



# CLLAIM

## LZH Laser Akademie CLLAIM Final Conference

### Piloting professional profiles - Supervisor

Project title: **C**reating know**L**edge and skill**L**s in **A**dditive **M**anufacturing

Reference number: 2017-3309/591838-EPP-1-2017-1-ES-EPPKA2-SSA



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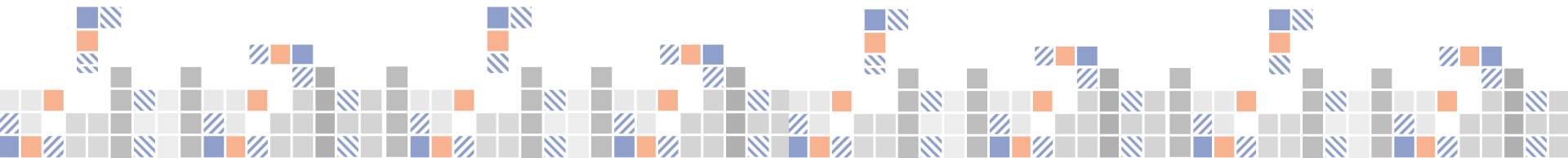
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# Agenda

## Metal AM Supervisor

- Routes to qualification
- Guideline for Metal AM Supervisor
- Piloting of Competence Units





# Routes to qualification

## Metal AM Supervisor

- Guideline for European education, training, examination and qualification of additive manufacturing personnel
- Occupational Standards and Learning Outcomes for the qualifications
- Published online: <http://cllamprojectam.eu/europeanguides.html>

### Three routes to gain the qualification

Standard Route

Blended Learning Route

Alternative Route



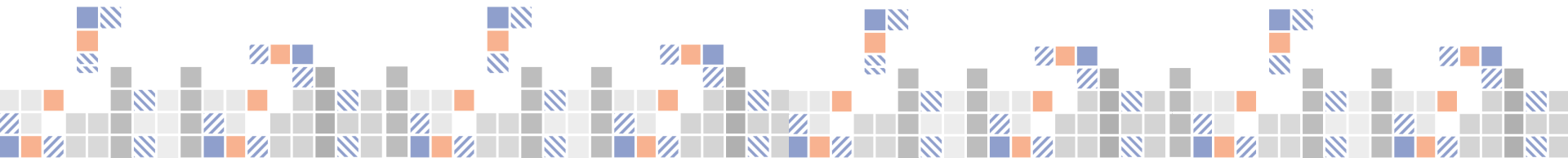
# Guideline for Metal AM Supervisor

## Content

- Learning Outcomes (generic outcome descriptors and in detail for each competence unit)
- Recommended contact (teaching) hours

## Access conditions

- National compulsory school diploma
- Basic knowledge and skills related with Quality Assurance and HSE
- At least 1 year of experience in Quality and Safety supervision is recommended





# Guideline for Metal AM Supervisor

## Occupational Standard

Metal AM Supervisors are professionals with the ***specific knowledge, skills, autonomy and responsibility to supervise AM production on shop floor***, being its main tasks to:

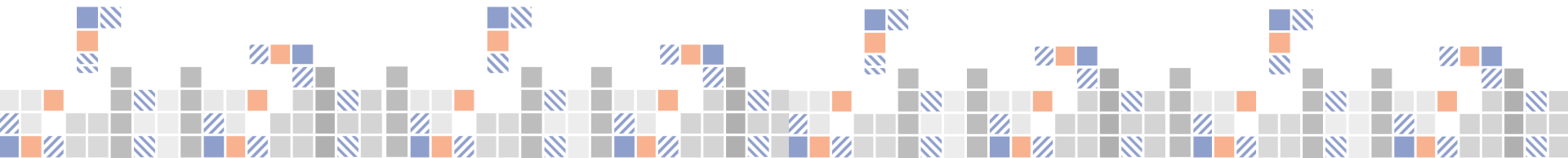
- Ensure quality procedures
- Ensure Health & Safety Environment procedures



# Guideline for Metal AM Supervisor

## Qualification Outcome Descriptors:

- **Knowledge:** Factual and broad concepts in the field of Metal AM processes
- **Skills:** Fundamental cognitive and practical skills on simples and specifics of Metal additive manufacturing problems required to:  
Develop proper solutions & Application of procedures and tools
- **Autonomy and Responsibility:** Self-manage of professional activities and simple standard applications of Metal AM manufacturing in predictable contexts but subject to change. Take responsibility for supervising routine metal AM production and related personnel.



