

On the basis of the identified workplace conditions and the ascertained risks, measures have been proposed to reduce the risks the employees face during their work.

In accordance with the requirements of the standard, the company's regulatory documentation has been previously prepared and made available:

- Working Instruction (Pi) 557_05 Permission to Work, part: procedure for securing the entry and work inside equipment and restricted spaces,
- Nr 557 Safety Rules, the part applying to the conditions for entry and work in sealed equipment,
- Pi 557_09 The Use of Portable Handheld and Electric Tools,
- Nr 557 Safety Rules, part: Assembly Work and part: Work at Heights and Auxiliary Building Constructions,
- Pi 500_19 Assembly of Operational Equipment – disassembly and assembly of flange connections.
- The basic personal protection equipment for employees in the individual professions is stipulated in Pi 557_03.

The above listed documentation had been used to prepare workers for work.

The actual maintenance of the cooling coil was performed by a welder, while the replacement of the flange seal was performed by a pipe fitter. Their activities presented the typical risks that the company has indicated in the risks register, Nr 557T_040, including the adopted measures to reduce them. If the foreman discovered a new risk during an inspection of the workplace conditions, he would use form Nr 557B_050 Discovery of New Risks for its documentation, evaluation and for the adoption of measures for its reduction.

After the evaluation of the discovered faults in the equipment and the workplace conditions, a production engineer searched the Working Procedures list for the written working procedure for repairs to the cooling coil and the working procedure for the replacement of the flange seal at the valve. The indicated activities – the repair of the cooling coil and the replacement of the flange seal –

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are frequent and repeated activities for the maintenance of this equipment, and therefore the company has previously prepared written working procedures, incorporated into the regulatory documentation, and these are subsequently always supplemented by other specific measures on the basis of the local workplace conditions during individual actions.

The inspection of the workplace for the repair of the cooling coil did not indicate any new risks, and no other measures needed to be stipulated.

The inspection of the workplace for the repair of the flange seal showed that safe work at height must be provided, and for this purpose scaffolding would have to be constructed. This scaffolding had to be constructed by a person with professional competency to construct scaffolding – after the completion of the scaffolding, this person submitted to the team leader a Scaffolding Handover and Acceptance Record, Nr 500JJ_020.

A stipulated employee discussed the working procedures indicated above and the safety measures to reduce the risks with the working group of employees that would perform the repairs. During this discussion they evaluated the completeness of the identification of the risks, the correctness and completeness of the adopted measures to reduce risks, and the feasibility of the performance of working procedures. On this basis, the foreman calculated the time required for the repairs and the price offer.

The results and the course of selected implemented actions are evaluated, among other things, at regular monthly meetings with employees led by the foreman with the participation of the centre's production engineer and the division director or his representative, while working procedures can be modified on the basis of findings and comments from employees, for example.

Ensuring workplace safety

After arriving at the stipulated workplace and reporting to the head of operations of the equipment operator Hexion Speciality Chemicals Pardubice s.r.o., they began with work. They marked the workplace using a safety tape and "no entry for unauthorised persons" signs, and began to work on the equipment. After opening the upper and lower hatches of the sealed vessel, they installed the hose and connected the forced ventilation extractor for the internal space of the vessel.

Usage of appropriate equipment

The stipulated personal protective equipment for the welder, pipe fitter and scaffolder is given in Pi 557_03 Provision of PPE, in Annex A. An inspection of both workplaces did not indicate a need to provide the employees with additional PPE. During the morning allocation of work, and before leaving for the workplace, the foreman inspected the individual employees to ensure that they were correctly dressed and that they had the specified PPE.

On the basis of past experience, welders are always equipped with a basic set of handheld tools, portable handheld electric tools and a welding set. After an inspection of the workplace, when it was discovered that the work would be performed inside a sealed metal vessel, the welder was also provided with portable electric handheld tools with safe power supply (a handheld grinder and a portable lamp).

On the basis of past experience, pipe fitters are always equipped with a basic set of handheld tools and portable handheld electric tools. An inspection of the workplace proved that there was no need to provide additional equipment for the performance of the required repair.

