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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

**Erasmus+**
**Cooperation partnerships in adult education**
**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-1 Cases for the training course-- different welding defects

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**Version:**
**Date:** **20.01.2023**

# Welding defects.

## Introduction.

According ISO 3834 defines three levels of quality: Comprehensive, standard and elementary. Most welding companies will implement one of these quality levels, at least if the companies are working with international customers.

One important part in ISO 3834 is inspection and documentation of the welds. One important part of the standard is also how you inspect the welds before, during and after welding.
Most contracts will contain requirements for the welding itself, where it is regulated how to inspect the welds, what type of deviations, defect rate and repair rate are defined and what is acceptable.

Many of the defects in welding can be avoided if the correct welding techniques are trained so the welder has the right skills, how the welding technology is implemented in production and so forth.

## About this document.

This document contains a number of typical welding defects. It shows a sketch of the defect as well as a radiographic film of how the defect can be observed.

## How to use this document.

The reference to these welding defects is ISO 6520.
Study the standard and let the students answers the two first questions:

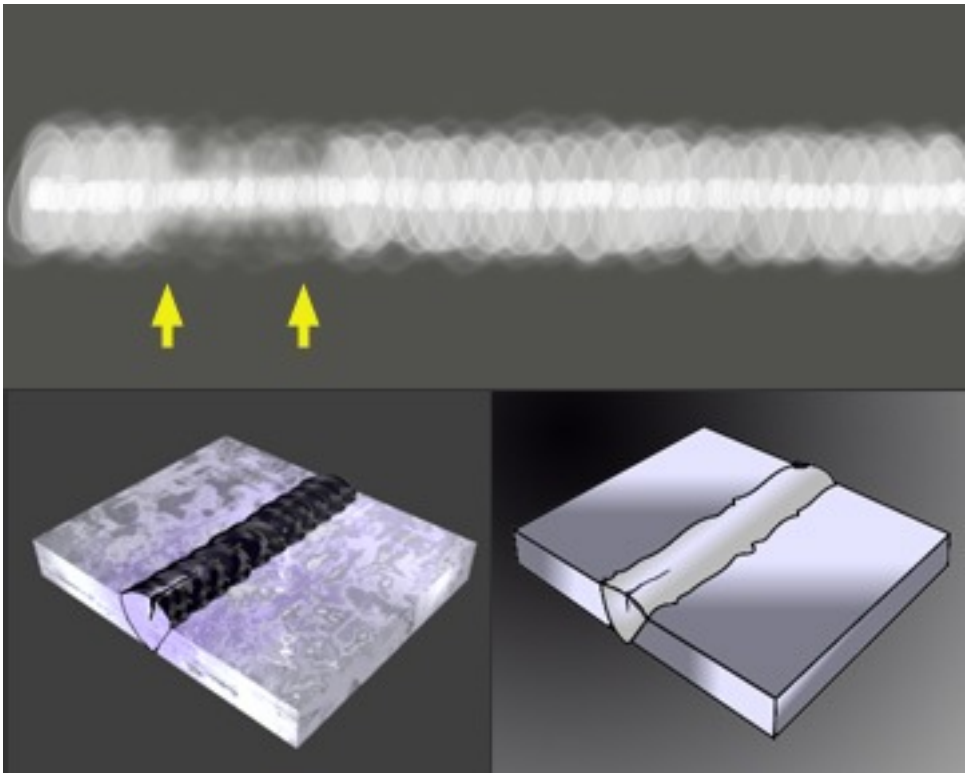
1. What type of defect is this?
2. What is the defect number?

The answers can be found in the ISO standards

The next two questions can be asked when the students carry out practical welding.
They can be asked to vary their welding parameters and then observe why they get these defects and how can they avoid these defects.

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

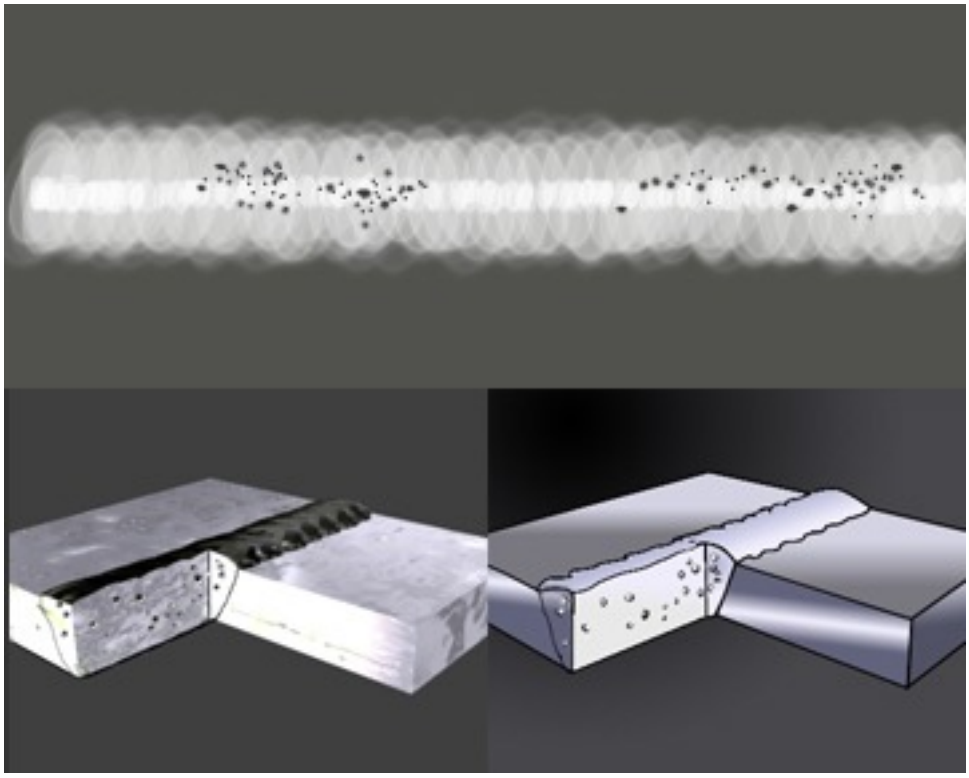
**Defect 1**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

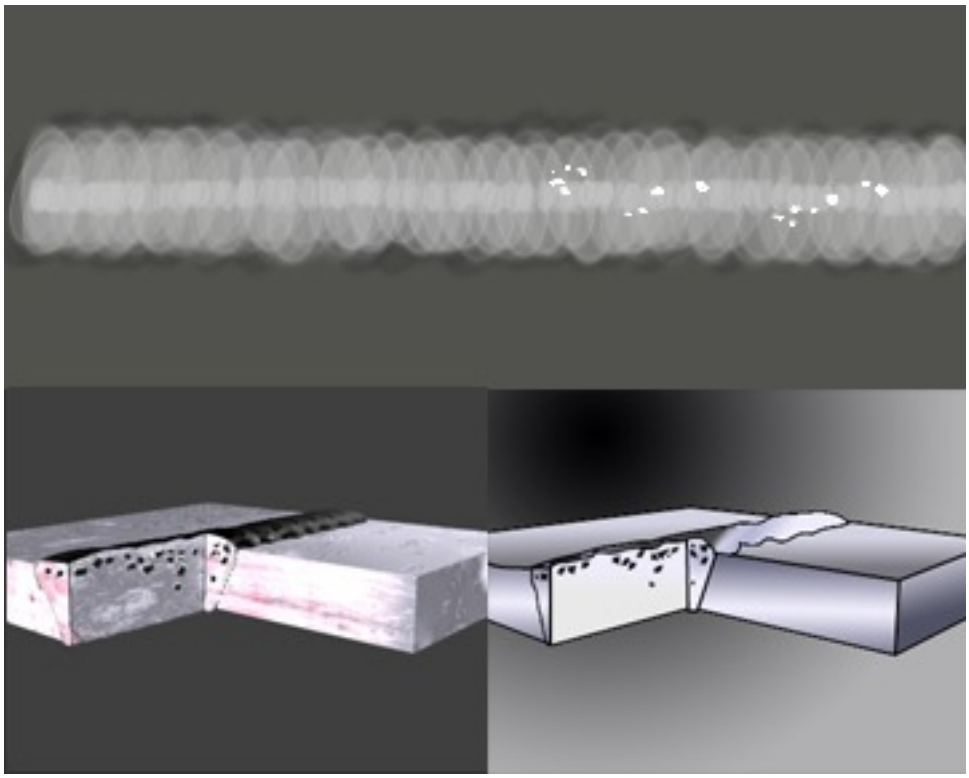
**Defect 2.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

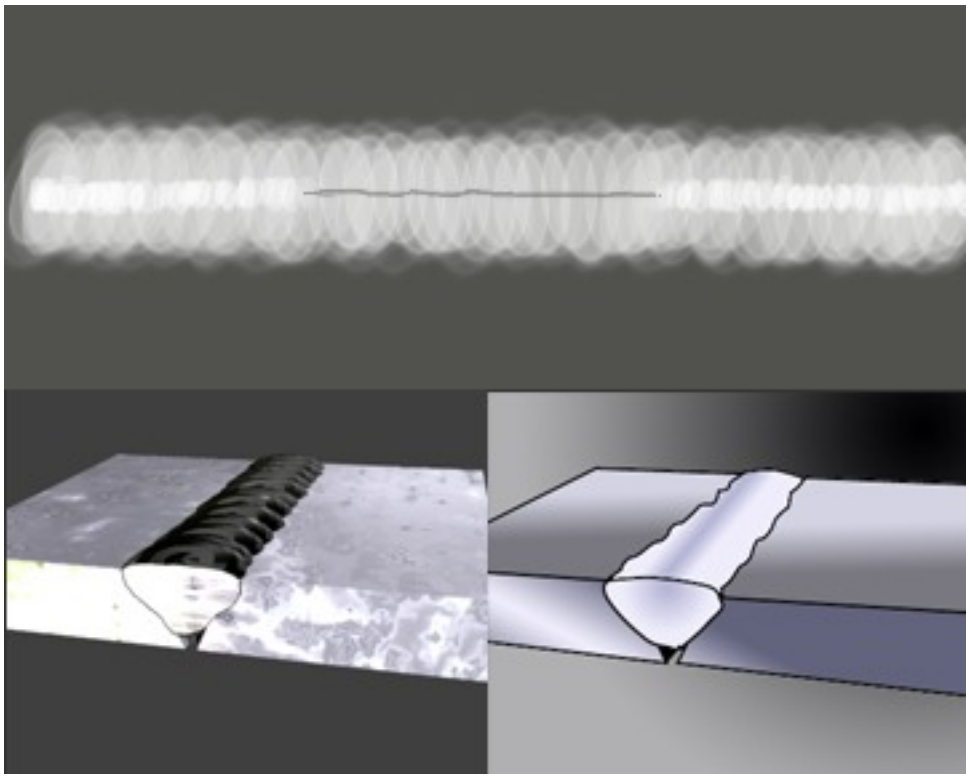
**Defect 3.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

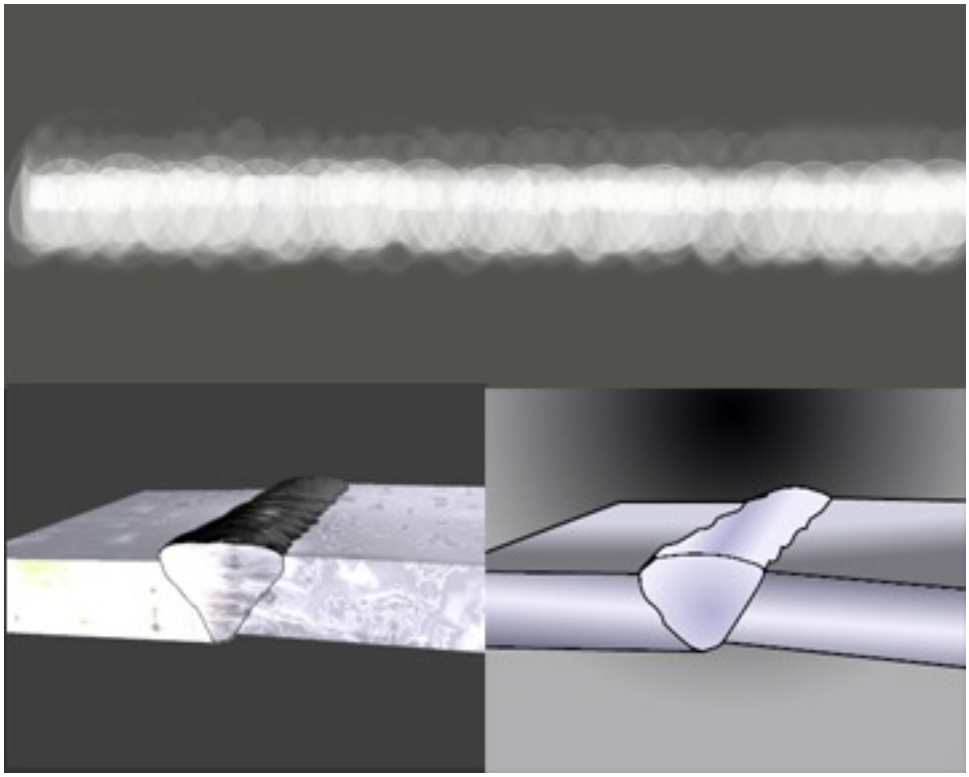
**Defect 4.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

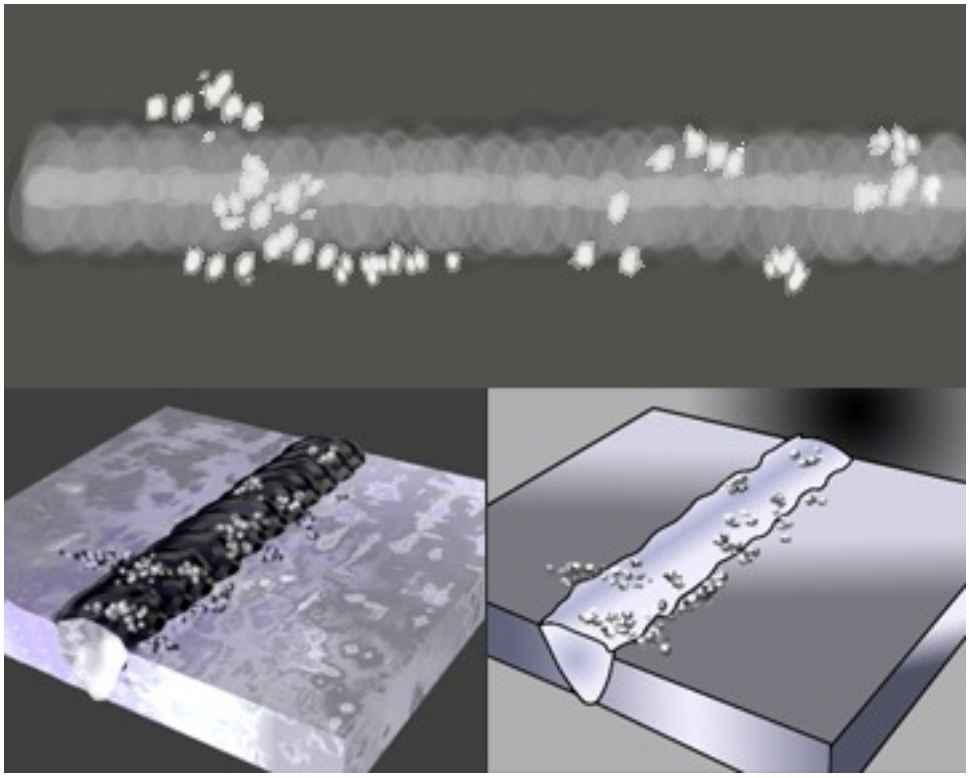
**Defect 5.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 6.**



1. What type of defect is this?
2. What is the defect number?

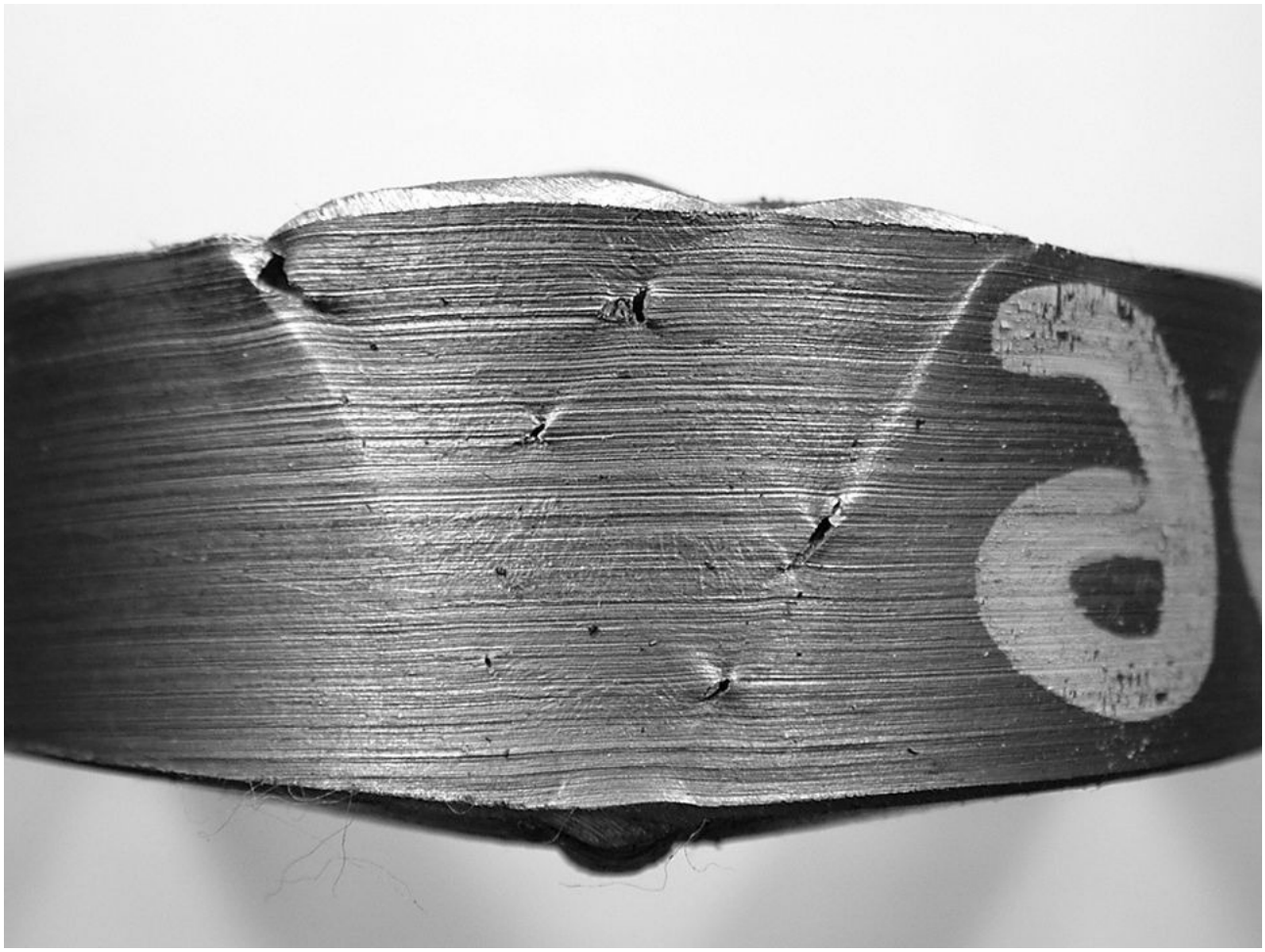
3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 7.**