# Guideline for Metal AM Supervisor

Competence Units	Recommended Contact Hours*	Expected Workload**
CU00: Additive Manufacturing Process Overview	7	14
CU01: DED-Arc Process	14	28
CU08: DED-LB Process	14	28
CU15: PBF-LB Process	14	28
CU46: Quality Assurance for Metal AM Processes	14	28
CU47: HSE for Metal AM Processes	14	28
CU48: Powder Handling	14	28
<b>Total</b>	<b>91</b>	<b>182</b>

\*Contact Hours are the minimum recommended teaching hours for the Standard Routes. A contact hour shall contain at least 50 min of direct teaching time.

\*\*Workload is calculated in hours, corresponds to an estimation of the time students typically need to complete all learning activities required to achieve the defined learning outcomes in formal learning environments plus the necessary time for individual study

# Guideline for Metal AM Supervisor

Competence Units	Recommended Contact Hours*	Expected Workload**
<b>CU00: Additive Manufacturing Process Overview</b>	7	14
CU01: DED-Arc Process	14	28
<b>CU08: DED-LB Process</b>	14	28
CU15: PBF-LB Process	14	28
CU46: Quality Assurance for Metal AM Processes	14	28
<b>CU47: HSE for Metal AM Processes</b>	14	28
CU48: Powder Handling	14	28
<b>Total</b>	<b>91</b>	<b>182</b>

Competence Units in **bold** were piloted by LZH Laser Akademie

- CU00 in February 2020 (in-person learning)
- CU08 in June and July 2020 (online)
- CU47 in October 2020 (in-person learning)





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# Piloting of Competence Unit 00

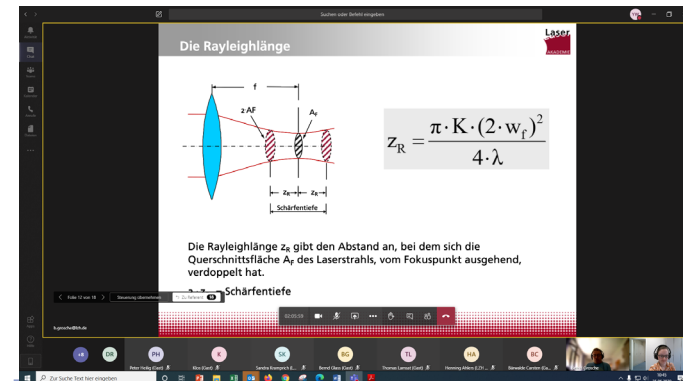
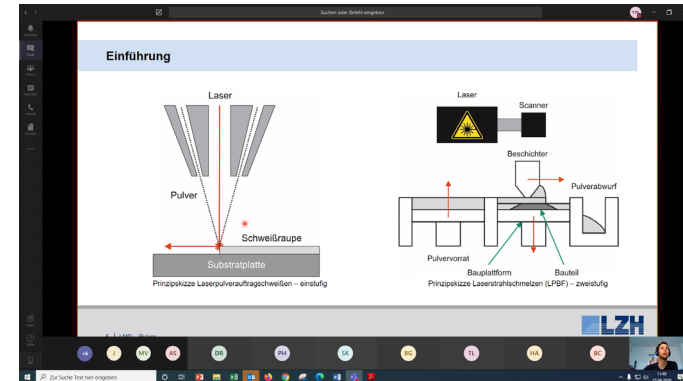
- Competence Unit 00: Additive Manufacturing Process Overview
- Messe Hannover, Germany
- 25<sup>th</sup> February 2020
- In-person learning
- 12 participants





