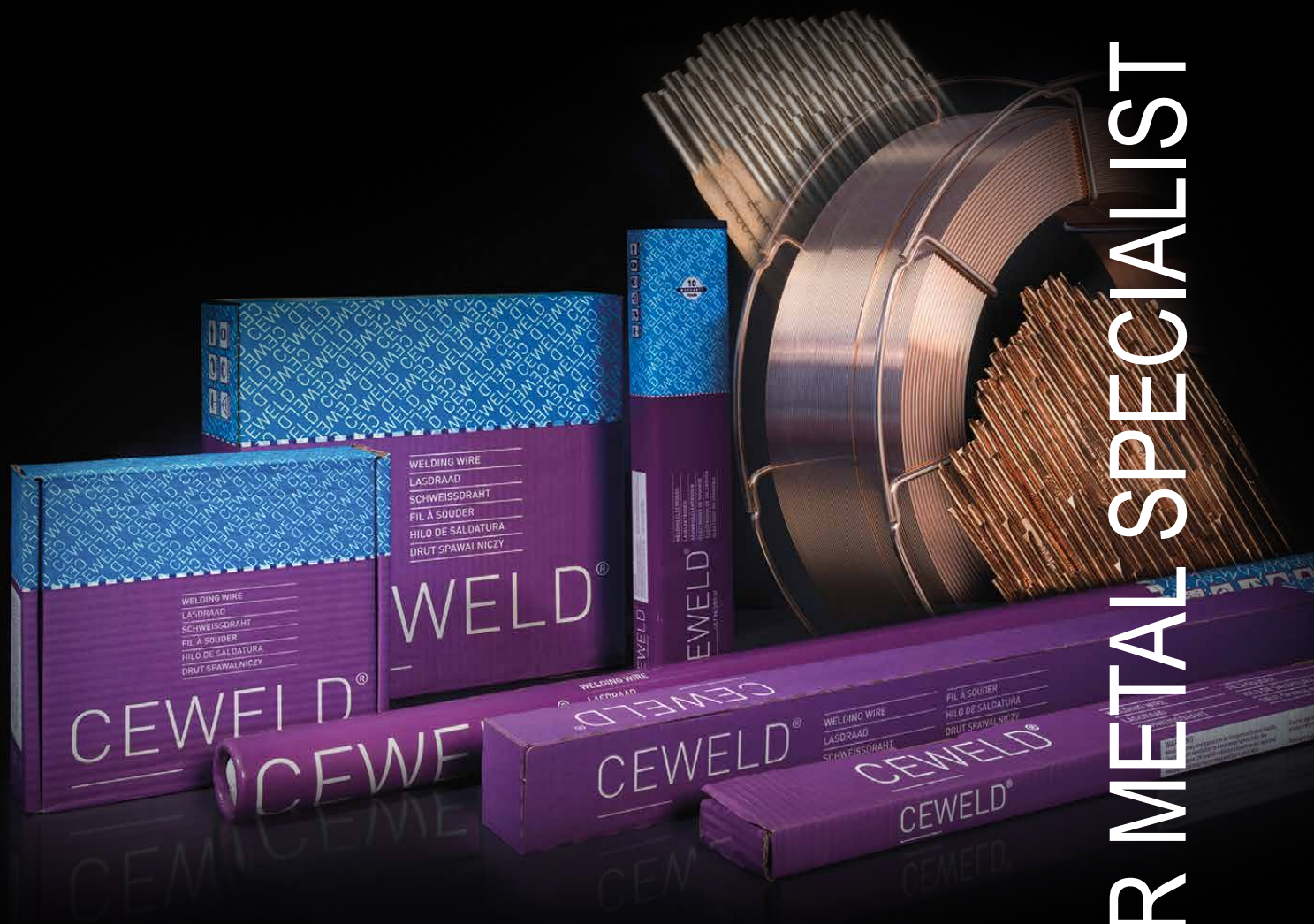
certilas®

"CEWELD® AquaForce" the new generation of underwater stick electrodes



THE FILLER METAL SPECIALIST

In the last few years, several coated electrodes for underwater welding have been developed by us. **CEWELD® AquaForce HR** and **CEWELD® AquaForce MG** are the last two developments.
Both electrodes were designed in accordance with DIN 2302 (which is a template for an new ISO standard) as well as the AWS A 5.35 and the AWS D 3.6M.