1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

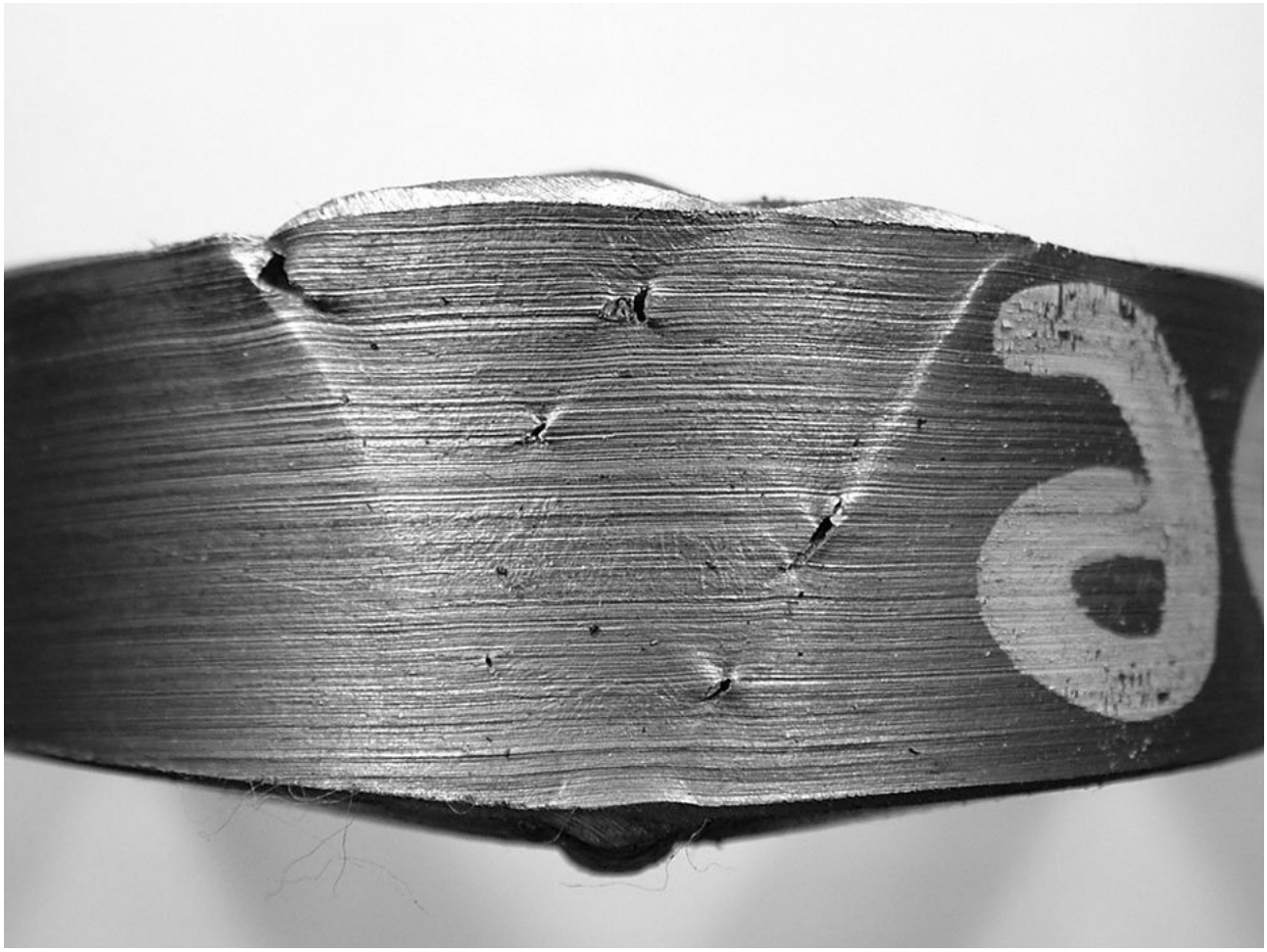
**Defect 8.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

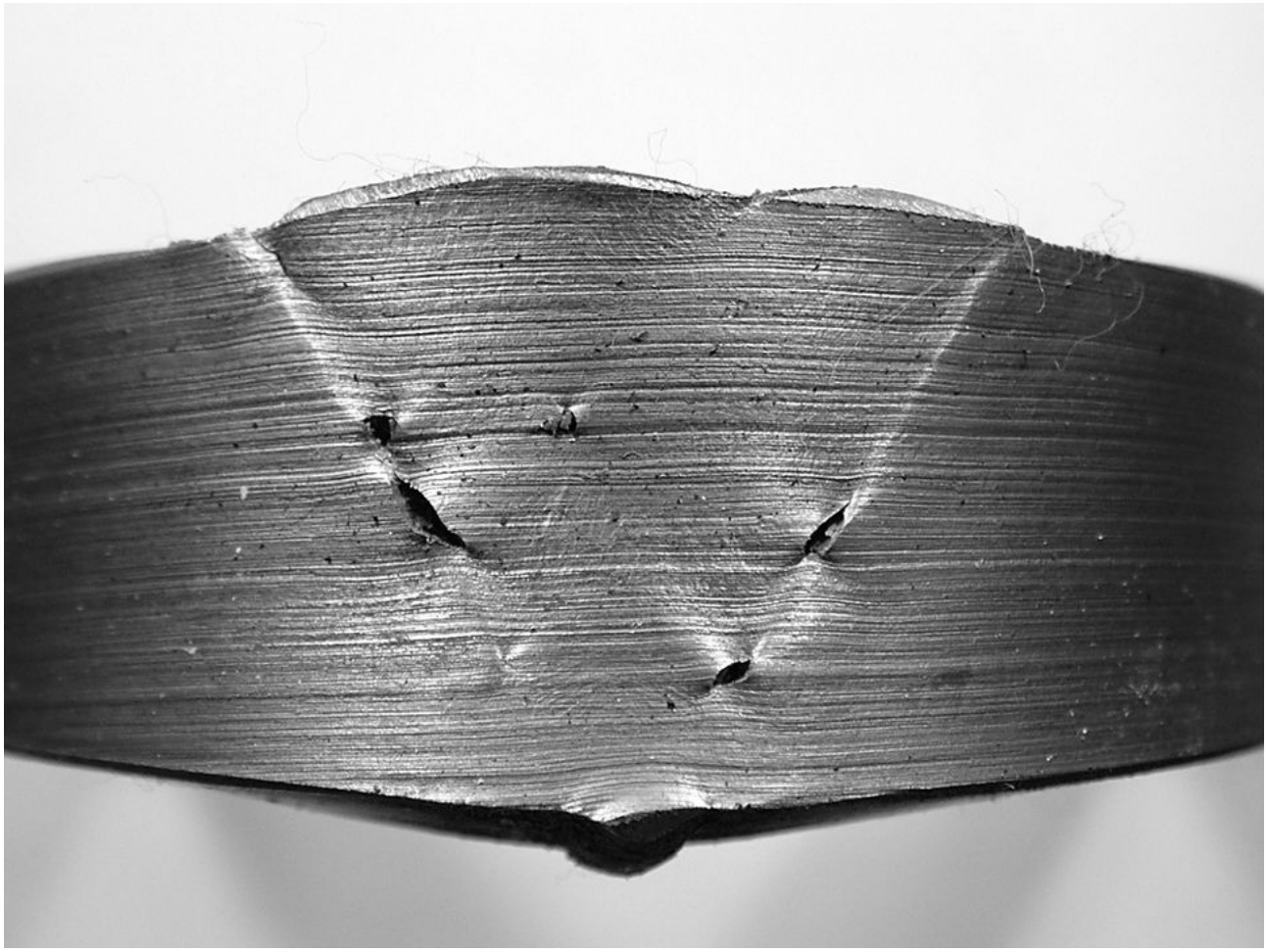
**Defect 9.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

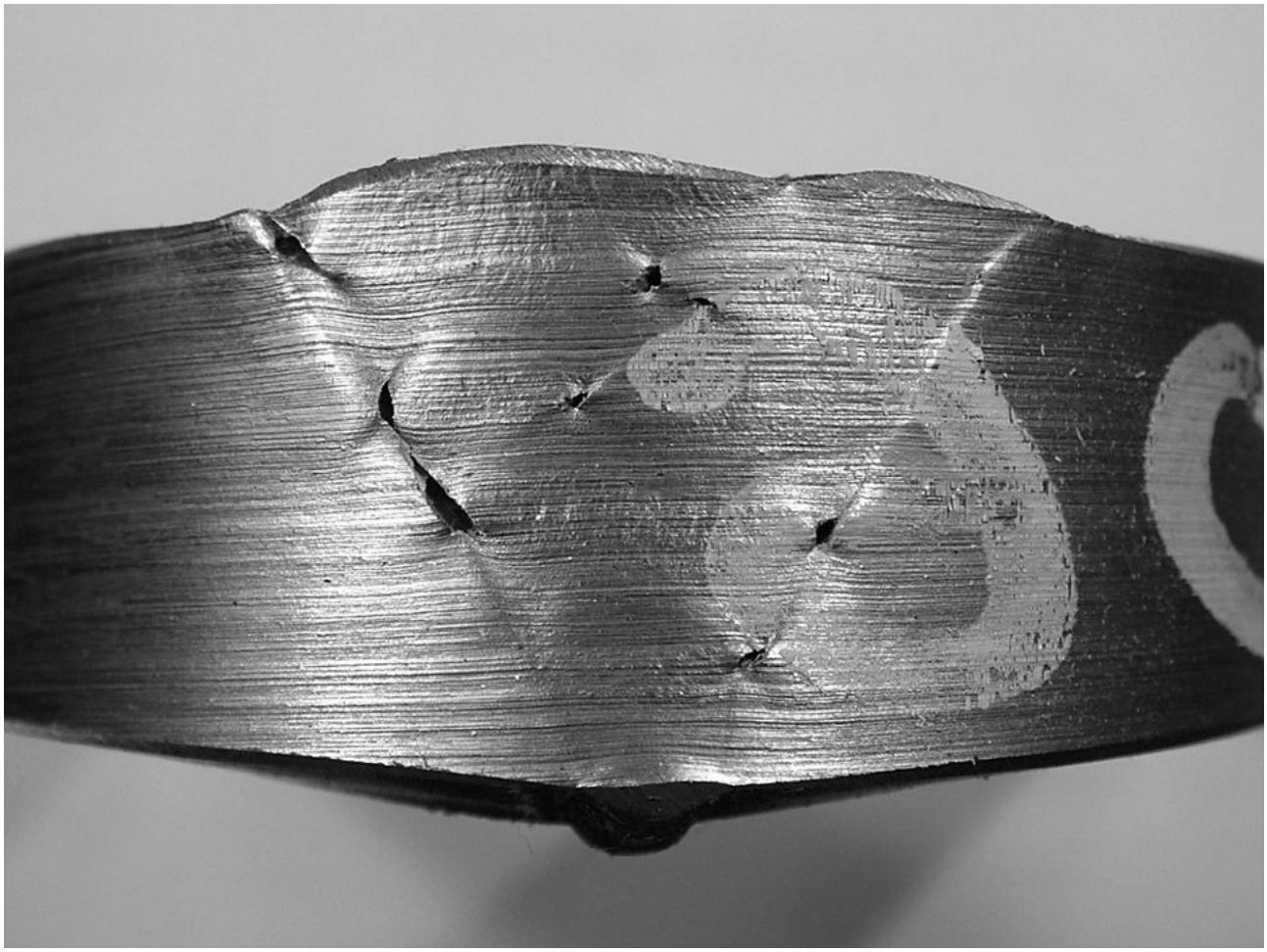
**Defect 10.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 11.**



1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 12.**

1. What type of defect is this?
2. What is the defect number?

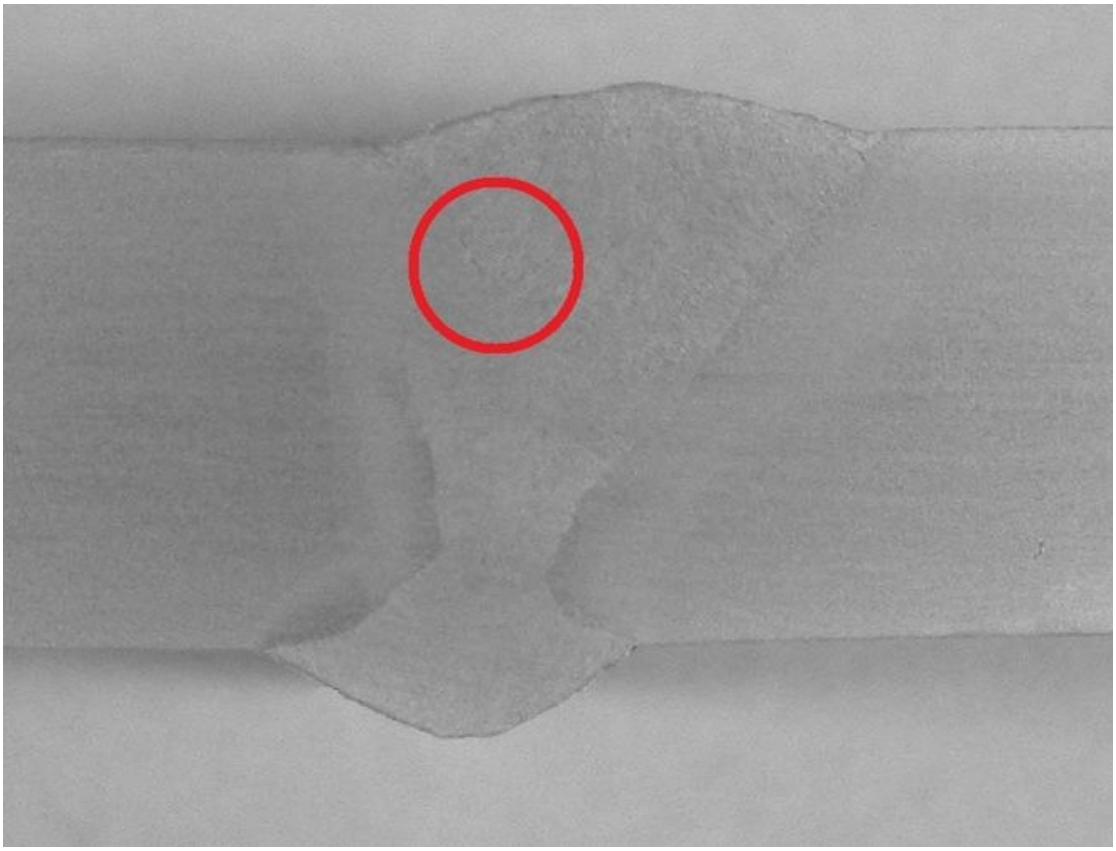
3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 13.**

1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 14.**



1. What type of defect is this?
2. What is the defect number?

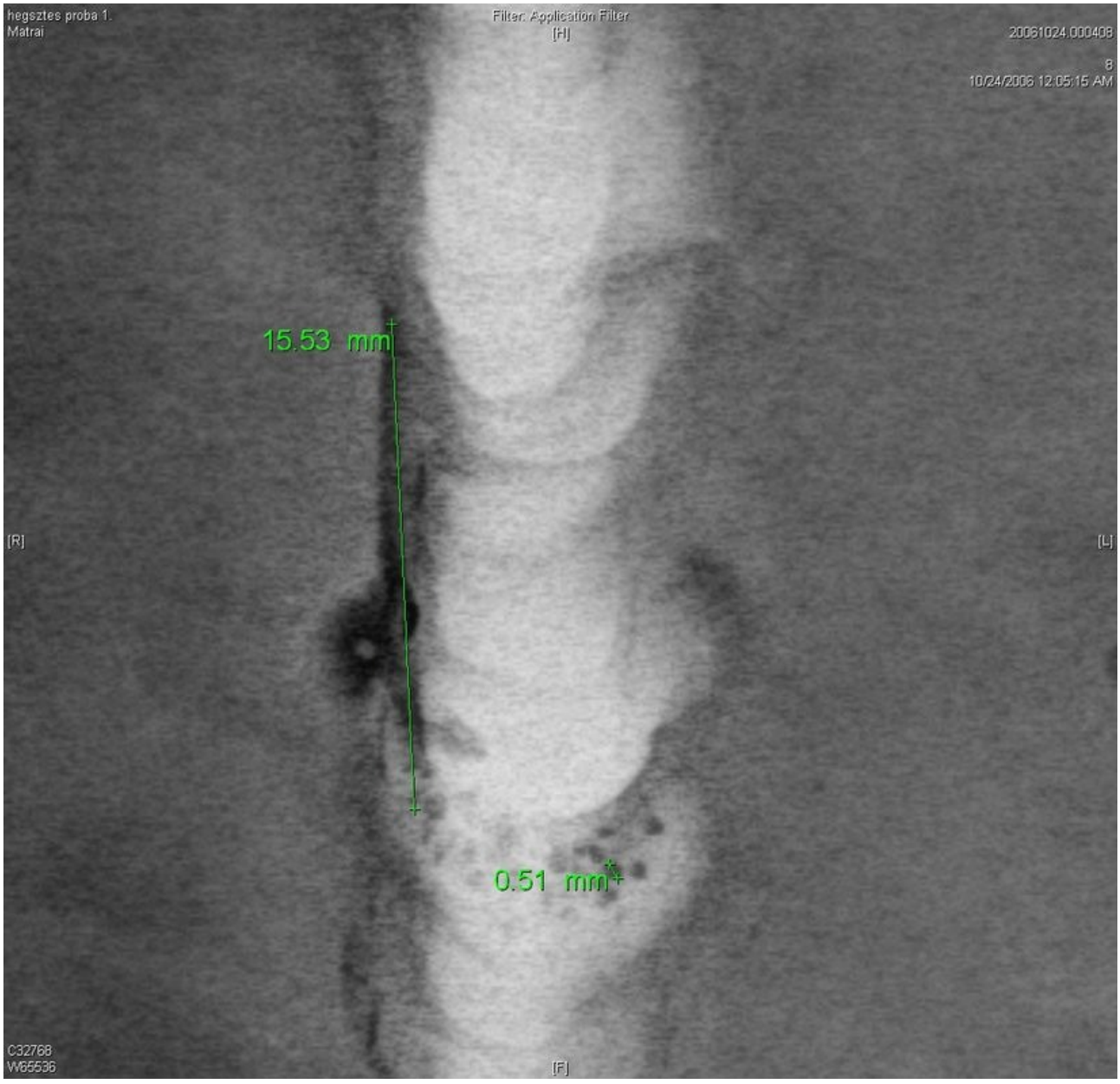
3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 15.**


1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

**Defect 16.**




1. What type of defect is this?
2. What is the defect number?

3. What are the key reasons for getting such a defect during welding?
4. How can you avoid this defect type during the welding?

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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

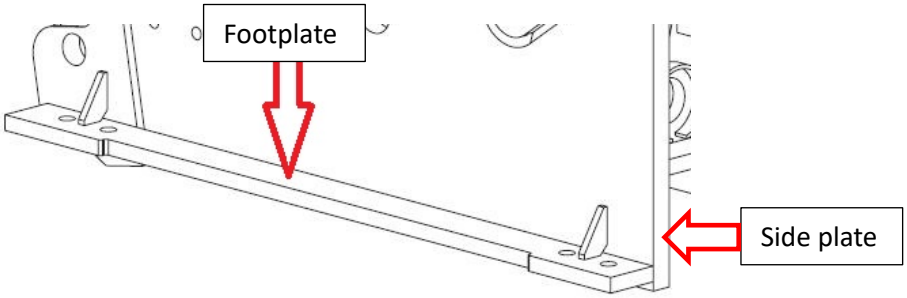
**Erasmus+**
**Cooperation partnerships in adult education**
**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-2 Cases for the training course-Repair of Frame

**Version:**
**Date:** **20.01.2023**

## An instruction for manual welding of footplate to the side plate of a frame.

A pWPS will be used as an instruction to weld the parts. See pWPS-S355-TBW-135-01!