# Piloting of Competence Unit 08

- Competence Unit 08: DED-LB Process
- MS Teams Online pilot
- 26<sup>th</sup> June + 2<sup>nd</sup> July 2020
- Online lecture
- 10 participants
- 7 passed the examination



# Piloting of Competence Unit 08

The screenshot displays a Zoom meeting interface. The central focus is a presentation slide titled "Physikalische Grundlagen der Laserstrahlung" (Physical Basics of Laser Radiation) by Bernd Grosche. The slide image shows a laser cutting process with a metal nozzle and bright sparks. The Zoom window includes a top bar with the Zoom logo and a meeting ID (921 232 111 111), a right sidebar with a list of participants, and a bottom toolbar with various controls. A small video window in the bottom right corner shows a participant.

**AIT** ADDITIVE TECHNOLOGY INSTITUTE

## Additive Fertigung in der Praxis

**robotized**  
**Robotmaster**

Bikromaterial:  
LKR  
Leichtmetallkompetenzzentrum  
Ranshofen GmbH

Ansprechpartner:  
Dr. Stephan Usarik  
Thematic Coordinator Material  
based design  
[www.ait.ac.at/esam](http://www.ait.ac.at/esam)


CHALLENGE CHALLENGE CHALLENGE

Navigation icons: Home, Back, Forward, Search, etc.

[illegible]

Strahlführung mit Spiegeln I

90°-Umlenkeinheit



Rückseite

Kupferspiegel

Vorderseite

Quelle: Kupfer

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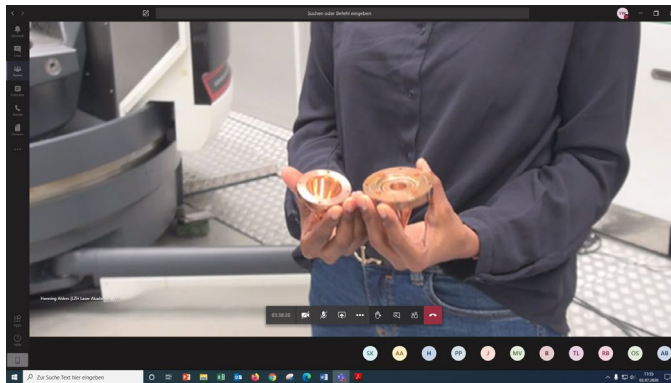
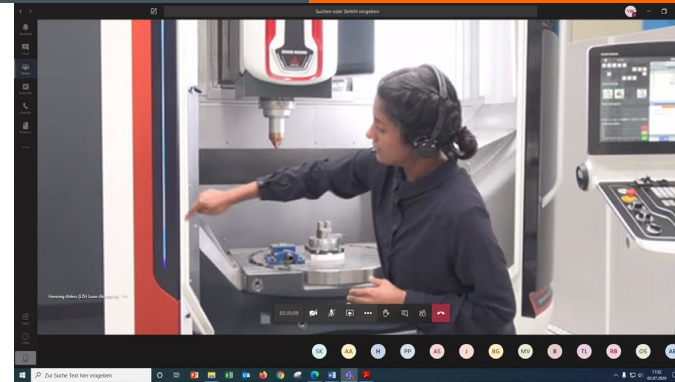
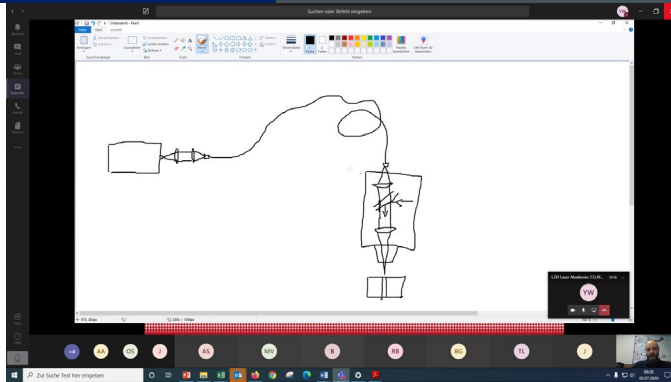
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# Piloting of Competence Unit 08







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# Piloting of Competence Unit 47