The employees were demonstrably instructed regarding the obligation to perform an inspection and a check, and potentially an operational test, before the use of electric appliances. Electric tools are inspected prior to issuing. The system of inspections and the checks of electric handheld tools is stipulated in Nr 547 Rules for Inspections and Maintenance of Technical Equipment.

Working according to a plan

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The work was performed according to a stipulated time schedule and working procedures, which stipulate an obligation to perform in-process inspections in specific phases and to perform a final inspection after the completion of the repair. The in-process inspections are performed by the group leader during the work and at previously stipulated points.

Performance of the final inspections

The final inspection was performed by the group leader in the presence of the authorised representative of the operator. In cases which are simpler than this repair, all the records of the repairs performed, including the in-process and final inspections, are recorded in the daily record Pi 800_03 Annex G.

After the performance of the given final inspections and the clean-up of the workplace, the repaired equipment was handed over to the operator through Record A on the Handover and Acceptance of Equipment from Operation for Repair and Back.

3.4. What was achieved?

- The implementation of the register of risks with an indication of the typical predictable risks and the preparation of written working procedures for various activities, which provide cost savings during the preparation and planning of actions for repeated activities, has proven to be saving a great deal of time and money.
- The implemented occupational safety system significantly contributes to the acquisition and maintenance of the company's image and is also an advantage for it during tenders for orders, which is an economic benefit for the company.
- All improvements in safety and the protection of health, increased employees' satisfaction, a reduction in the number of occupational injuries and a reduction of the duration of inability to work, bring economic benefits which reimburse the additional investments into workers' training, revisions, personal protective equipment etc.

The implementation of the ČSN OHSAS 18001 standard has brought considerable benefits in terms of reducing accidents at work and increasing all workers' risk awareness.

The statistics for three years show positive trends in reducing accidents in the company Bis Czech (Table 1) as well as in the Pardubice Repair Division (Table 2).

Injury statistics for BIS Czech s.r.o. for the past 3 years

total number of employees in 2009: 933

	2007	2008	2009
<i>Injuries recorded</i>	16	12	7
<i>Fatal injuries</i>	0	0	0
<i>Inability to work due to injury</i>	282	652	579*

* This figure is influenced by the continuation of inability to work from 2008.

Table 1: Injury statistics for BIS Czech s.r.o. for the past 3 years

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Injury statistics for the Pardubice Repair Division for the past 3 years

total number of employees in 2009: 54

	2007	2008	2009
<i>Injuries recorded</i>	2	0	1
<i>Fatal injuries</i>	0	0	0
<i>Inability to work due to injury</i>	57	0	12

Table 2: Injury statistics for the Pardubice Repair Division for the past 3 years

The issue of occupational safety is a regular part of the preparation and planning of actions and meetings with employees, while notice boards are also used to promote safe work.



Picture 1: Noticeboard

3.5. Success factors

- The successful implementation of an integrated OSH management system in the maintenance sector and the top management commitment.
- The implementation of the register of risks with an indication of the typical predictable risks and the preparation of written working procedures for various activities, which provide cost savings during the preparation and planning of actions for repeated activities, has been shown to save a great deal of time and money.
- The implemented occupational safety system significantly contributes to the acquisition and maintenance of the company's image and is also an advantage for it during tenders for orders, which represents an economic benefit for the company.

3.6. Further information

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3.7. *Transferability*

The OHSAS 18001 certification can positively improve the efficiency of internal operations and consequently reduce accidents, danger and downtime. The employees' safety and the quality of the working environment are actively improved because the objectives and responsibilities are made clearer and all employees are prepared for an effective dealing with any future hazards. The company can demonstrate a high level of occupational health and safety with the implemented quality system. These are the aspects which are important for companies in all branches. The approach which was established by BIS Czech is transferable to all businesses, especially for companies that deal with maintenance.

4. References, resources:

- Information provided by the organisation in the framework of the Good Practice Award Competition 2010/2011.
- <http://www.bisczech.cz/eng/>