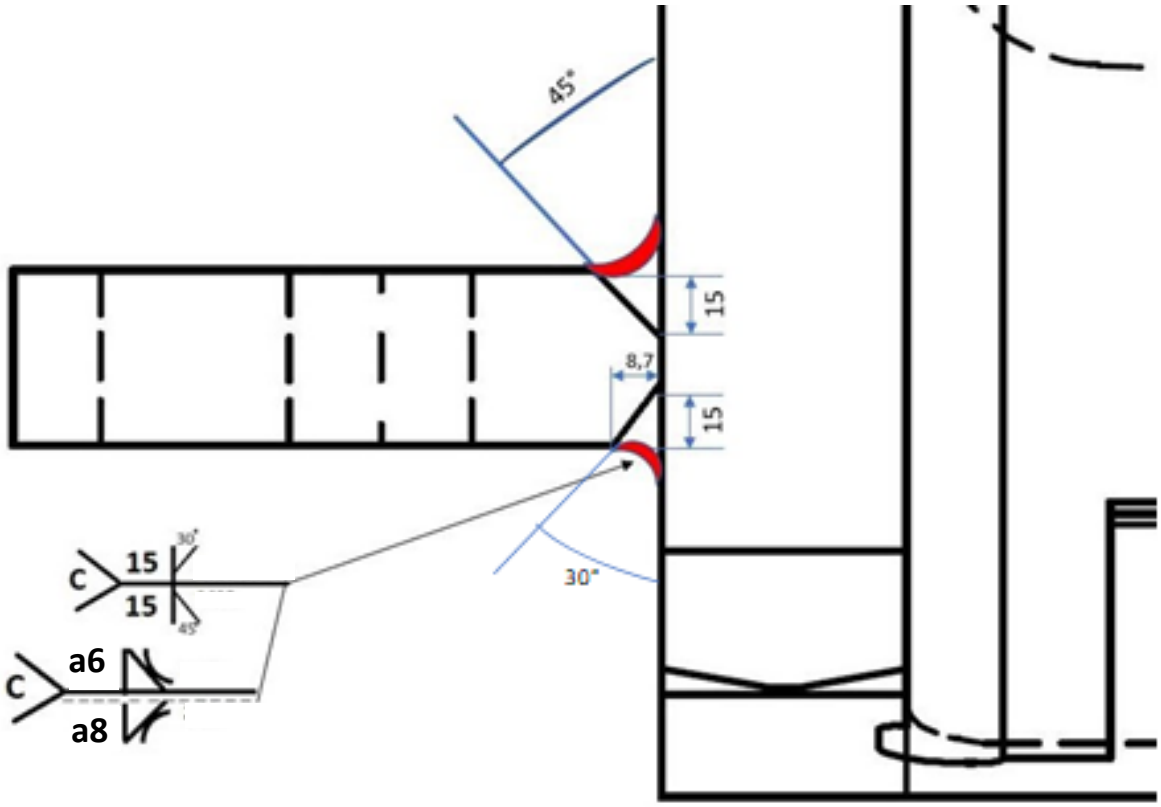

**Base material** for both footplate and side plate is EN 10025-3 S355N (1.0545), Gr 1.2

**Welding method:** 135, MAG

**Filler material:** EN ISO 14341-A:G 46 4 M21 4Si1 (SFA/AWS A5.18 ER70S-6)

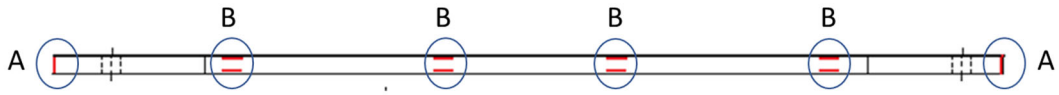
## The joint design

The joint is partial welded Double HY welds with additional fillet welds

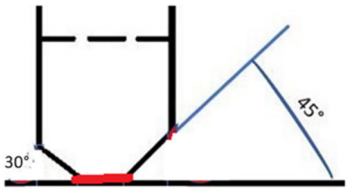


## Tack welds

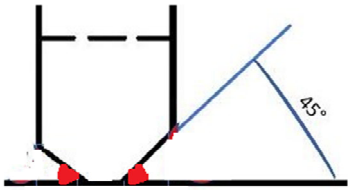
Tack welds are placed along and at the ends of the joint according following figure.




Position A, 2 positions: Single sided, each 20 mm long.

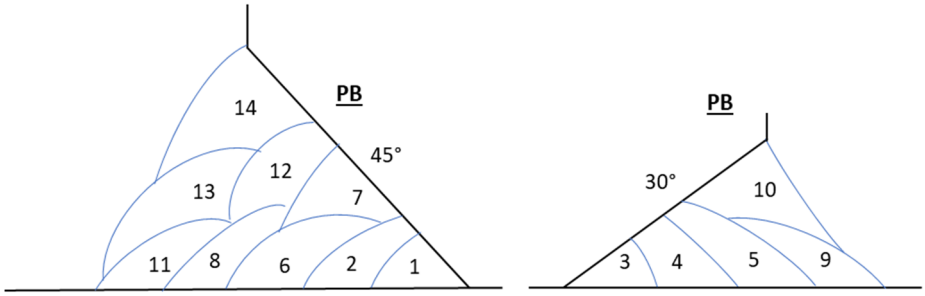



Position B, 4 positions: Double sided, each 50 mm long

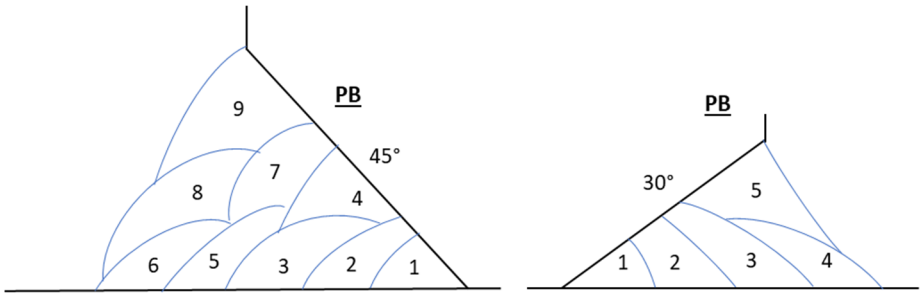



## The weld sequence (string planning)

In case one welder welds both sides of the joint the string planning should be as following figure.




In case two welders simultaneously weld each side of the joint the string planning should be as following figure.



Weld on Sweden
MAKES INDUSTRY GROW

# Svetsdatablad (pWPS)

Welding Procedure Specification
Enligt / According to: SS-EN ISO 15609-1

Svetsdatablad nr / WPS No: **S355-TBW-135-01**

WPQR nummer / WPQR No:

Tillverkare / Manufacturer: **Weld on Sweden**

| Enl. Figure / as figure | Grundmaterial beteckning / Parent material designation: | Materialtjocklek (mm) / Material thickness (mm): | Ytterdiameter rör (mm) / Outside pipe diameter (mm) |
|---|---|---|---|
| A: | **EN 10025-3 S355N (1.0545), Gr 1.2** | **Foot plate, T50** | |
| B*: | **EN 10025-3 S355N (1.0545), Gr 1.2** | **Frame side plate, T70** | |

Förbands- & svetstyp / Joint & weld type:
**Partial welded Double HY welds with additional fillet welds**

Svetsläge Welding position:
**PC-PB**

Metod för fogberedning & rengöring / Method of preparation & cleaning:
**Machining. Wire brushing for interpass cleaning**

s-mått el. a-mått / Throat thickness (mm):
**s15+a6 / s15+a8**

Förhöjd arbetstemperatur / Pre-heat temperature (°C):
**75 with mats and/or oppen flame**

Mellansträngstemperatur / Interpass temperature (°C):
**max 100**

Särskild värmning eller torkning / Any special baking or drying:
**NA**

Rotmejsling/rotstöd, detaljer / Details of back gouging/backing:
**NA**

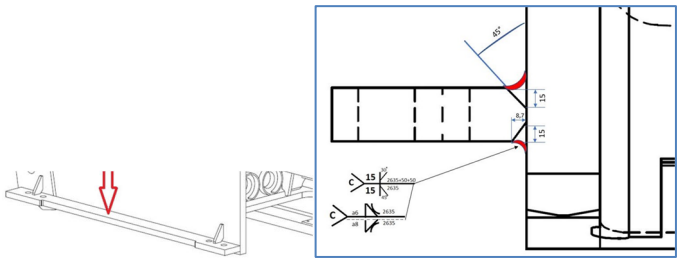
Svetsmetod och bågtyp / Welding method and mode of metal transfer*:
**ISO 4063-135-S (+M21)**

Annan information / Other information *:
**Filler materials with equivalent mechanical properties, same nominal composition and same or lower hydrogen content as following can be used**
**EN ISO 14341-A:G 46 4 M21 4Si1 (SFA/AWS A5.18 ER70S-6)**

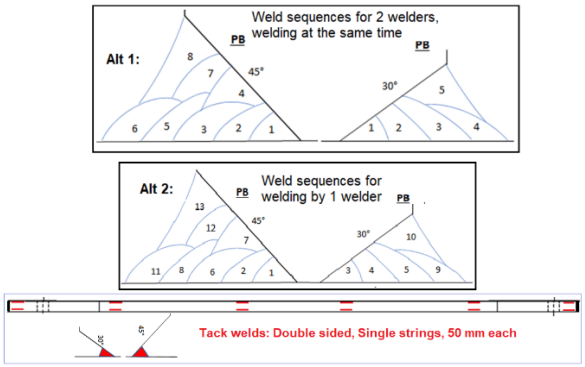
Antal strängar och lager / Number of runs and layers:
**Multi run**

Häftsvetsning (metod) / Tack welding (method):
**135, the same setting as 1:st run**

Fogutformning / Joint design [mm]



Strängplanering / Welding sequences




| Lager, Sträng, / Layer, Run | Svets-metod / welding process | Elektrodmaterial / Electrode material: Beteckning / Designation | Fabrikat / Make | Diam. (mm) | Ström / Current (A) | Spänning / Voltage (V) | Strömtyp / Polarity | Bågtyp / Transfer mode | Gas el. Pulver beteckning topp/rot Gas or Flux | Gas-flöde (l/min) topp/rot Gas flow | Trådmatnings-hastighet (m/min) Wire feed | Utsticks-längd (mm) Stick out | Längd (mm) el. Hast (mm/min)* Length or speed | Sträck-energi* (kJ/mm) Heat input |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tack 1-12 | 135 | G46 4 M21 4Si1 | OK AristoRod 12.63 | 1,2 | 290 | 30,5 | DC+ | S | M21 | 20 | 10 | 20 | 510 | 0,85 |
| S1-S2 Alt 1 | 135 | G46 4 M21 4Si1 | OK AristoRod 12.63 | 1,2 | 290 | 30,5 | DC+ | S | M21 | 20 | 10 | 20 | 510 | 0,85 |
| S3-S8 Alt 1 | 135 | G46 4 M21 4Si1 | OK AristoRod 12.63 | 1,2 | 260 | 29 | DC+ | S | M21 | 20 | 8,5 | 20 | 450 | 0,92 |
| | | | | | | | | | | | | | | |
| S1-S4 Alt 2 | 135 | G46 4 M21 4Si1 | OK AristoRod 12.63 | 1,2 | 290 | 30,5 | DC+ | S | M21 | 20 | 10 | 20 | 510 | 0,88 |
| S5-S13 Alt 2 | 135 | G46 4 M21 4Si1 | OK AristoRod 12.63 | 1,2 | 260 | 29 | DC+ | S | M21 | 20 | 8,5 | 20 | 450 | 0,85 |
| | | | | | | | | | | | | | | |

Väteutdrivning / Post-heating:
**8 h / 200 °C (HR 60 °C/h)**

Värmebehandling efter svetsning &/el. åldring / Post weld heat treatment &/or ageing:

(Tid, temperatur, metod, uppvärmnings- och svalningshastigheter*)

Varmhållningstemperatur / Pre-heat maintenance temperature (°C):
**75**

Utarbetad av (Tillverkare) / Prepared by (Manufacturer):

Namn / Name: **Ali Bahrami, IWE SE181**

Signatur /Signature: .....

Datum / Date: **2023-06-12**

Granskare (om annan än tillverk.) / Examiner (if other than manufact.)

Namn / Name:

Signatur /Signature: .....

Datum / Date:

# Welding Record

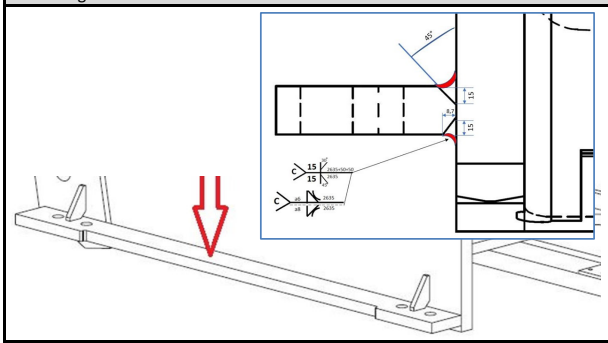
| Product/object | | | pWPS/WPS No | Welding Record No | Page |
|---|---|---|---|---|---|
| Welding Footplate to Frameside | | | pWPS-S355-135-03 | 1 | 1 |
| Base material designation | Charge No | | Filler material (designation, Make, Size) | Charge No | |
| EN 10025-3 S355N (1.0545) | | | G46 4 M21 4Si1/Aristorod 12.63 Ø1,2 | | |
| Base material group (ISO/TR 15608) | Charge No | | Any special backing or drying | Tungsten electrode, type/dimension | |
| Group 1.2 | | | | | |
| Welding Method (ISO 4063) | Welding Position | | Details of back gouging / Backing (depth & shape) | Method of preparation and cleaning | |
| 135 | PB | | - | Machining. Wire brushing | |
| Shape of BM (Tube/Plate) | Thickness (mm) | Diameter (mm) | Weaving (maximum width of the run) | Weaving amplitude, frequency, dwell time | |
| Plate | 50/70 | | - | - | |
| Shielding gas/Flux, top side | Gas flow, top side (l/min) | | Distance between contact tube to welding point | Gas nozzle diameter (MIG, MAG, TIG) | |
| M21 | 20 | | 20 | | |
| Backing gas/Flux | Gas flow, backing (l/min) | | Plasma Welding, details | Torch angle, Work angle | |
| - | - | | - | | |
| Preheat maintenance temp. (°C) | Max interpass temperature (°C) | | Post-heating for hydrogen release (Time & temp.) | Pulse welding, Details | |
| 75 | 100 | | 8 h/200 °C | | |
| Post weld heat treatment (time, temp. & method) | | | Heating / Colling rate | | |
| | | | 60 °C/h | | |
| | | | Welding method, efficiency, k: | 0.8 | |

Heat input: $Q = k\frac{U\times I\times t}{1000\times l}\,\mathrm{kJ/mm}$

121: k = 1,0
111, 114, 131, 135, 136, 137, 138 : k = 0,8
141, 15 : k = 0,6

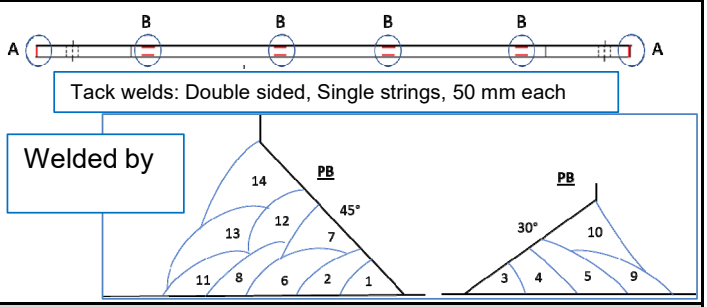
| Layer, string | Welding method | Electrode diameter mm | Welding current (I) A | Welding voltage (U) V | Polarity | String length (l) mm | Welding time (t) s | Interpass temp °C | Wire feed speed m/min | String width mm | Transfer mode (MIG/MAG) | Welding speed mm/min | Heat input kJ/mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TW | 135 | 1.2 | | | DC+ | | | | | | | | |
| S1 | 135 | 1.2 | 290 | 30.5 | DC+ | 2690 | 300 | 80 | 9.7 | 10 | S | 538 | 0.79 |
| S2 | 135 | 1.2 | 290 | 30.5 | DC+ | 2690 | 310 | 85 | 9.7 | 10 | S | 521 | 0.82 |
| S3 | 135 | 1.2 | 290 | 30.5 | DC+ | 2690 | 330 | 85 | 9.7 | 10 | S | 489 | 0.87 |
| S4 | 135 | 1.2 | 290 | 30.5 | DC+ | 2690 | 320 | 90 | 9.7 | 10 | S | 504 | 0.84 |
| S5 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 360 | 90 | 9.55 | 8 | S | 448 | 0.81 |
| S6 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 365 | 93 | 9.55 | 8 | S | 442 | 0.82 |
| S7 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 380 | 95 | 9.55 | 8 | S | 425 | 0.85 |
| S8 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 360 | 95 | 9.55 | 8 | S | 448 | 0.81 |
| S9 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 365 | 93 | 9.55 | 8 | S | 442 | 0.82 |
| S10 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 365 | 92 | 9.55 | 8 | S | 442 | 0.82 |
| S11 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 355 | 93 | 9.55 | 8 | S | 455 | 0.80 |
| S12 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 355 | 85 | 9.55 | 8 | S | 455 | 0.80 |
| S13 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 365 | 85 | 9.55 | 8 | S | 442 | 0.82 |
| S14 | 135 | 1.2 | 260 | 29 | DC+ | 2690 | 370 | 85 | 9.55 | 8 | S | 436 | 0.83 |

Joint design



Welding sequences

Throat thickness (if necessary)




Remark

| Minutes of | Welding date | Signature | ID No |
|---|---|---|---|
| AAB | 2023-07-11 | | |

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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

**Erasmus+**
**Cooperation partnerships in adult education**
**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-3 Cases for the training course-A weld inspection report

---

**Version:**
**Date:** **20.01.2023**

**An industrial case for repair-welding quality.**

**Summary.**

After several meetings and discussion about the weld quality at the Clients site a decision was made to reject the welds during a visit by the customer

The reasons for rejecting the welds were several together with a great amount of uncertainty about what actually happened during the welding process of the Clients site

The initial cause for all the meetings and discussions were excessive root protrusion observed and reported during the final inspection a the Clients site by the Customer.

**The case.**

This industrial case can be basis for a lot of different questions and reflections. Here are some questions that might be relevant:

1. What does this report tells us about the skills and competence of the welder?
2. What actions should the welder have been carrying out?
3. What does this report tells us about the Client?
4. What about the Clients QA system and documentation?
5. What about the Welding Inspectors role and responsibilities?
6. What costs will be involved here for the repair?
7. What consequences will this report have on actual further inspection activities?
8. What relation will the Customer and Client have after a case like this?

**Background.**

This is the report from a meeting between the Customer and a Client:

The initial cause for all the meetings and discussions were excessive root protrusion observed and reported during the final inspection at the Clients site by Customer representative.

Localised root protrusion exceeding acceptance criteria in Norsok M-601 was creating a lot of discussion ending in an instruction from the Customer to cut a section of the Hub and Pup piece, approximately 100 mm on each side of the weld and send the ring to test at the approved testing body.

The test ring was cut in three pieces of 120 deg. in axial direction and only the two sections with the most excessive root protrusion were tested.

The extent of testing was:
2- off root bend
1- of HV hardness survey in root area
1- of macro examination
1- of micro examination in root area on the Duplex side
1- of ferrite count in root area on the Duplex side
1- off G48 corrosion test at 25 deg. C

All tests pass except for the two root bend tests who failed with minor cracks. Two new traverse root bend test was performed in accordance with ISO 15614-1 and ASME IX and both pass successfully.

During the testing at the approved test body with the test ring cut in three pieces, it was possible to inspect the root area closely and pictures was sent to the Customer.. Those pictures revealing a poor looking root pass with several repair areas.

**History.**

Repairs have never been reported to the Customer and when asked by the Customer, the Client denies that there had been repair in the root pass.

The Clients explanation was that those areas exposed on the photos were stop/start in the root run, not weld root repair according their explanation in a mail.
"During production welding of root run, the welding technician, if not fully happy with the weld deposited, is permitted to dress back weld metal and deposited new weld. This is carried out in the process of production welding, i.e. before the weld is offered up for any inspection and cannot be classified as a repair."