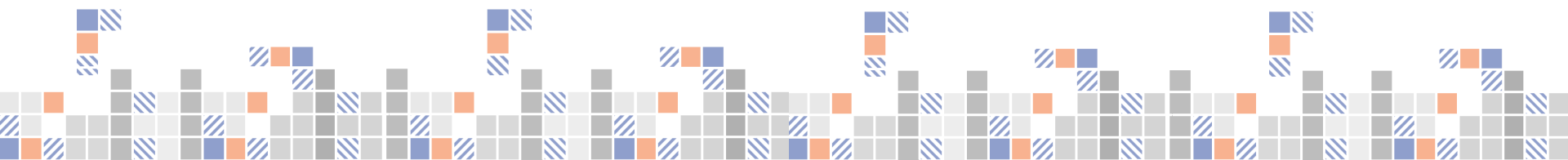
- CU 47: HSE for Metal AM Processes
- LZH Laser Akademie, Hanover, Germany
- 12<sup>th</sup> + 13<sup>th</sup> October 2020
- In-person learning
- 8 participants
- All participants passed the final examination



# CU47: HSE for Metal AM Processes

## Overview of Competence Unit 47

CU47: HSE for Metal AM Processes	Recommended Contact Hours	Workload
<b>Subject Title</b>		
HSE in facilities	5	
HSE for different energy sources	4.5	
HSE for different types of feedstock	4.5	
<b>Total</b>	<b>14</b>	<b>28</b>





## CU47: HSE for Metal AM Processes

- Job Function

Supervise HSE on Shop Floor

- Job Required Activities

- Ensuring **compliance with HSE requirements and instructions** featuring Metal AM processes and systems;
- **Providing support** to management and operational teams **in all aspects of safety, health, and environmental issues**;
- Monitoring/ Implementing corrective actions to **avoid Hazard risks**.



## CU47: HSE for Metal AM Processes

- **Learning Outcomes: Knowledge**
  - HSE requirements & instructions featuring Metal AM processes manufacturing
  - Infrastructures/Facility Requirements featuring Metal AM processes manufacturing
- **Learning Outcomes: Skills**

Learning Outcomes – CU 47 HSE for Metal AM Processes	
SKILLS	<p>Identify HSE training requirements for personnel operating at shop floor</p> <p>Describe the HSE hazards occurring on shop floor naming the different specifications applicable to the main metal AM systems</p> <p>Describe HSE procedures for handling and storage of metal AM feedstock naming the differences between wire and powder materials</p> <p>Describe metal AM HSE applicable legislation and standards ensuring personnel follows all the applicable HSE regulations at shop floor</p> <p>Verify if safety metal AM work procedures are properly followed monitoring personnel operations at shop floor</p> <p>Interpret Risk Assessment plans applying appropriate prevention and protection measures for reducing incidents at shop floor</p> <p>Produce incident/accident reports describing all the relevant factors related with the event.</p>

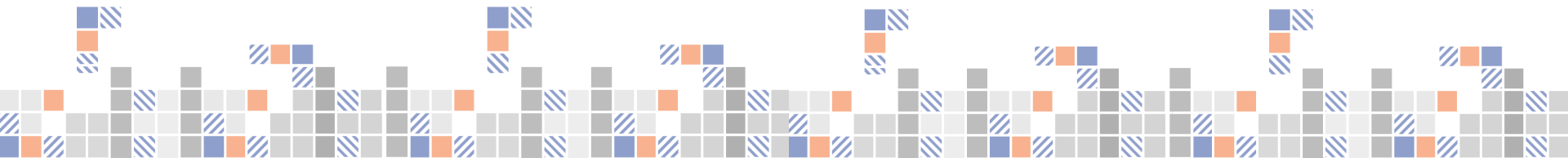




# Piloting of Competence Unit 47

## Development of curriculum:

- We mainly followed the guideline and competence description
- Objectives to consider:
  - achieve the required learning outcomes
  - bring the participants to a learning process that is as self-directed as possible in order to achieve a lasting and sustainable result
- Learning outcomes to be achieved are divided into knowledge and skills
  - Knowledge learning outcomes were achieved continuously throughout the process of attending the lessons
  - Skills were achieved in individual learning units

