

## TRAINING-ID: 1000-L2-01

### Advanced Training - Materials in Press Hardening of Steel (PHS) (2 days)

#### DESCRIPTION

The steel microstructure defines the final mechanical properties of the formed parts. The evolution of the microstructure characteristics, such as phase composition and grain size will be defined in theoretical units. The attendee will have an opportunity to create experimental investigations on the influence of various process parameters, for example, heating temperature, transfer time, and the cooling rate on the resulting mechanical properties. Furthermore, the influence of the process chain on the surface properties regarding coated and uncoated materials will be clearly represented. The structure and composition of the surface layers of press hardened materials will be investigated and analysed. The scheduled material investigations and analysis will be built on widely used press hardenable materials such as 22MnB5 and 34MnB5. This course combines theoretical explanation of materials phenomena with experimental internship in laboratory and final analytical examination of generated press hardened parts.

#### AUDIENCE

Engineers and technicians in the fields of production, tooling, material testing and QM & QS.

#### PREREQUISITES

Successful completion of the Principles of PHS „Heat Treatment & Hot Forming of Steel“.

#### BENEFITS

This Advanced Training is aimed at the development of deepening each participant's present knowledge in material behaviour during the complete press hardening process. This knowledge creates a solid foundation in understanding the influence of the process parameters on the press hardened components.

#### METHODS

To achieve the objectives listed in the content, digicon Academy provides a focused, practically and economically oriented knowledge transfer in the form of seminar lectures and field tests on samples. The involved trainers are highly qualified and experienced key-players in this market.

#### CONTENT

Theoretical units aim at creating a deep understanding of material transformations during heating, cooling and forming.

##### T1: Introduction

- Light weight design with steel
- Press hardening process

##### T2: Steel structure and properties

- Crystal structure
- Phases in steel
- Influence of time, temperature and alloying elements on phase composition
- Phase diagrams: equilibrium, time-temperature-austenitisation (TTA), time-temperature-transformation (TTT), continuous-cooling-transformation (CCT)

##### T3: Basic properties of press hardenable steels

- Chemical composition and mechanical properties
- TTA, TTT and CCT diagrams
- Coatings

##### T4: Phase transformations during press hardening and mechanical properties

- Austenitisation
- Formation of martensite, bainite and ferrite
- Adjusting of mechanical properties

**T5: Surface properties**

- Scaling of uncoated materials
- Evolution of AISI-coating
- Surface roughness in dependence from the heating rate

**T6: Materials Characterization**

- Destructive and non-destructive material testing
- Tensile and hardness testing
- Metallography, optical and laser microscopy
- Scanning electron microscopy

The main goal of the practical units is to obtain a practical experience of the influence of process parameters on the properties of press hardened components. The first part of the internship contains the production of small-scale components on the laboratory equipment simulating the whole press-hardening process chain. The second part of the practical training includes testing and analysis of the produced components.

**P1: Press hardening in laboratory**

Experiments to investigate the influence of

- Heating parameters on austenitisation
- Transport time on mechanical properties
- Cooling conditions on mechanical properties
- Heating time on surface properties

**P2: Analysis of press hardened components**

- Hardness measurement
- Tensile testing
- Metallography and optical microscopy
- Surface properties with laser microscopy
- Scanning electron microscope

**T7: Summarization**

- Summary of the training
- FAQ
- Feedback