With this explanation in mind it is easy to see what has happened. The welder have been working hard to make a proper root pass and areas which the Client denies are repair, is actually cut back areas of up to 50-60 mm. long re-welded root run and can be categorize as repair. To make bad worse, the root pass in those areas are blue/black coloured due to poor argon gas protection. The welders haven’t been waiting long enough, after cut back, to remove or blow grinding dust and oxygen away before start welding the root pass again.

Inspection performed by the Customer at the Clients facilities during the visit,  identify nearly the same amount of cut-back areas and the same unacceptable oxidation of the root pass with black colour in cut-back areas and a blue to black band on each side of the root pass.

Irregular and uneven root pass with excessive internal root protrusion up to 4 mm and with no smooth transition to the base material was observed in most of the Hub´s. In two of the Hubs, the Client had also tried to remove excessive root protrusion by grinding without the Customer´s approval.

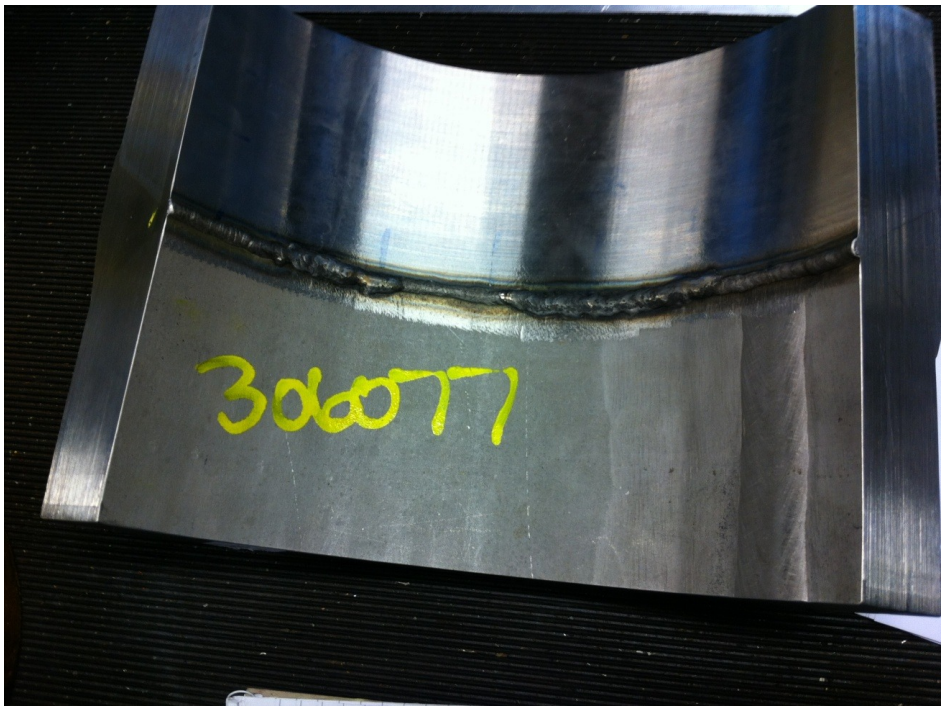
When ask for documentation from the manufacturing process at the Client, there was no documented evidence of welding inspection performed before and during welding. No monitoring documents of welding parameter such as amp, voltage, travel speed and heat input. No evidence of measuring oxygen content in back gas purging during welding. No evidence of welding inspection of the root pass.

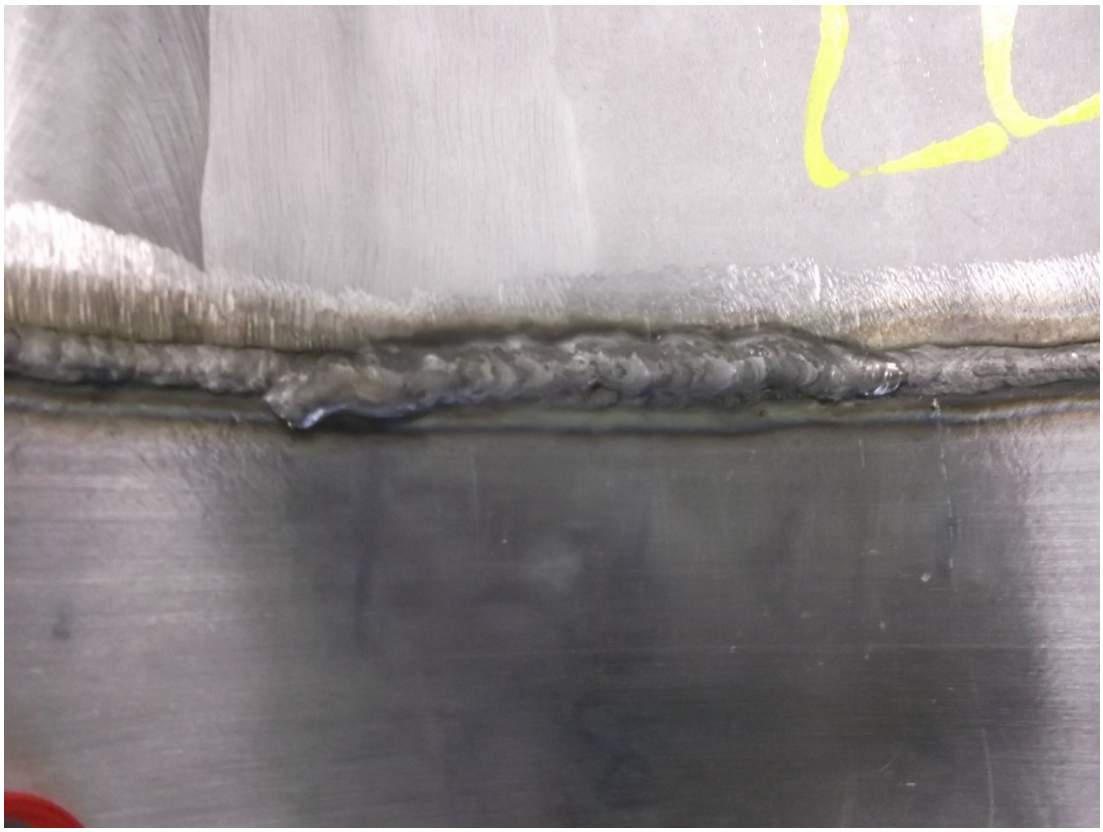
The Clients reply to the requirement for evidence of monitoring documentation was "that it was not a project requirement and not a standard within the industry".

Requirements for weld inspection and weld inspection reports are clearly described in Norsok M-601 section 5.6. and it is an essential requirement for the Customer. If anything's is going wrong it is important information for making a qualified decision.

**Conclusion.**
With the weld imperfections observed and described above and no documented evidence of the welding process at the Client, the only possible decision to make was to reject the welds.


3060


300077



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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

**Erasmus+**
**Cooperation partnerships in adult education**
**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-4 Cases for the training course-Welding a girder to plate

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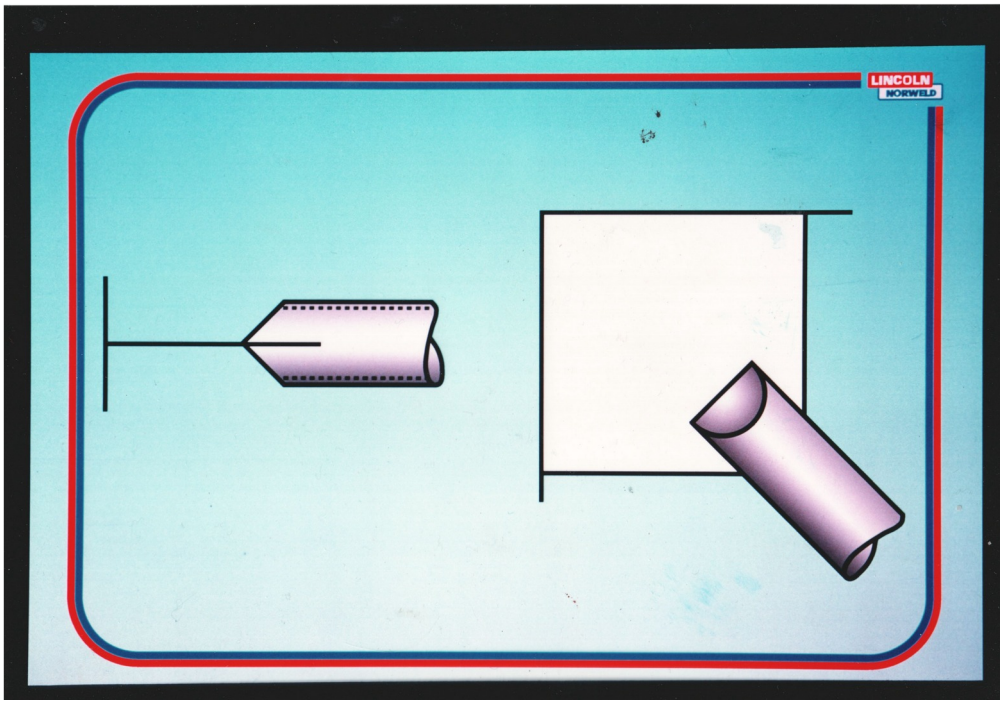
**Version:**
**Date:** **20.01.2023**

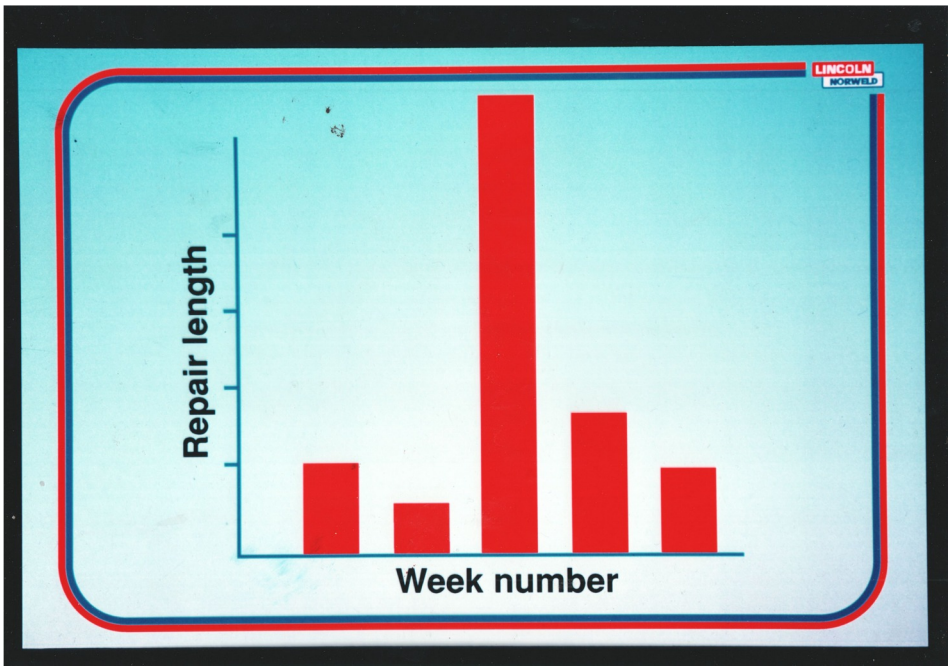
**Welding a pipe girder to a bracket.**

The welders got a work task to weld a number of pipe girders to bracket and to weld the bracket to the structure.
The task was to:
1. Cut or create a slice in the pipe, Ø300,  for the bracket.
2. Insert the bracket into the slice and fillet weld the connection.
3. Add two end segment to the pipe so that the pipe is fully closed.
4. Fasten the bracket to the steel structure.




Questions:
1.How would you weld this connection?  (in what sequence)
2. How many welds do you have here?
3. How would you inspect your welding job?

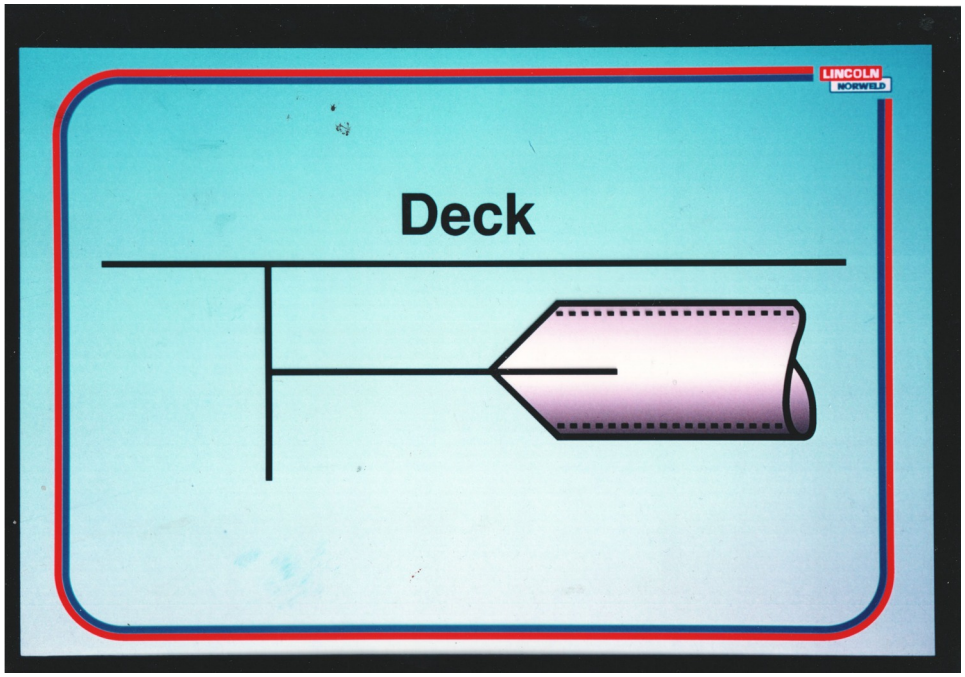
The the following statistics give you the weekly repair rate for the company. We see an enormous increase in the repair length for the week when this special connection was welded.




Questions:

1. Any idea why this happened ?
2. Are you missing any information in order to explain this occurrence?

The welded girder connection fastened to the deck structure.
NOTE: The Deck structure is of course horizontal.




Questions:

1. What causes the problem for the welder here?
2. Have the welder any responsibility to comment this welding connection?
3. What can be done here in order to create a better access condition?
3a. At the design stage
3b. At the production stag you have done in a case like this?

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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

**Erasmus+**
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**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-5 Cases for the training course

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**Version:**
**Date:** **20.03.2024**

# Assembling and welding a press.

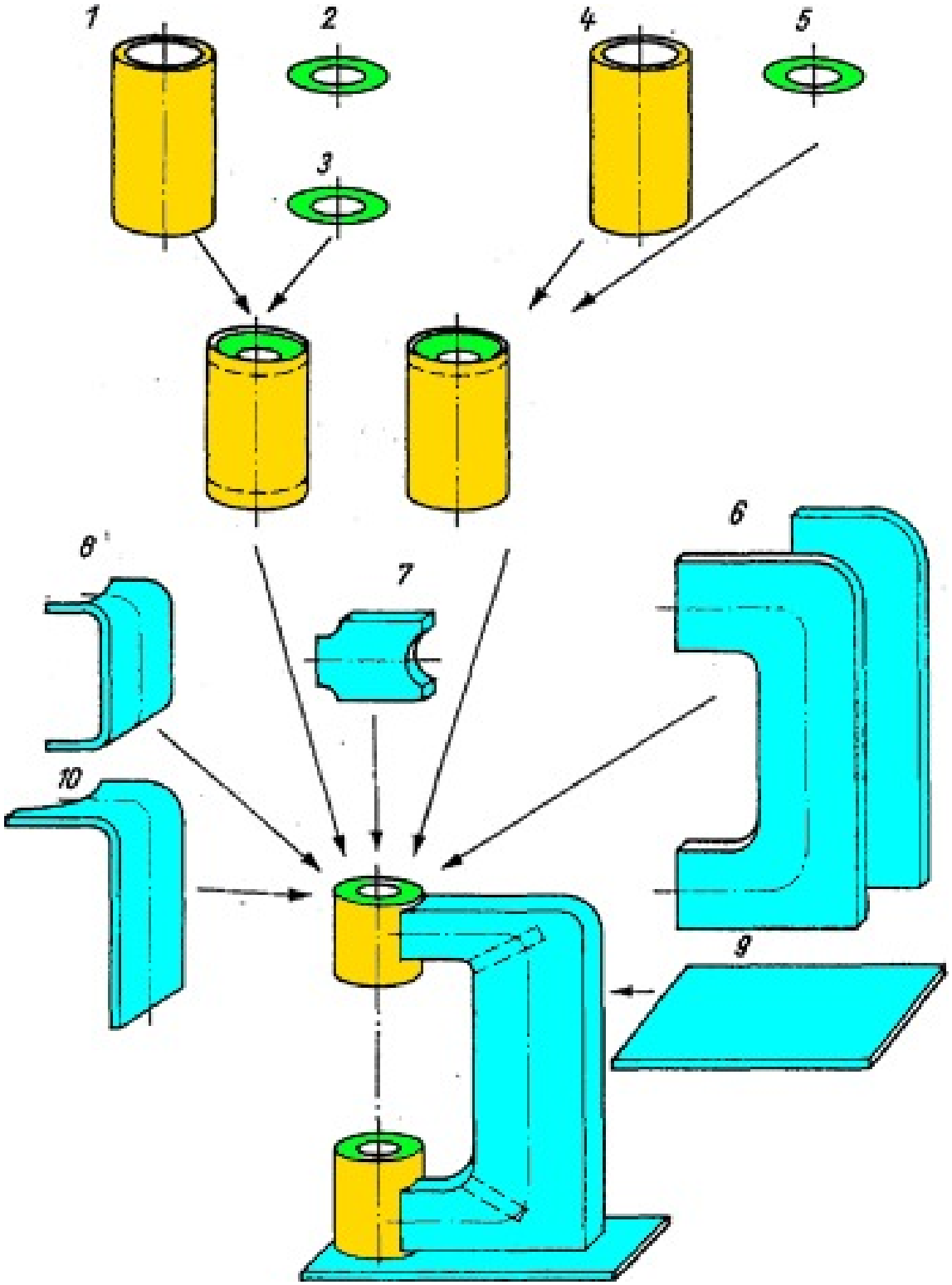
## Product features:

Important data:
- welded construction,
- box beam construction,
- maximum pressing force 15 kN,
- length 1075 mm,
- height 2000 mm,
- width 450 mm

Individual parts:
1 pressure cylinder, top;
2 cylinder ring, top;
3 Cylinder ring, top;
4 pressure cylinder, below;
5 Cylinder ring, below;
6 side wall;
7 bulkheads:
8 front plate
9 floor plate
10 back plate

Questions:

1. Describe how will you carry out the welding sequence?
2. Describe how will you inspect and document your work after welding?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# IQSIM2

## New Innovative Simulator Tools for Quality Capacity Environmental Production Process Training in Education of Migrants