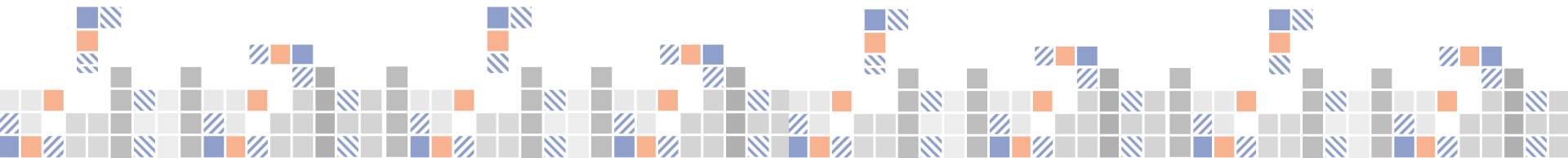




# Piloting of Competence Unit 47

## Schedule of piloting event:

- The event had a recommended duration of 14 contact hours
- The attendance lessons were spread over 1.5 consecutive days
- After the pilot event, a learning success control was carried out
- The event was held as a face-to-face event in compliance with the current COVID-19 regulations

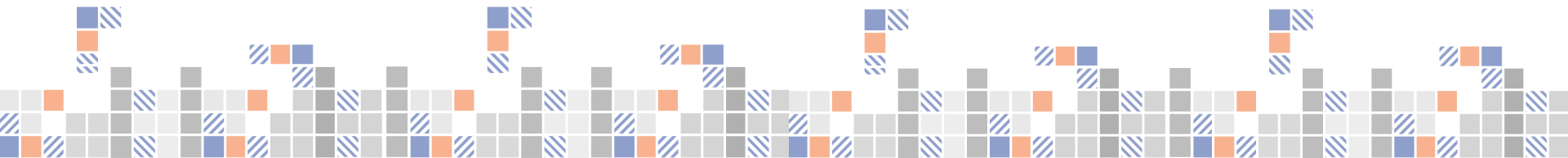




# Piloting of Competence Unit 47

## Schedule of piloting event:

- The basic concept was a mixture of lecture input and self-activity
  - The input from the lecture ensures a goal-oriented learning process
  - The self-activity offers a higher learning success due to better linking possibilities
  - The participants worked additionally in pairs or small groups to exchange experiences
- By alternating the individual phases, the attention of the participants can be maintained and increased





## CU47: HSE for Metal AM Processes

### ■ Learning Outcomes: Skills

- (1) Identify HSE training requirements for personnel operating at shop floor.
- (2) Describe the HSE hazards occurring on shop floor naming the different specifications applicable to the main metal AM systems.
- (3) Describe HSE procedures for handling and storage of metal AM feedstock naming the differences between wire and powder materials.
- (4) Describe metal AM HSE applicable legislation and standards ensuring personnel follows all the applicable HSE regulations at shop floor.
- (5) Verify if safety metal AM work procedures are properly followed monitoring personnel operations at shop floor.
- (6) Interpret Risk Assessment plans applying appropriate prevention and protection measures for reducing incidents at shop floor.
- (7) Produce incident/accident reports describing all the relevant factors related with the event.



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# Piloting of Competence Unit 47

## Lesson Plan and Skills



Agenda Tag 1 Montag, 12.10.2020, 9:00 – 17:00 Uhr



Zeit	Thema
09:00 – 09:15 Uhr	Begrüßung und Vorstellung
09:15 – 09:45 Uhr	Begriffsdefinition HSE
09:45 – 10:20 Uhr	Grundlagen Additiver Fertigungsverfahren
10:20 – 10:25 Uhr	Pause zum Durchlüften
10:25 – 12:25 Uhr	Gefährdungspotentiale in der additiven Fertigung und Grundlagen der Gefährdungsbeurteilung
12:25 – 13:00 Uhr	Mittagspause und Lüften
13:00 – 14:00 Uhr	Durchführung der Gefährdungsbeurteilung
14:00 – 15:00 Uhr	Rechtliche Grundlagen, Standards, Vorschriften
15:00 – 15:15 Uhr	Pause zum Durchlüften
15:15 – 16:15 Uhr	Umgang mit Gefahrstoffen, Handhabung, Lagerung, Entsorgung
16:15 – 17:00 Uhr	Erstellen einer Betriebsanweisung Teil 1
17:00 Uhr	Verabschiedung Tag 1 von 2