**Erasmus+**
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**Agreement no.: 2021-1-NO01-KA220-ADU-000033720**

## D3.1-6 Cases for the training course-Assembling a structure

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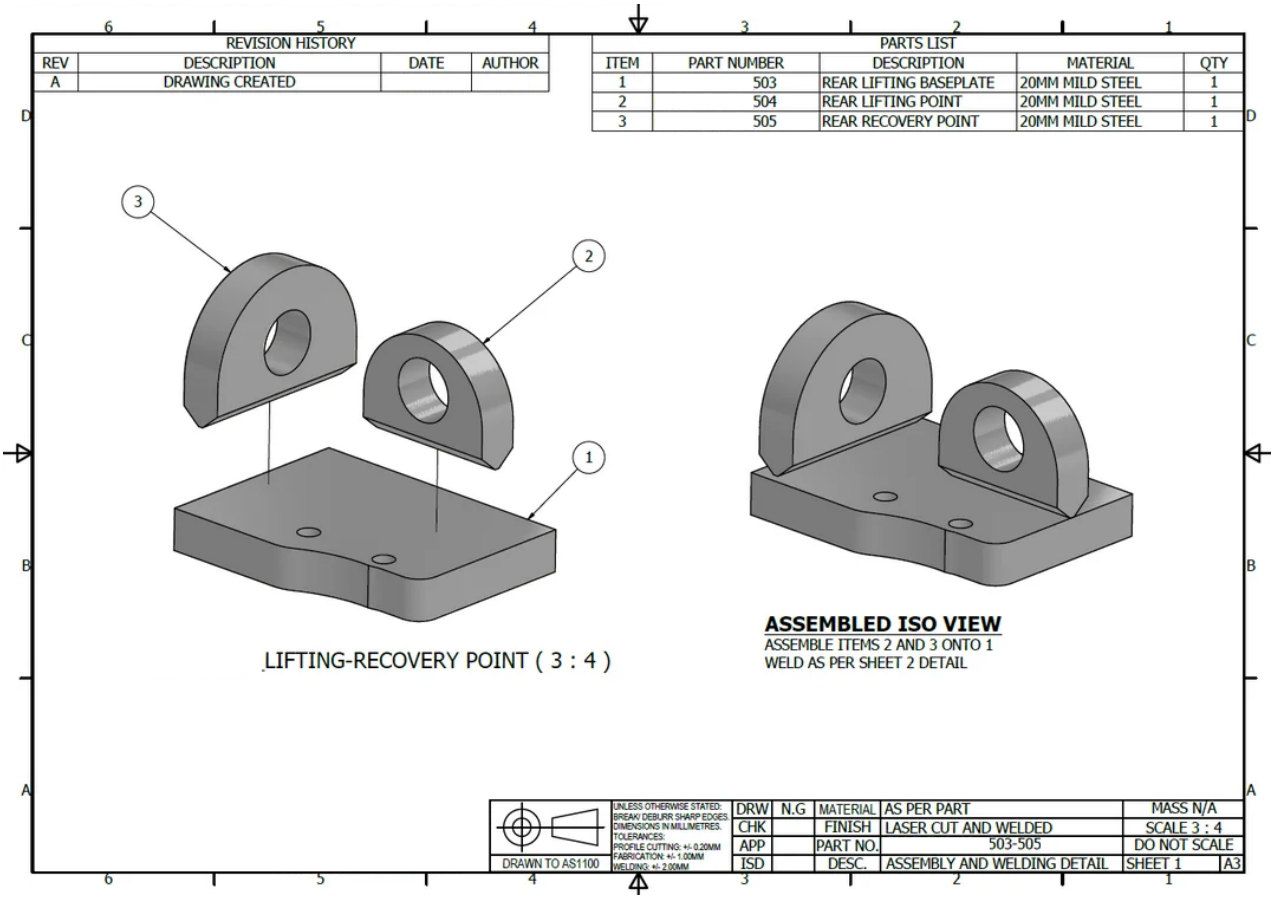
**Version:**
**Date:** **06.04.2024**

## Assembling a metallic structure

**Product features: Mild steel t=20 mm**
**Dynamically loading**
**Number of pieces to be realized: 50**

Questions:

1. Describe how will you chose the joint form and how will be their designation?
2. Detail the reasons for chose a specific welding process.
3. Detail the welding sequence.
4. Detail the reasons for chose a specific inspection plan and methods
5. Describe the main phases of work documenting after welding?



| REVISION HISTORY | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | AUTHOR |
| A | DRAWING CREATED | | |

| PARTS LIST | | | | |
|---|---|---|---|---|
| ITEM | PART NUMBER | DESCRIPTION | MATERIAL | QTY |
| 1 | 503 | REAR LIFTING BASEPLATE | 20MM MILD STEEL | 1 |
| 2 | 504 | REAR LIFTING POINT | 20MM MILD STEEL | 1 |
| 3 | 505 | REAR RECOVERY POINT | 20MM MILD STEEL | 1 |



LIFTING-RECOVERY POINT ( 3 : 4 )

**ASSEMBLED ISO VIEW**
ASSEMBLE ITEMS 2 AND 3 ONTO 1
WELD AS PER SHEET 2 DETAIL

UNLESS OTHERWISE STATED:
BREAK/ DEBURR SHARP EDGES.
DIMENSIONS IN MILLIMETRES.
TOLERANCES:
PROFILE CUTTING: +/- 0.20MM
FABRICATION: +/- 1.00MM
WELDING: +/- 2.00MM

DRAWN TO AS1100

| | | | | |
|---|---|---|---|---|
| DRW | N.G | MATERIAL | AS PER PART | MASS N/A |
| CHK | | FINISH | LASER CUT AND WELDED | SCALE 3 : 4 |
| APP | | PART NO. | 503-505 | DO NOT SCALE |
| ISD | | DESC. | ASSEMBLY AND WELDING DETAIL | SHEET 1 A3 |

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# The effect of the welding parameters on the welding geometry of the seam

IQSIM2 kísérleti tanfolyam CU5

Benus Ferenc

# Welding parameters:

## Effect of change in the current

The examples have a set of different welding parameters and you will see how the results will be in the weld.

General questions to all examples:

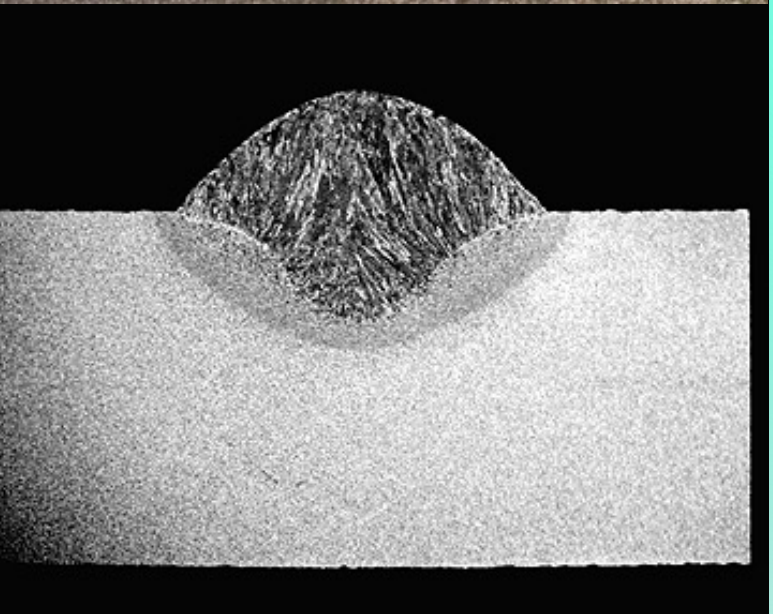
1. How can you correct the welding parameters so that the results are within the acceptable range?

2. What type of weld defects may occure?

3. During the welding itself—how will you discover that you are out of the range for the welding parameters?

# Wire feed and voltage

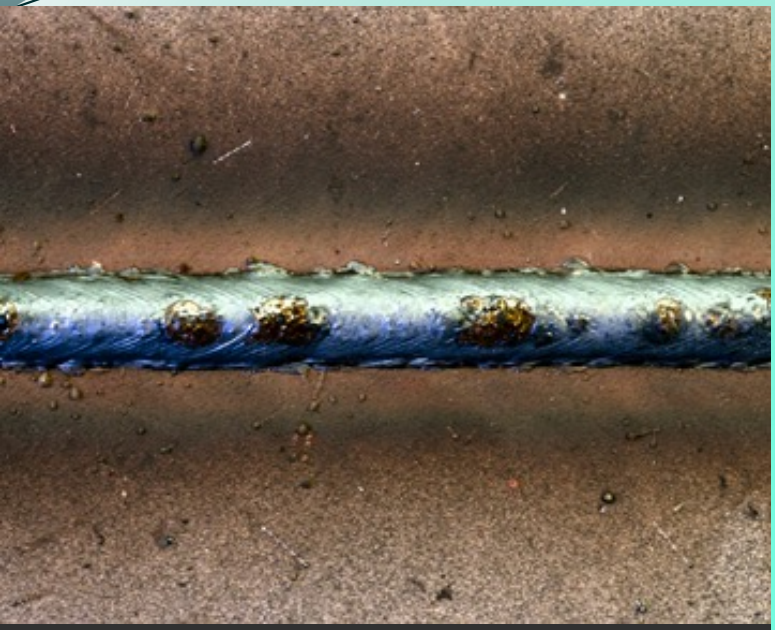
# Short circut

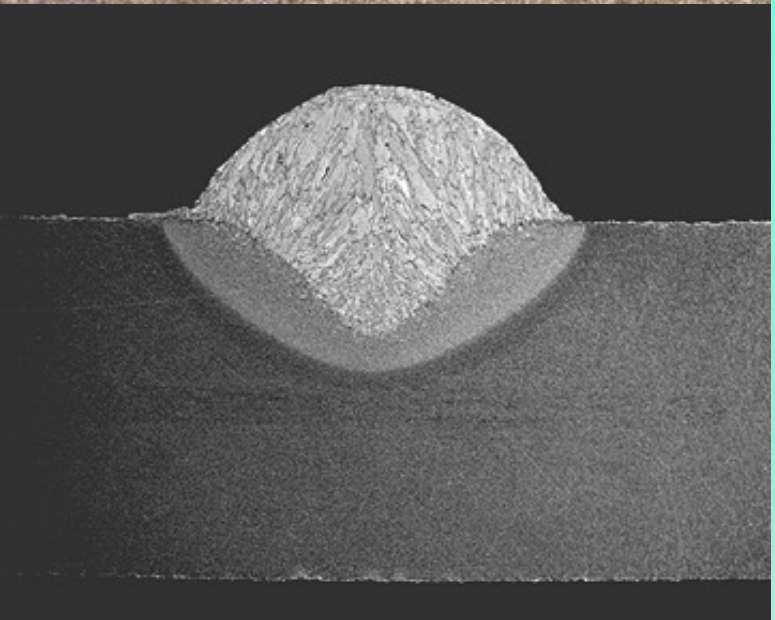


Material thickness: 10 mm
Material quality: S235
Wire. dia Ø: 1,2 mm
Current: **225 A**
Voltage: 23 V
Shield gas : M21
Gas flow: 18
Welding position: PA

# The wire width is large

# The wire feed speed is high





Wire dia: 1,2 mm

Current: **265 A**

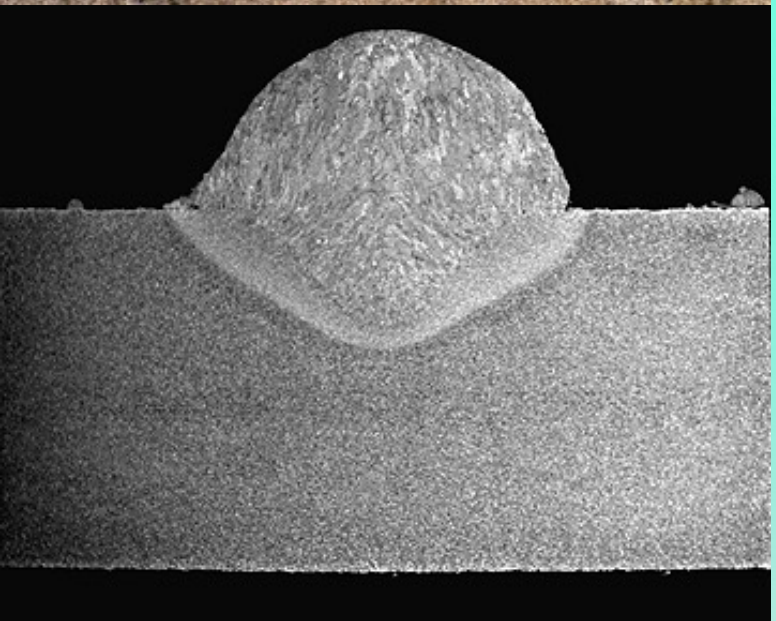
Voltage: 23 V

Shielding gas : M21

Coarser arc and spattering

# The wire speed is too high

# The wire feed speed is too high



Wire diameter: 1,2 mm

Current: **305 A**

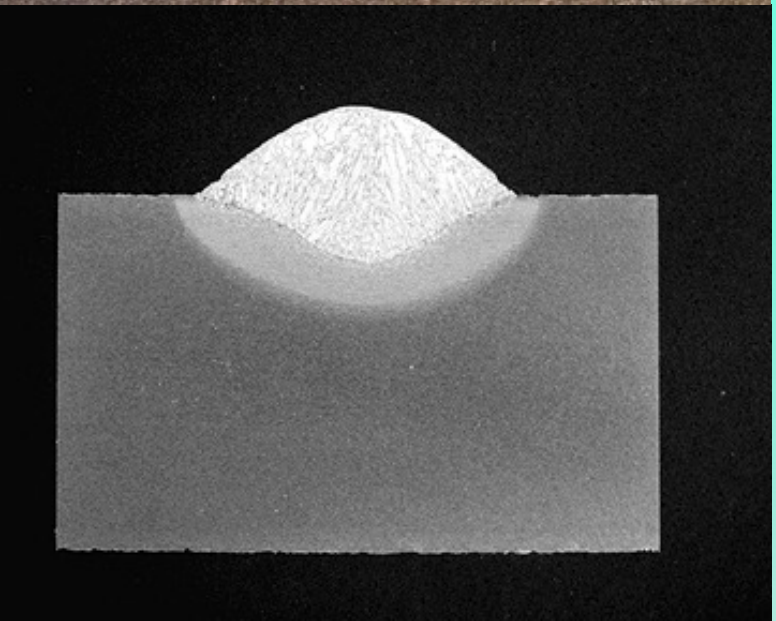
Voltage: 23 V

Shielding gas : M21

Coarser and significant spattering

# The wire width is small

# The wire width is small



Wire diameter: 1,2 mm

Current: **165 A**

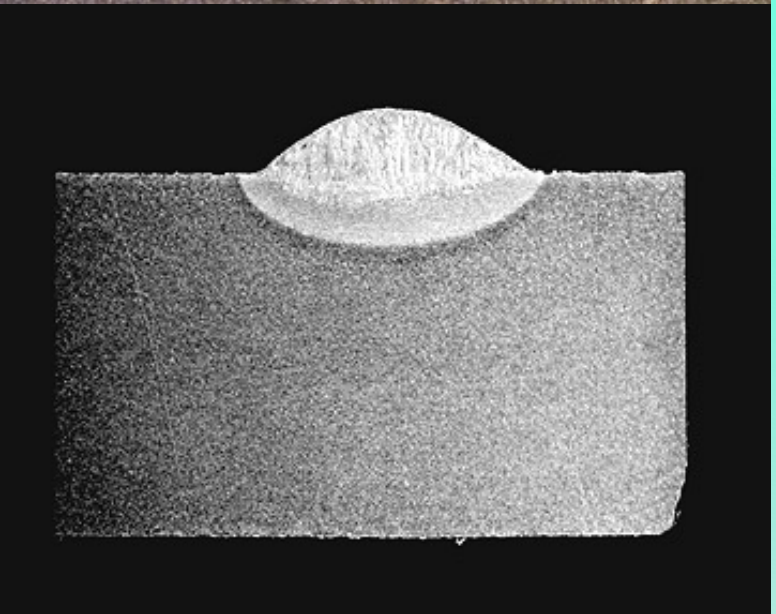
Voltage: 23 V

Shielding gas : M21

The arc is „relaxed”

# The wire width is very small

# The wire width is very small



Wire diameter: 1,2 mm

Current: **110 A**

Voltage: 23 V

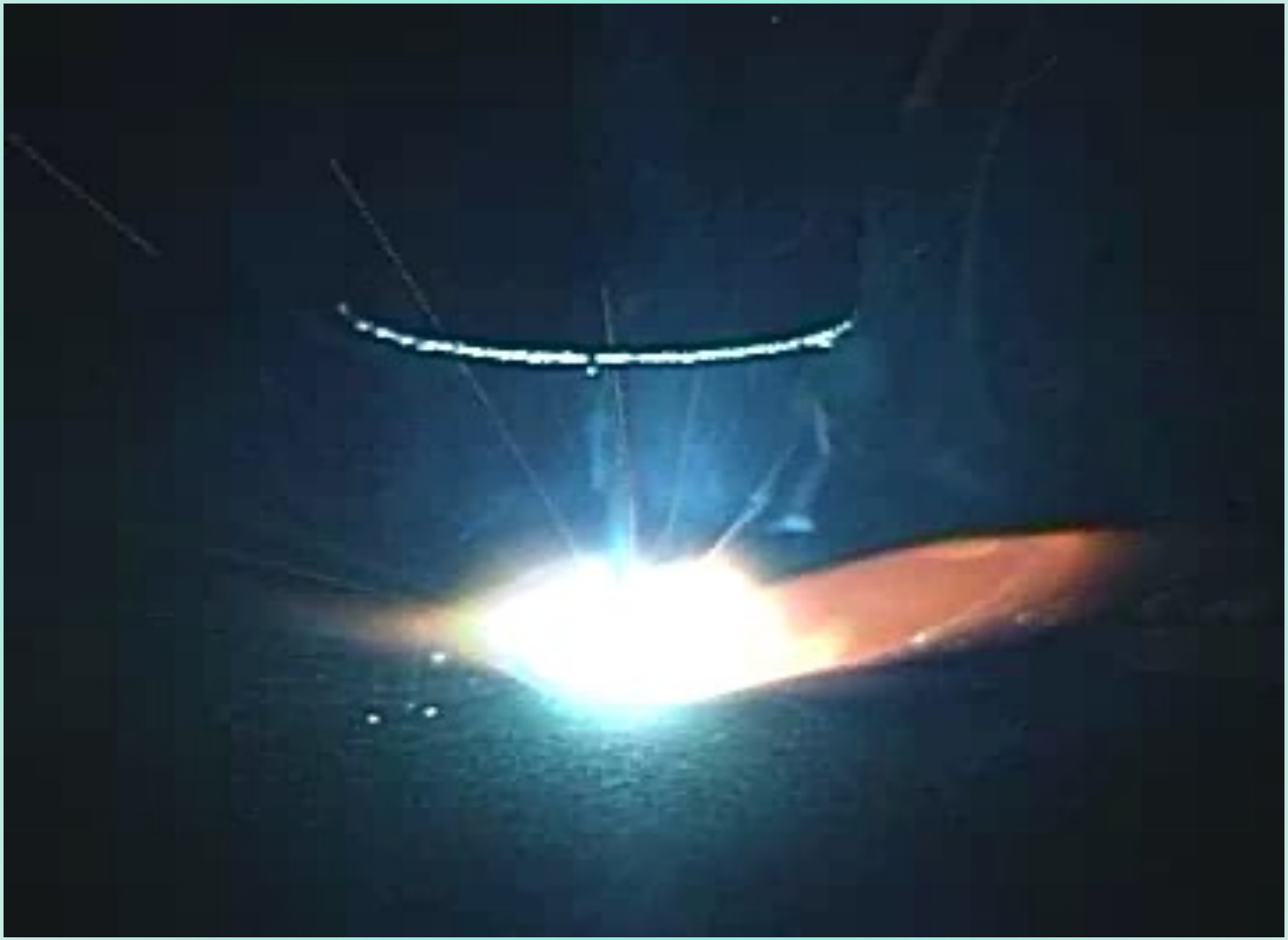
Shielding gas : M21

**Irregular short circuts, rough arc and spattering**

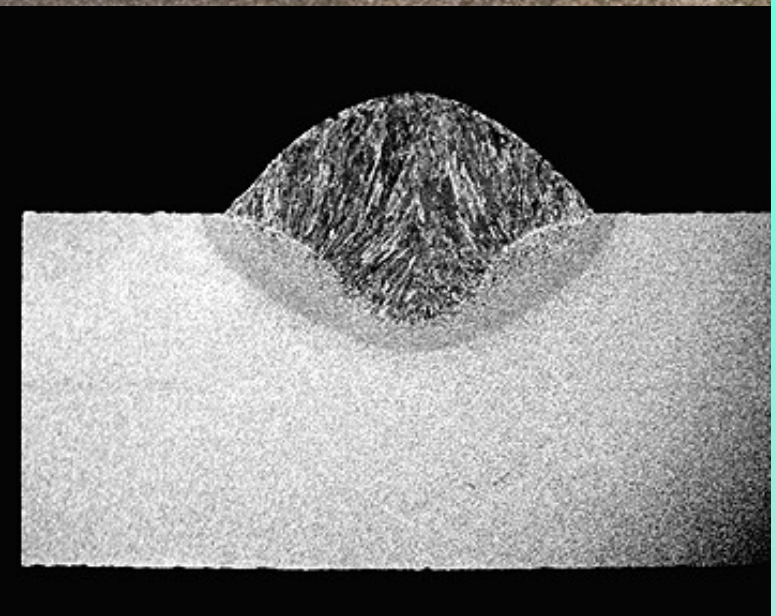
# Welding parameters:

## Effect of stress variations

# Alignment of wire speed and voltage



# Alignment of wire speed and voltage

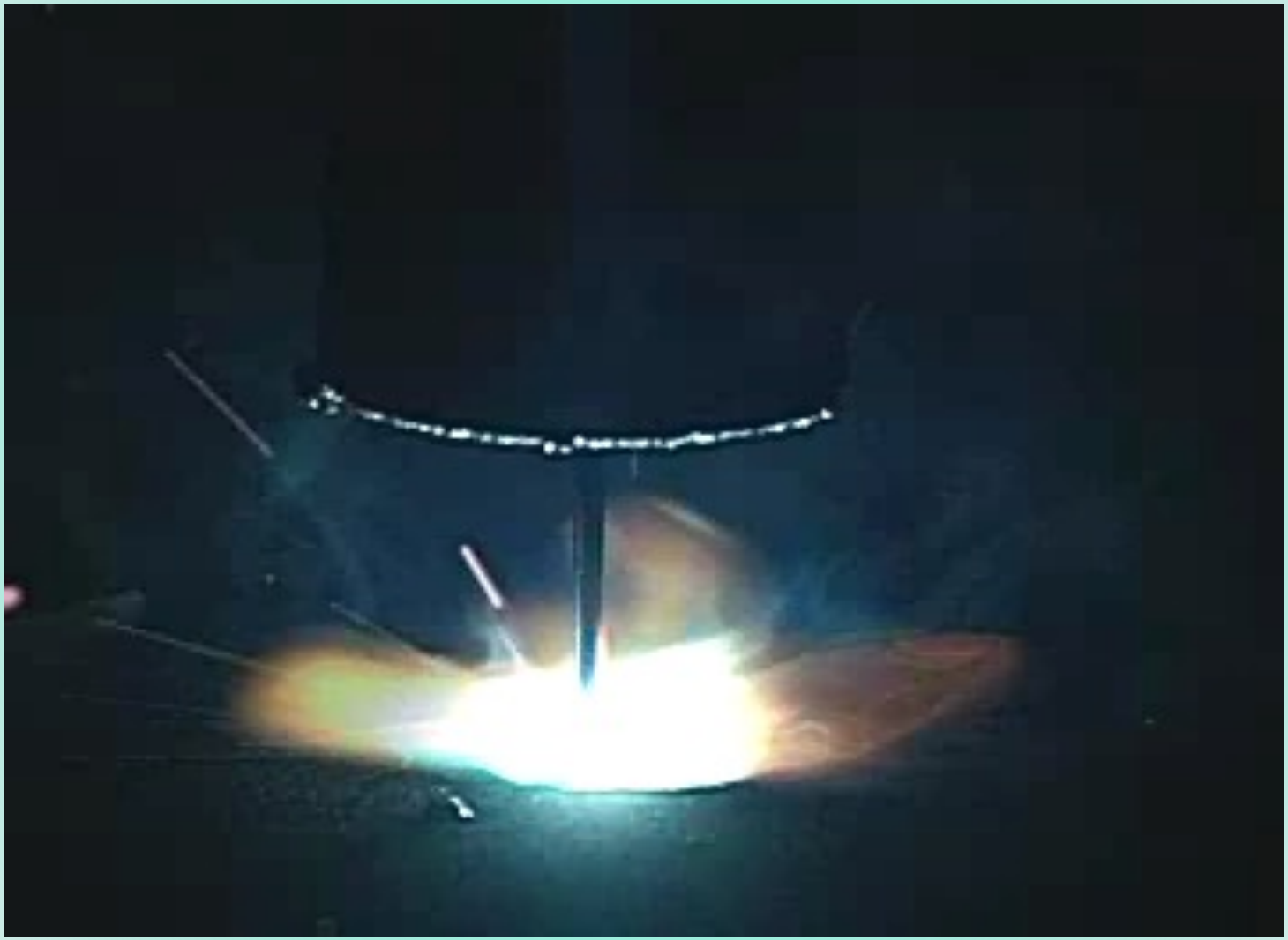


Wire diameter: 1,2 mm

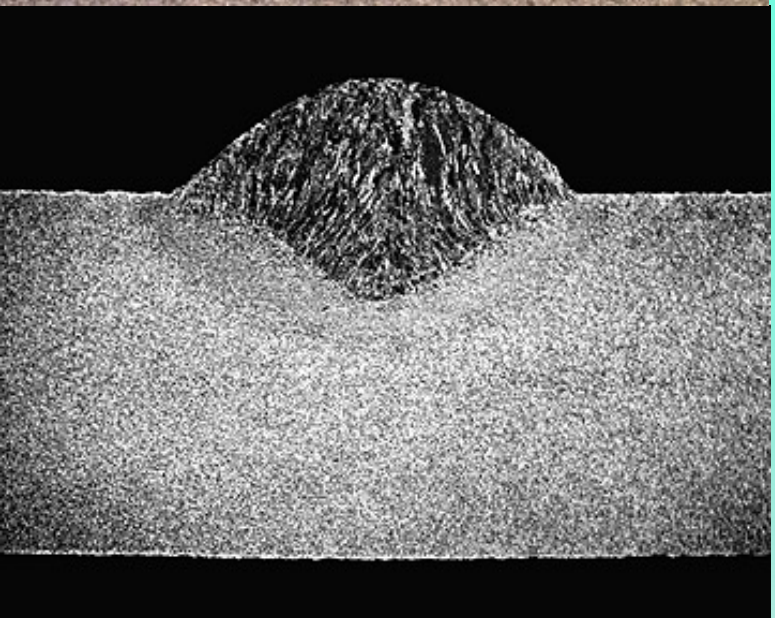
Current: 225 A

Voltage: **23 V**

# Tension of closed arc is high



# Tension of closed arc is high



Wire diameter: 1,2 mm

Current: 225 A Voltage:

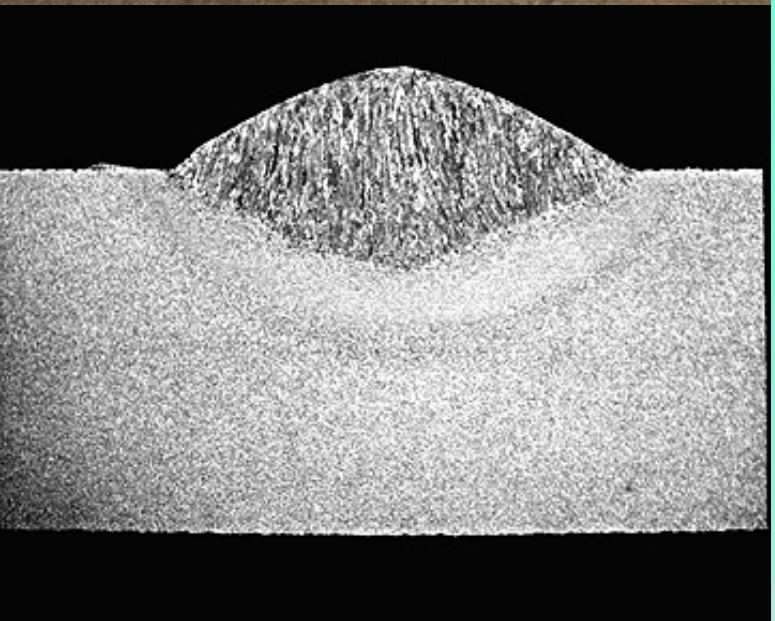
**25 V**

Shield gas : M21

**Slightly irregular arc**

# Tension of closed arc is too high

# Tension of closed arc is too high

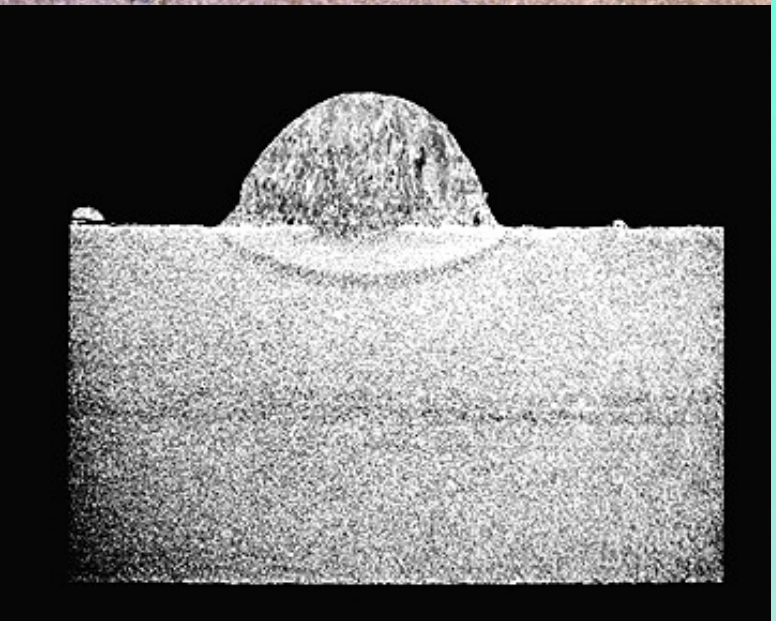


Wire diameter: 1,2 mm
Current: 225 A
Voltage: **30 V**
Shielding gas : M21

Coarse irregular arc and strong spattering

# Closed arc tension is small

# Closed arc tension is small



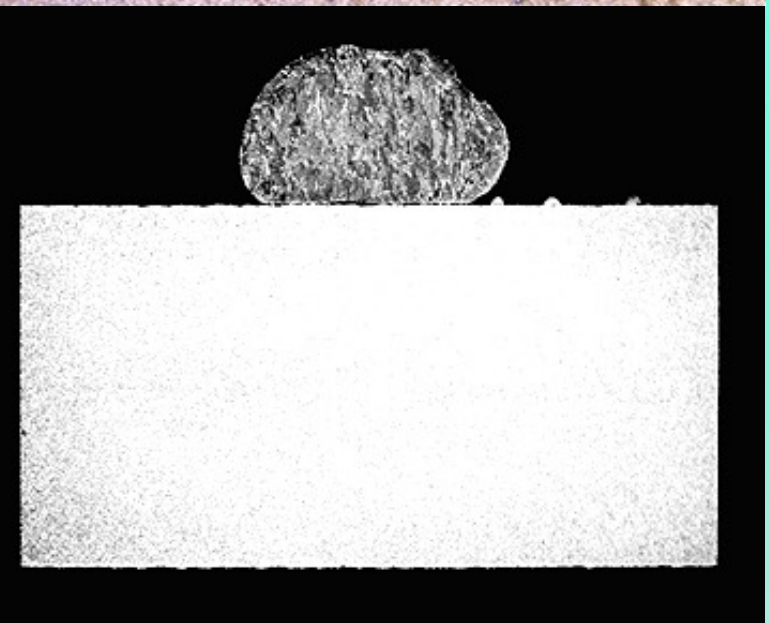
Wire diameter: 1,2 mm

Current: 225 A

Voltage: **19 V**

# Closed arc tension too small

# Closed arc tension too small



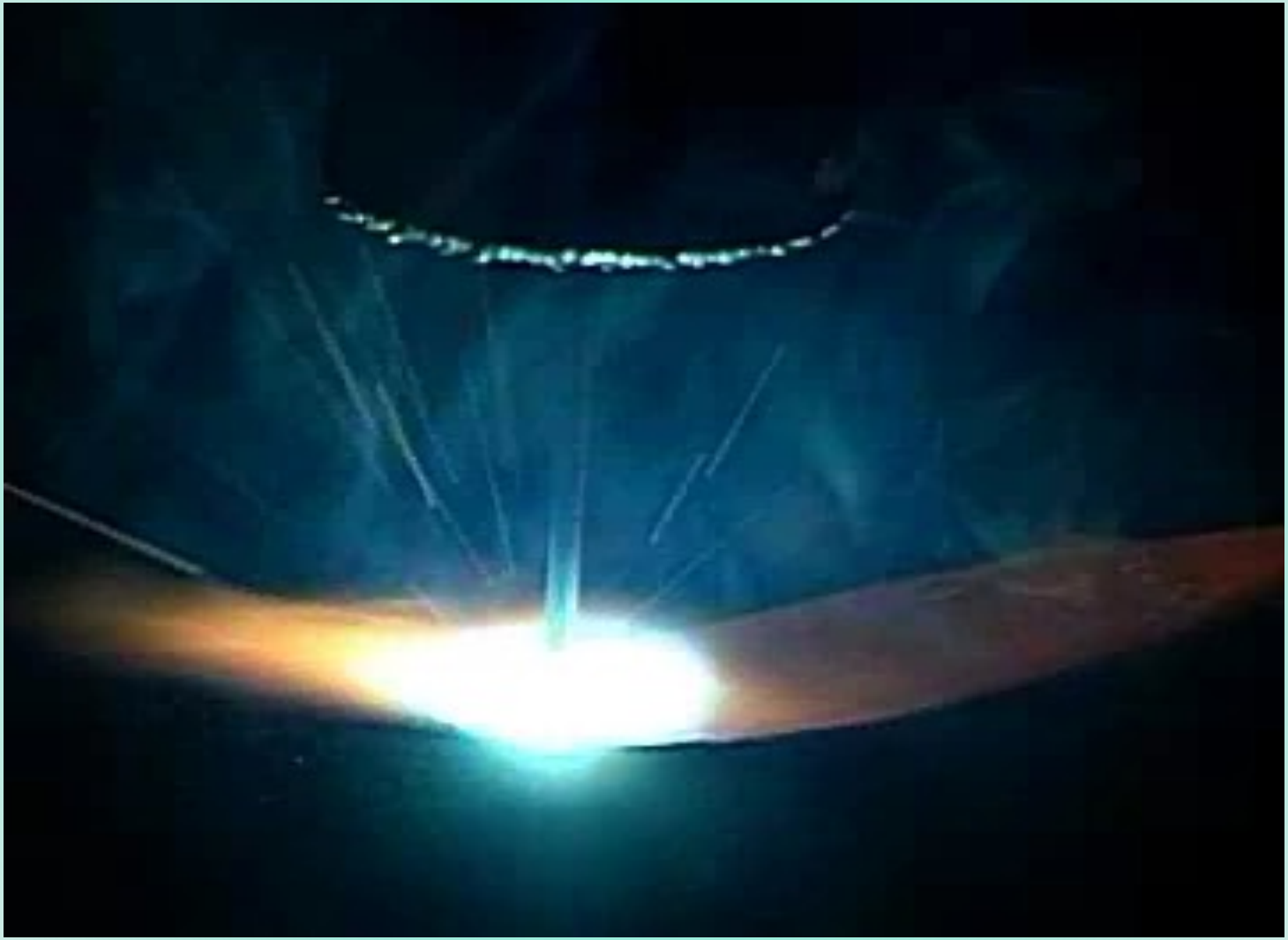
Wire diameter: 1,2 mm
Current: 225 A
Voltage: **15 V**
Shielding gas : M21

**Very coarse irregular, Irregular seam and strong spatter**

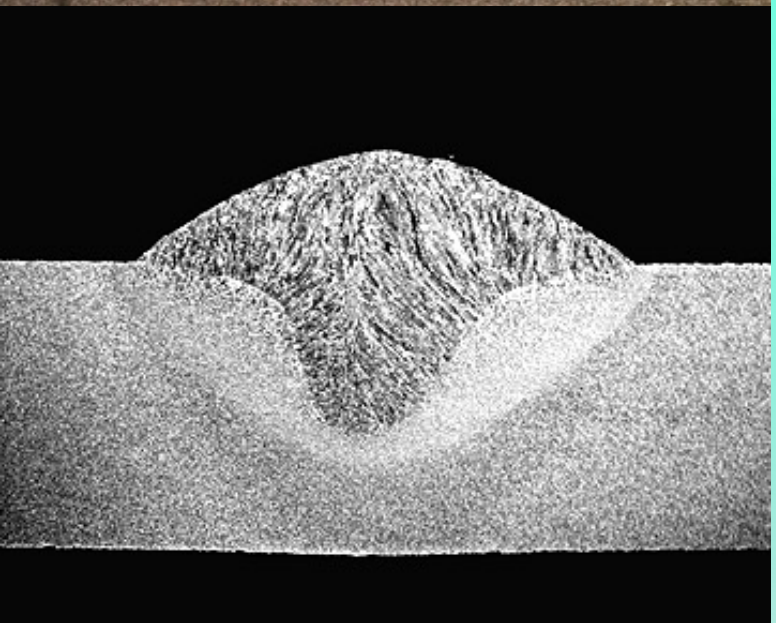
# Welding parameters:

## Spray arc current

# Wire speed and voltage in line



# Fine droplet (spray-like) transfer results



Wire diameter: 1,2 mm

Current: **300 A**

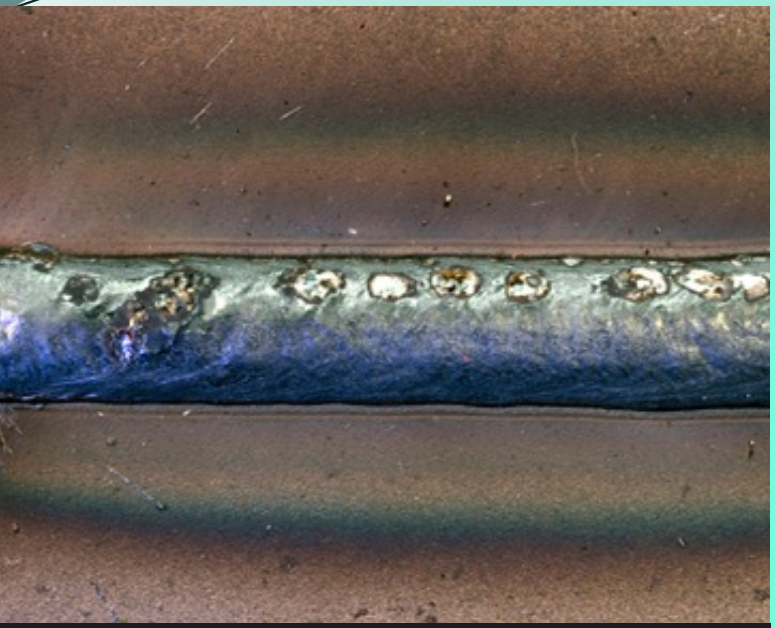
Voltage: 34 V

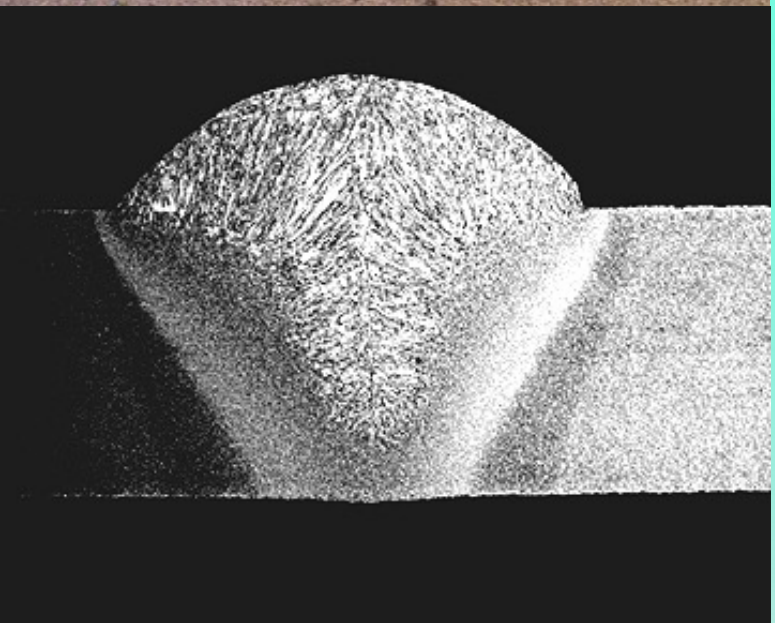
Shielding gas : M21

Results in fine droplets (spray-like) mass transfer

# Spray arc tension is high

# Spray arc current is high





Wire diameter: 1,2 mm

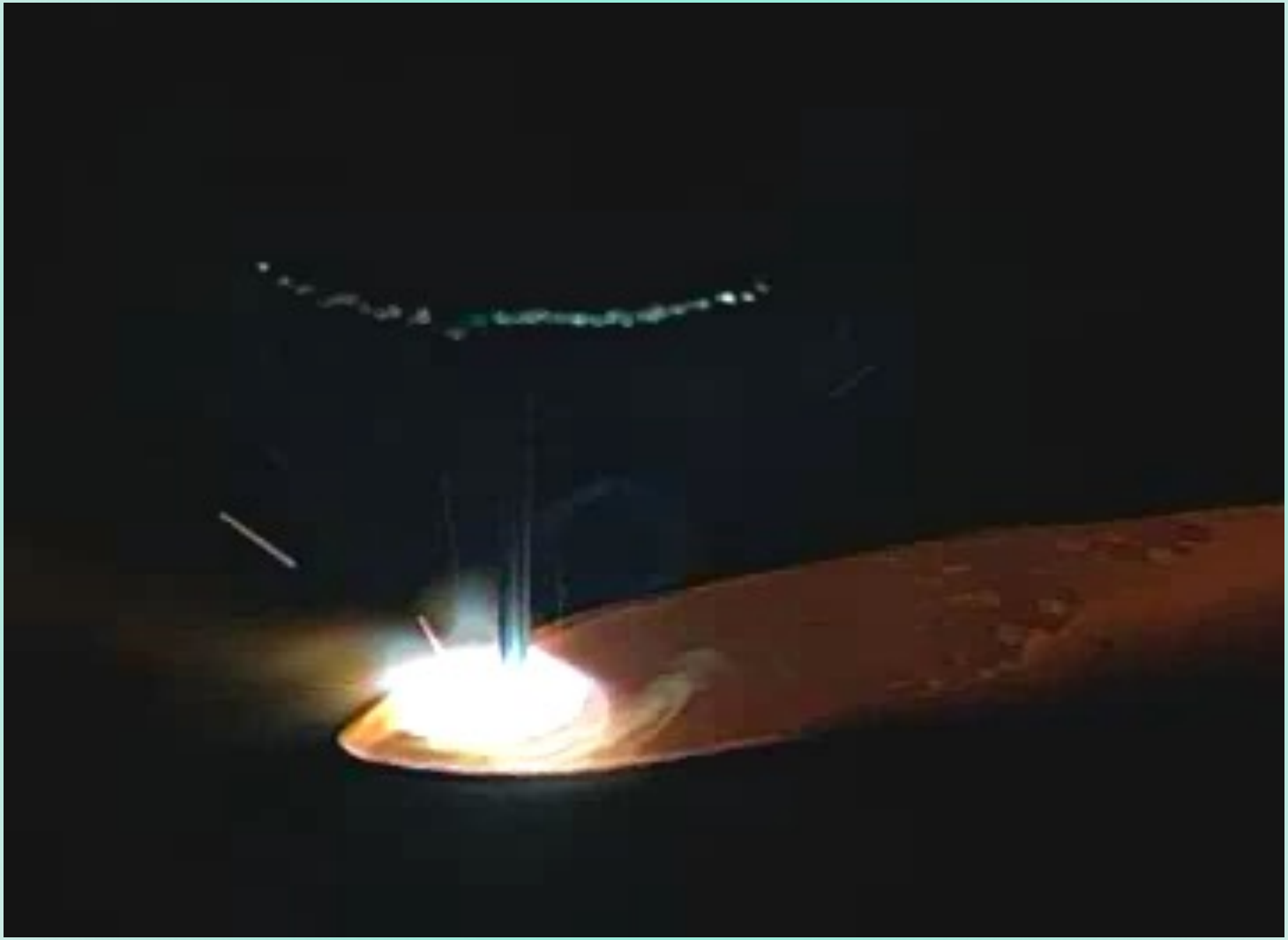
Current: **330 A**

Voltage: 34 V

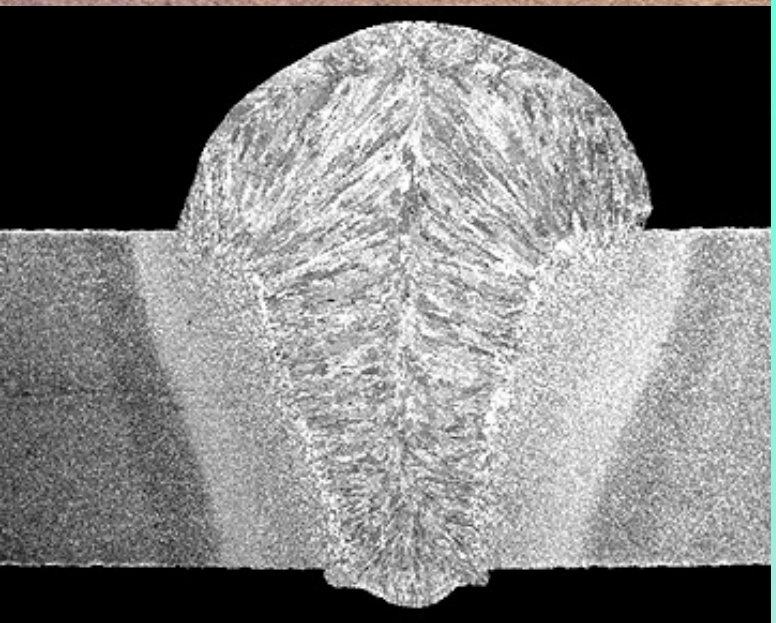
Shielding gas : M21

Smooth seam surface and appropriate material transition

# Spray arc current is very high



# Spray arc current is very high



Wire diameter: 1,2 mm

Current: **360 A**

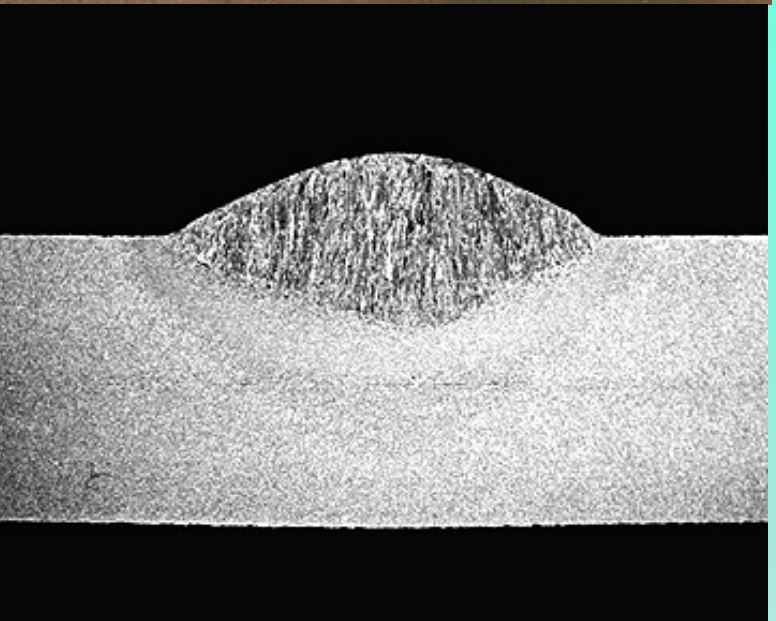
Voltage: 34 V

Shielding gas : M21

Frequent short-circuts are Possible, irregular convex seam shape

# Spray arc current is small

# Spray arc current is small



Wire diameter: 1,2 mm

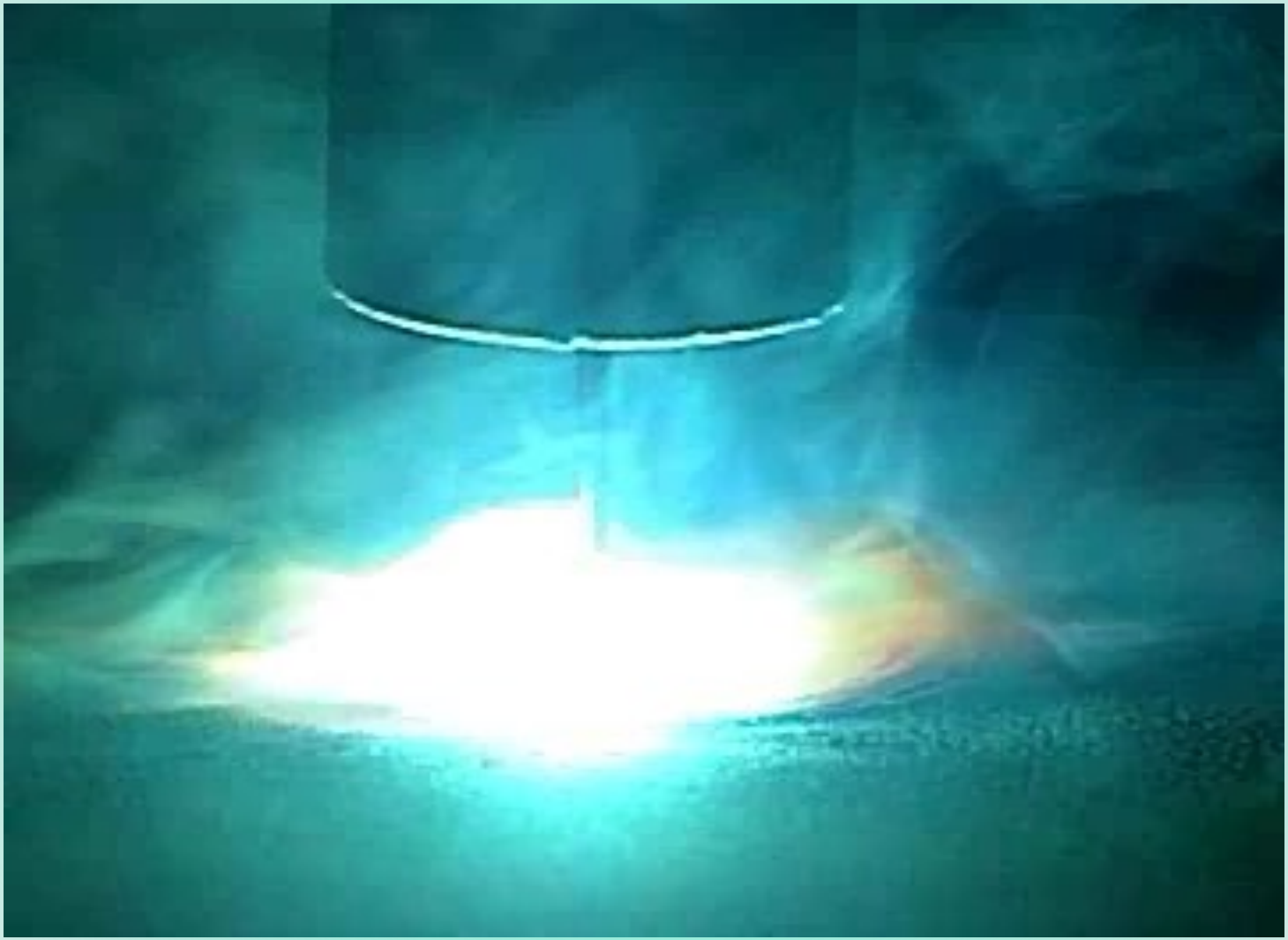
Current: **260 A**

Voltage: 34 V

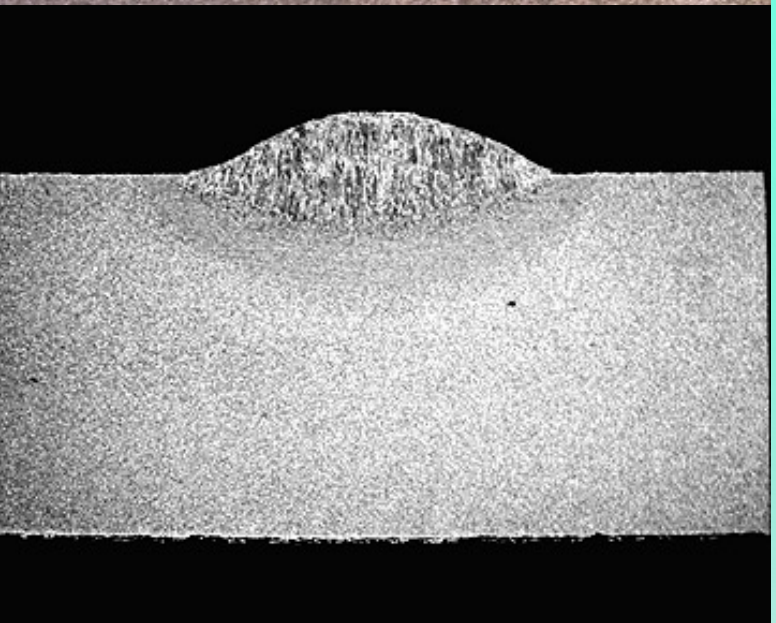
Shielding gas : M21

**Irregular arc and spattering**

# Spray arc currently very low



# Spray arc currently very low



Wire diameter: 1,2 mm

Current: **160 A**

Voltage: 34 V

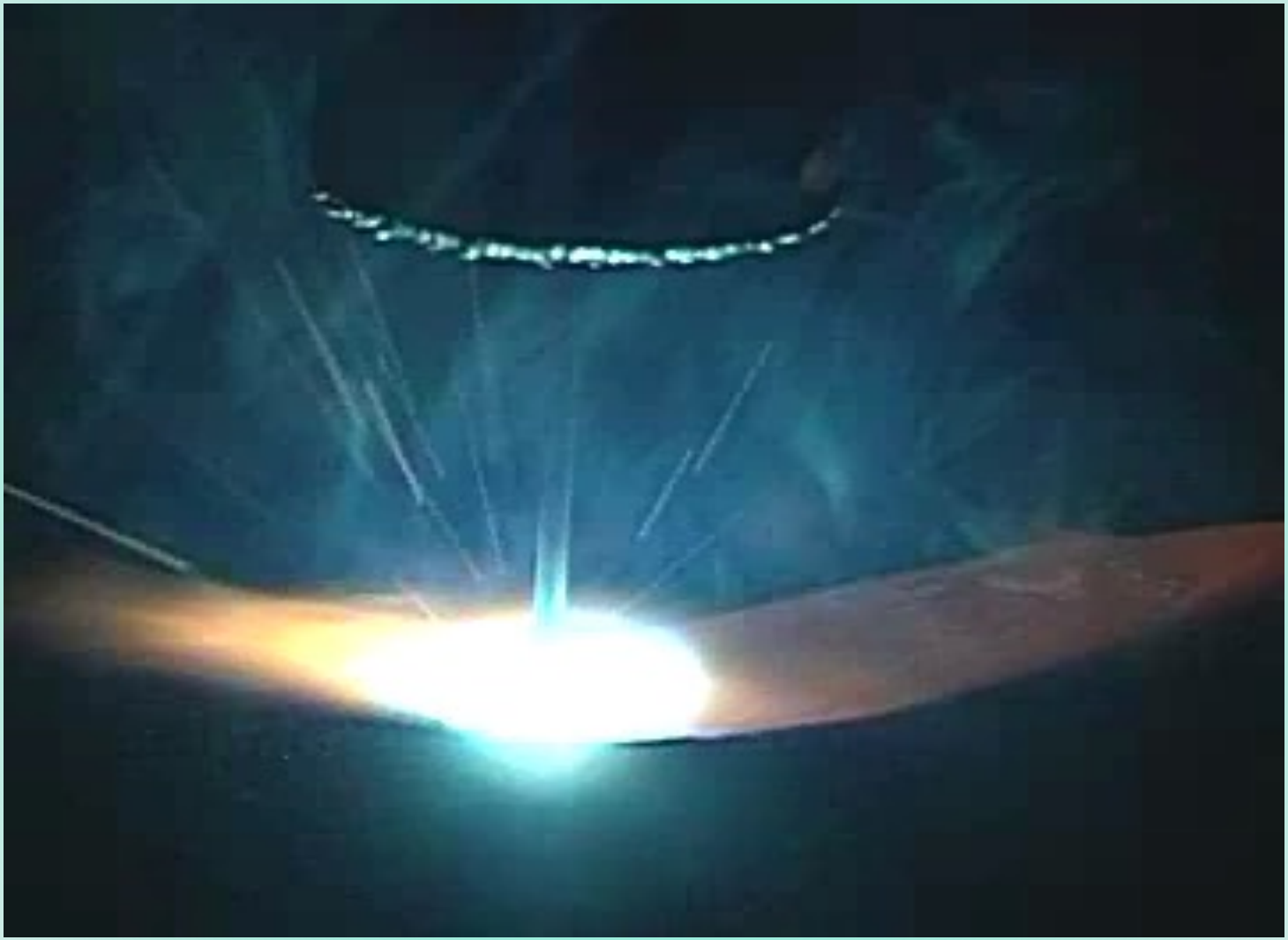
Shielding gas : M21

**Irregular excessively flat arc on the seam**

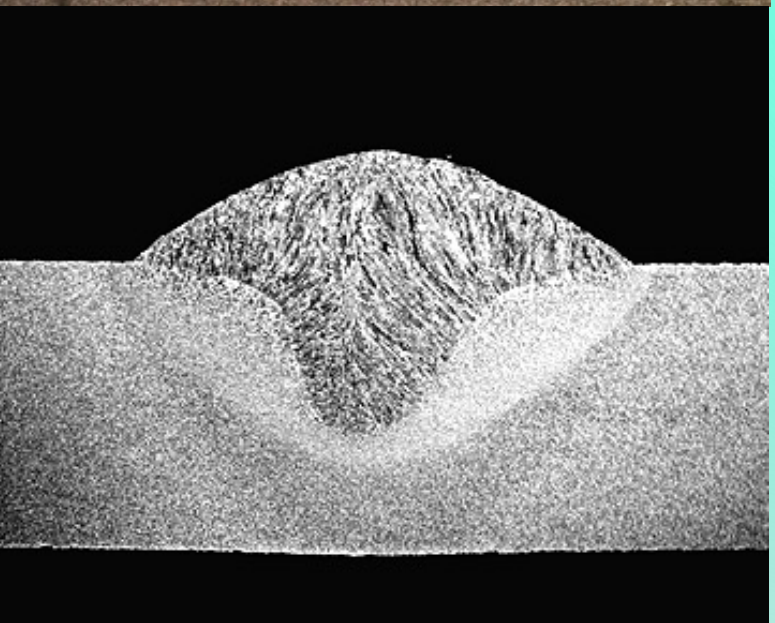