- 1
- 2
- 3
- 4
- 5
- 6
- 7

Agenda Tag 2 Dienstag, 13.10.2020, 8:30 – 13:00 Uhr

Zeit	Thema
08:30 – 08:40 Uhr	Begrüßung und Rückblick auf Tag 1
08:40 – 09:40 Uhr	Erstellen einer Betriebsanweisung Teil 2
09:40 – 09:45 Uhr	Pause zum Durchlüften
09:45 – 10:20 Uhr	Persönliche Schutzausrüstung bei Additiven Fertigungsverfahren
10:20 – 11:20 Uhr	Erstellen eines Unfallberichts
11:20 – 11:40 Uhr	Unterweisung von Mitarbeitern
11:40 – 12:00 Uhr	Pause zum Lüften
12:00 – 12:30 Uhr	Wissensabfrage
12:30 – 13:00 Uhr	Rückmeldungen und Feedback zur Pilotveranstaltung
13:00 Uhr	Verabschiedung Tag 2 von 2

- 1
- 2
- 3
- 4
- 5
- 6
- 7

Creating Knowledge and Skills in Additive Manufacturing (CLLAIM)  
Project No. 591838-EPP-1-2017-1-ES-EPPKA2-SSA

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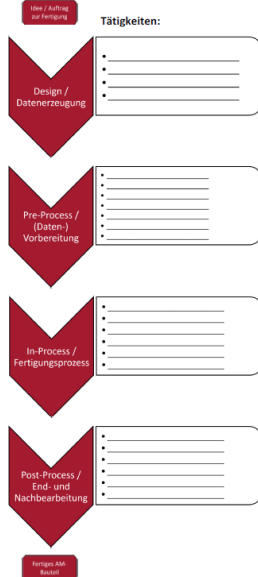


# Piloting of Competence Unit 47

## Worksheets:



### Prozesskette Additive Fertigungsverfahren



Creating Knowledge and Skills in Additive Manufacturing (CLLAIM)  
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### Arbeitssystem „Das Arbeitssystem „Additive Fertigung eines Metallbauteils“

Beschreiben Sie das Arbeitssystem auf der Basis des Einführungsvortrags

Eingabe	
Arbeitsaufgabe	Additive Fertigung eines Metallbauteils
Mensch	
Arbeitsmittel	
Arbeitsplatz, Arbeitsstätte	
Arbeitsablauf	
Arbeitsumgebung	
Ausgabe	
Andere Arbeitssysteme	

### UNFALLANZEIGE

1 Name und Anschrift des Unternehmens

2 Unternehmensnummer des Unfallversicherungsträgers

3 Empfängerin

4 Name, Vorname der versicherten Person

5 Geburtsdatum : Tag : Monat : Jahr

6 Straße, Hausnummer

7 Geschlecht : ☐ Männlich ☐ Weiblich

8 Staatsangehörigkeit

9 Leiharbeitsnehmerin

10 Auszubildende/r

11 Die versicherte Person ist

12 Anspruch auf Entgeltfortzahlung besteht für

13 Krankenkasse (Name, PLZ, Ort)

14 Tödlicher Unfall?

15 Unfallzeitpunkt

16 Unfallort (genauer Ort- und Straßennamen mit PLZ)

17 Ausführliche Schilderung des Unfallherganges (Verursachung des Unfalls, ggf. Beteiligung von Maschinen, Anlagen, Gegenständen)