# Welding parameters

## Arc tension

# Alignment of wire speed and voltage



# Results in fine droplet (spray-like) mass transfer



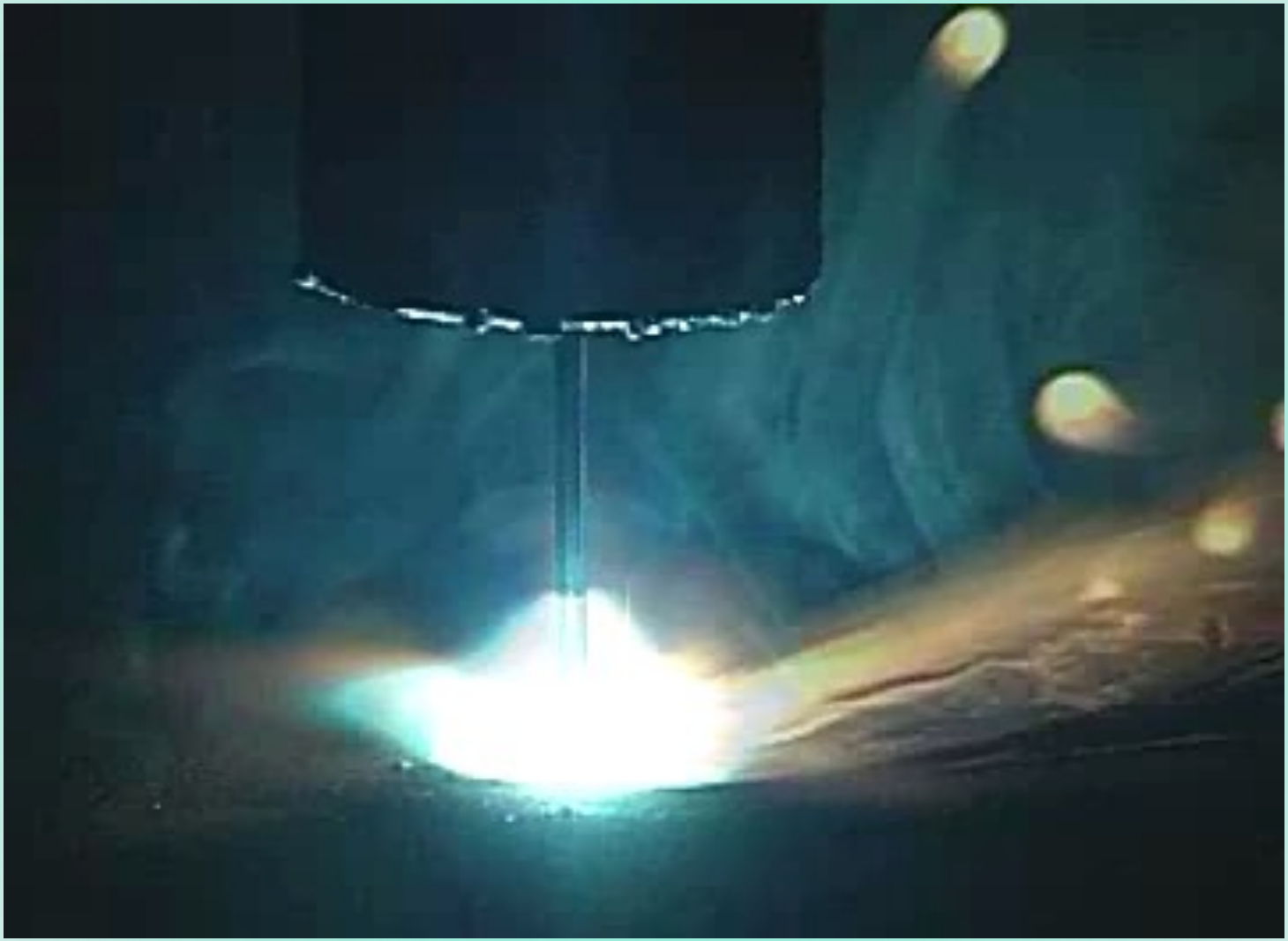
Wire diameter: 1,2 mm

Current: 300 A

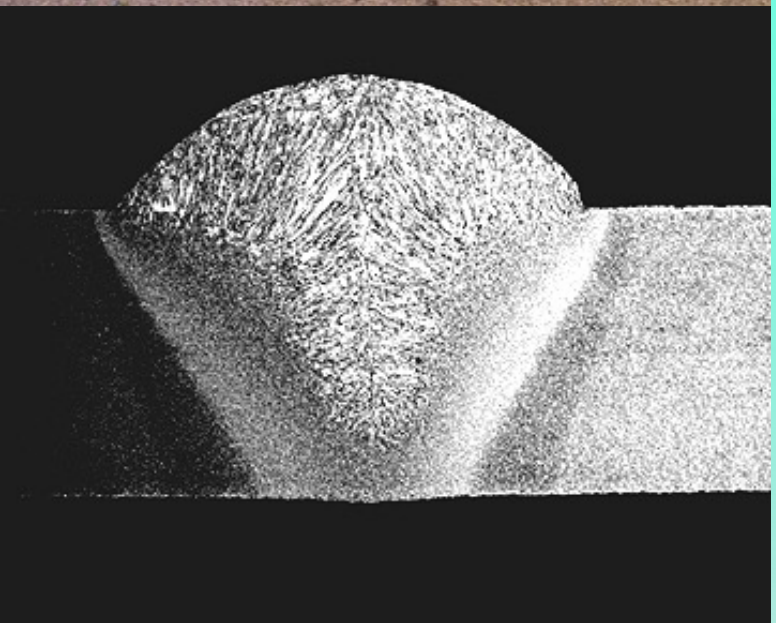
Voltage: **34 V**

Shilding gas : M21

# Peremeters arc tension is high



# Peremeters arc tension is high



Wire diameter: 1,2 mm

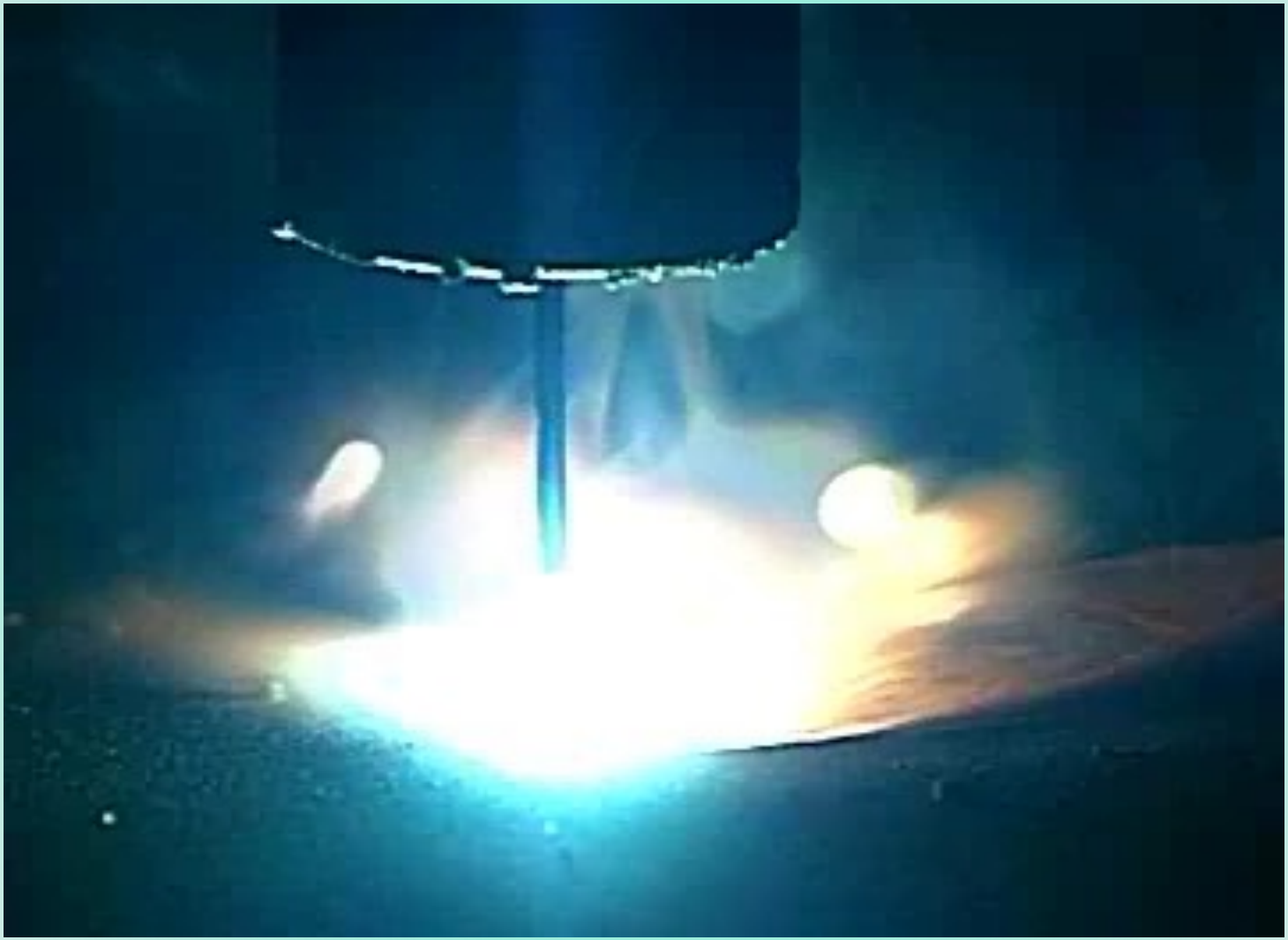
Current: 300 A

Voltage: **36 V**

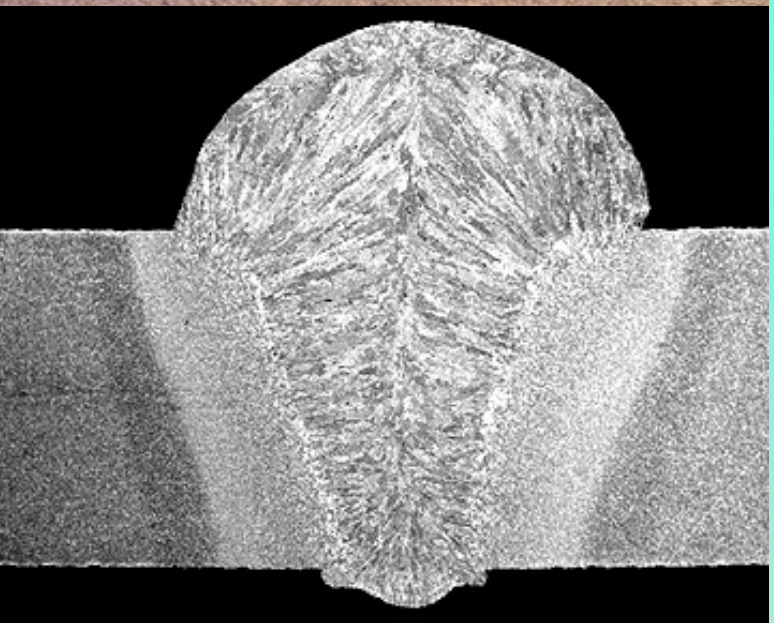
Shielding gas : M21

**Slightly irregular arc, small splashes**

# Arc tension is very high



# Arc tension is very high



Diameter: 1,2 mm

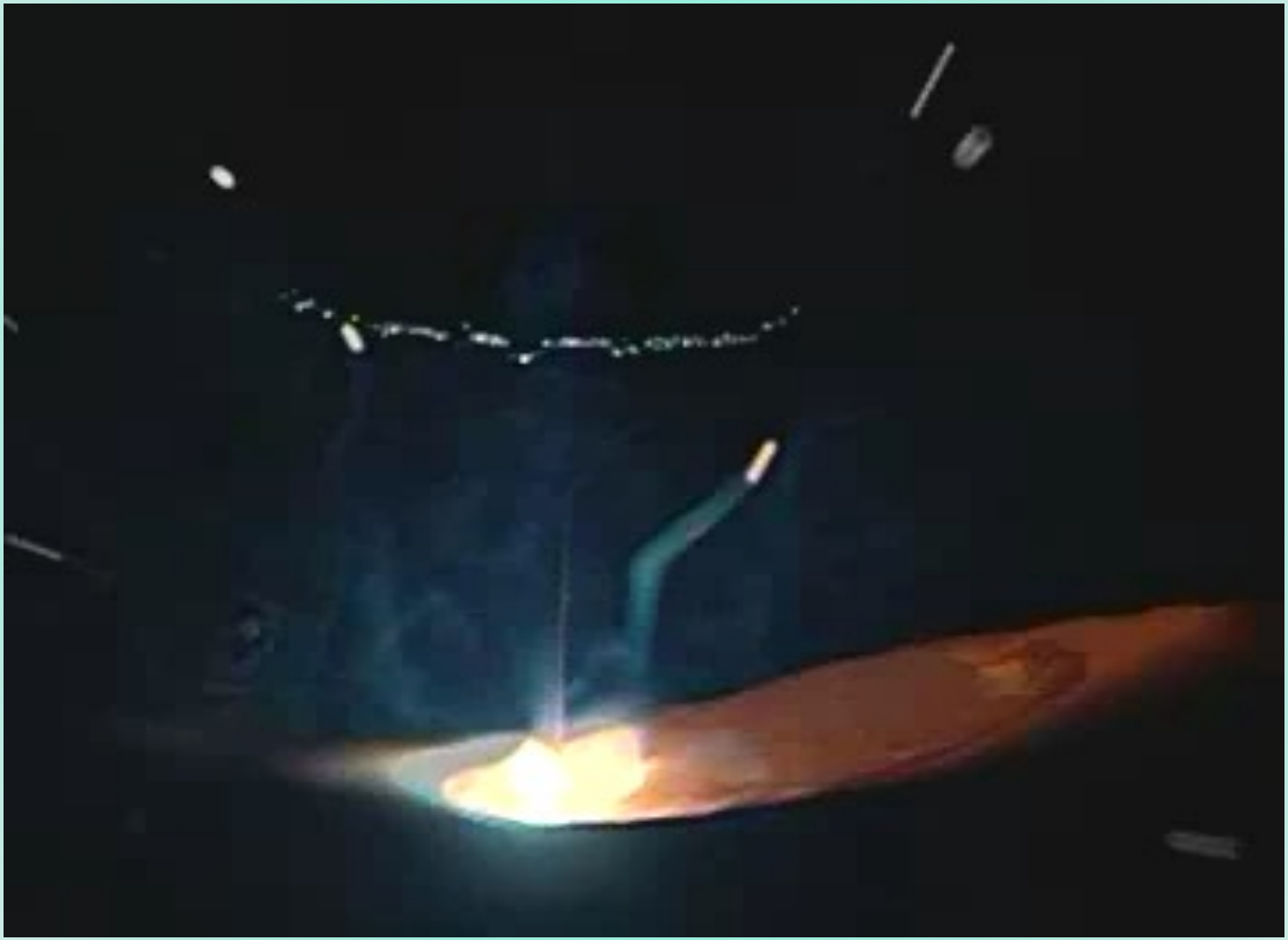
Current: 300 A

Tension: **40 V**

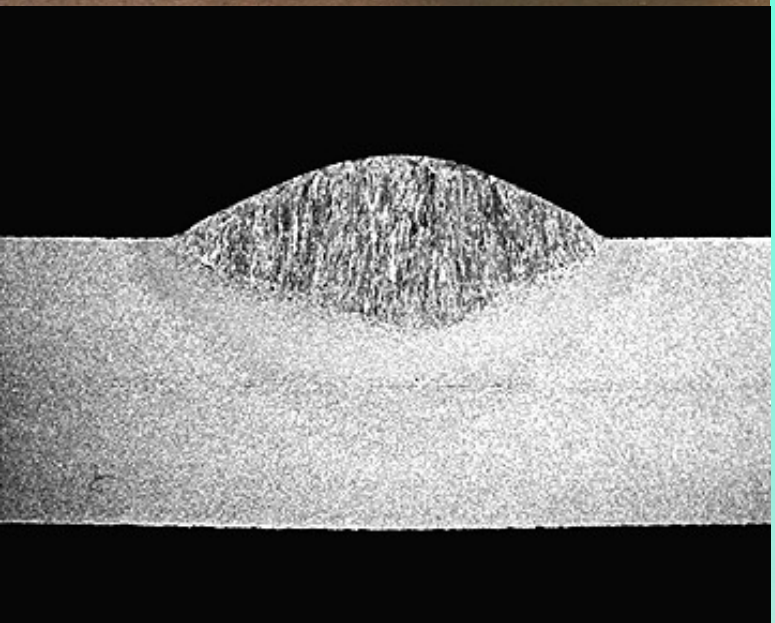
Shielding gas : M21

**Irregular long arc, splashing**

# Arc tension is small



# Arc tension is small



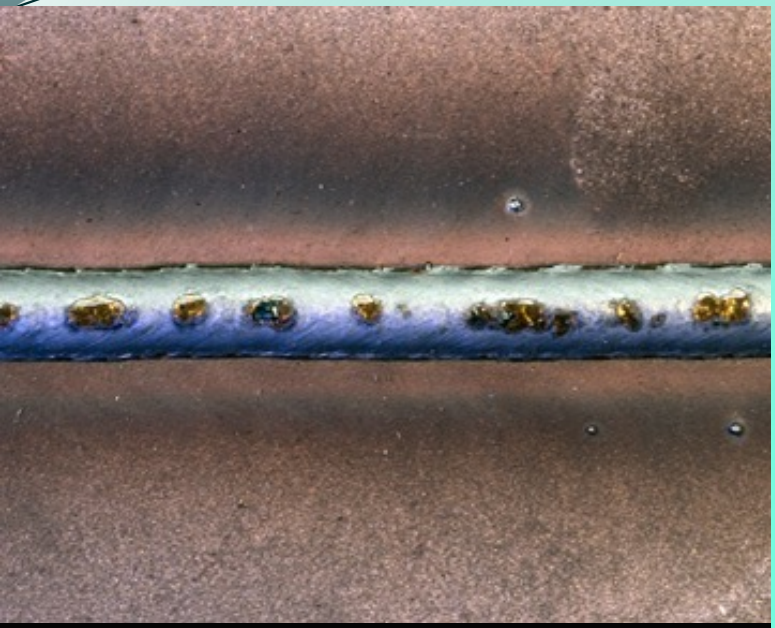
Wire diameter: 1,2 mm
Current: 300 A Voltage:
**26V** Shielding gas : M21

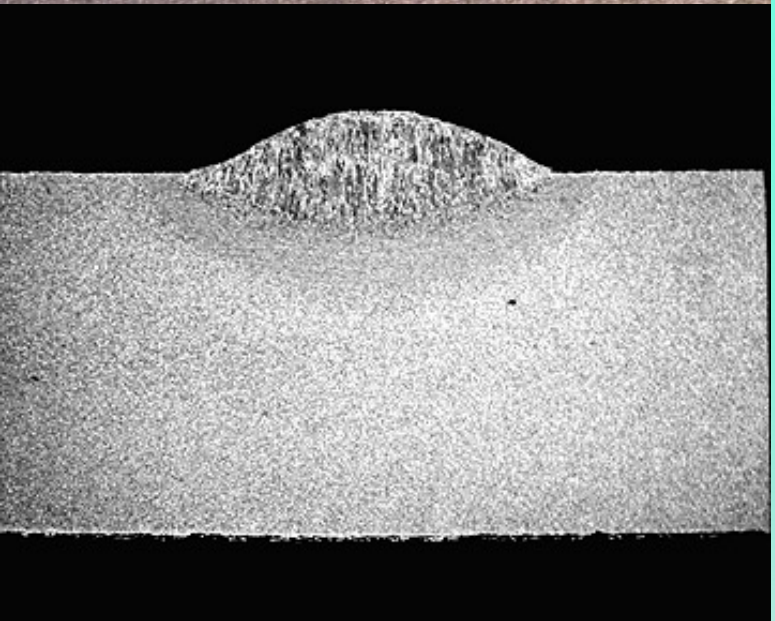
1

**Irregular short arc, strong splash and strong arc sound**

# The tension of the arc is very small

# The tension of the arc is very small





Wire diameter: 1,2 mm

Current: 300 A

Voltage: **17 V**

Shielding gas: M21

**Very short, irregular, extinguishing arc, very strong splashing, harsh arc sound**

Thank you for your attention!