18 Verletzte Körperteile

19 Art der Verletzung

20 Wer hat von dem Unfall zuerst Kenntnis genommen? (Name, Anschrift)

21 Erstbehandlung:

22 Beginn und Ende der Arbeitszeit der versicherten Person

23 Zum Unfallzeitpunkt beschäftigt/tätig als

24 Seit wann bei dieser Tätigkeit?

25 In welchem Teil des Unternehmens ist die versicherte Person ständig tätig?

26 Hat die versicherte Person die Arbeit eingestellt?

27 Hat die versicherte Person die Arbeit wieder aufgenommen?

28 Datum, Unternehmen (Bevollmächtigter), Betriebsrat (Personalrat), Telefon-Nr. für Rückfragen

U 1000 0117 Unfallanzeige

### Unterweisen Mitarbeiter

#### Aufgabe

- Welche Arbeitsmedizinische Vorsorge hat der Arbeitgeber für den beschriebenen Prozess anzubieten?
- Welche Vorsorge ist notwendig, wenn statt Titan mit Edelstahl gearbeitet wird?

### Durchführung der Gefährdungsbeurteilung

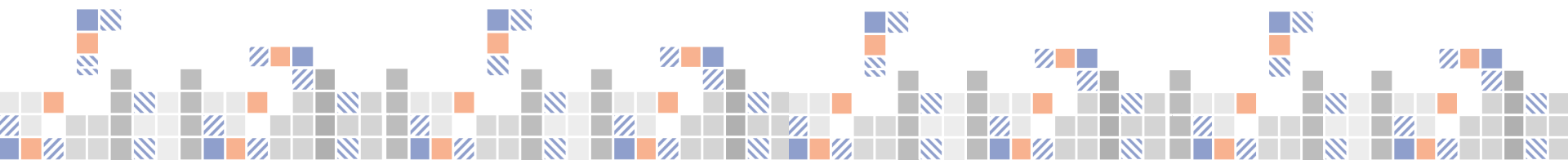
#### Aufgabe:

- Wodurch treten Gefährdungen bei der additiven Fertigung eines Planetengetriebes aus Titan-Pulver mittels PBF-LB auf?
- Ermitteln Sie die Gefährdungen und den Gefährdungsfaktor auf der Basis der Tabelle.
- Beurteilen Sie das Risiko auf der Basis der Risikomatrix nach Schubert

# Piloting of Competence Units

## Evaluation:

Question	Evaluation (4 points max)
How satisfied are you with the overall quality of the training?	3.7
How satisfied are you with the structure of the course ( if more than one Competence Unit, also consider the sequence)?	3.4
How satisfied are you with the performance of the trainers?	3.6
How satisfied are you with the support provided by the trainers?	3.7
How satisfied are you with the established contact hours?	3.0
How satisfied are you with the addressed questions and answers?	3.4
How satisfied are you with the audience participation (encouragement)?	3.5
How satisfied are you with the achievement of the training objectives?	3.4

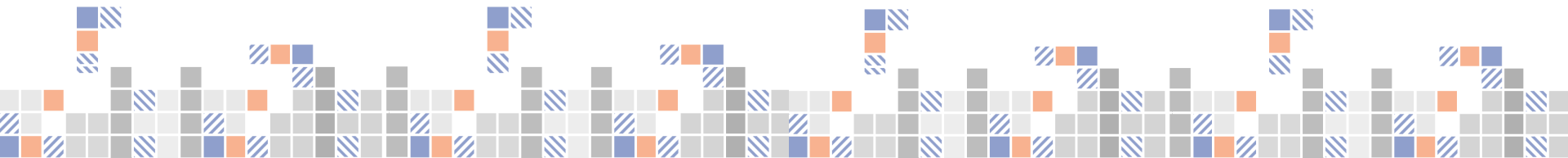




# Piloting of Competence Units

## Opinions and Feedback:

- “very diversified course” “consistently well-designed slides”
- “founded basics, senseful structure, examples from the economy”
- “Lot of group working activities, good insights in HSE aspects, different methods used to create and repeat knowledge”
- “lecturers/trainers are obviously experts in their field”
- “very good introduction”
- “very useful, compact training”
- “Basics compact, but structured and meaningfully worked out”
- “Complex subject matter well structured with individual contributions and specialist knowledge supplemented with practical examples, specialist content corresponds to the latest state of the art”
- “good interaction of speakers and participants despite online seminar”





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# Thank you for your attention

Yvonne Wessarges  
LZH Laser Akademie



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