Some basic information

1. Underwater welding.

1.1 Definitions:

The term "underwater welding" is used to describe welding work carried out under various ambient conditions in which the workpieces to be welded are located below the surface of the water.
The work is carried out with or without filler metal.

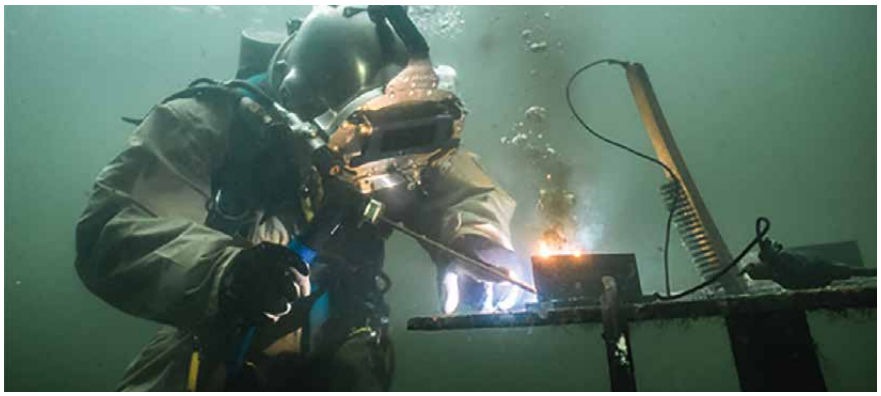
A distinction is made according to the ambient pressure at the welding point:
= atmospheric pressure or
> atmospheric pressure

Surrounding pressure at the welding point	Medium	Designation according to medium and pressure	Designation according to medium
> atmospheric pressure (hyperbar)	wet	Hyperbaric wet underwater welding	Wet underwater welding
	dry	Hyperbaric dry underwater welding	Dry underwater welding
= atmospheric pressure	dry	1-bar underwater welding	

2. CEWELD® AquaForce Electrodes are designed for hyperbaric, wet underwater welding.

2.2 Wet underwater welding.

Direct contact of arc and workpiece with the water.

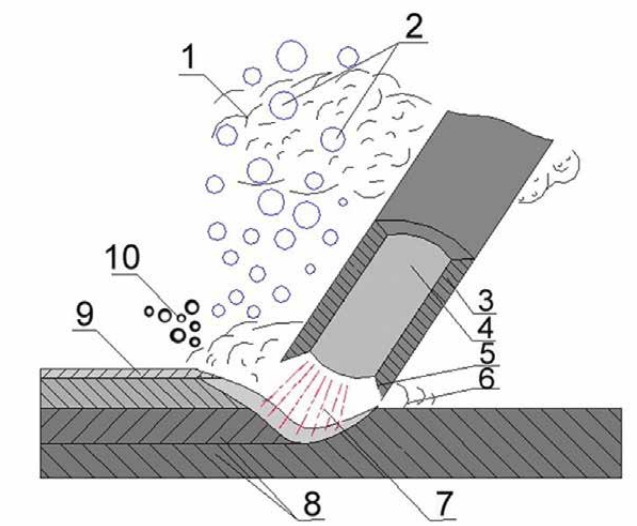


2.3 The most important facts are:

- It is the key technology for repairing underwater steel structures that cannot go into dry dock.
- Welding is performed underwater and is directly exposed to the wet environment.
- The greater flexibility makes it more effective, efficient and economical than long stays in the shipyard with laborious evacuation of the water.
- Power is supplied by cables and hoses connected to the welder.
- Complete insulation of the cables and hoses is essential to avoid the risk of electric shock.
- SMAW (Shielded metal arc welding) is one of the most commonly used methods in repair welding

2.4. What should be considered in principle.

Advantages	Disadvantages
• Versatility. • Less costly than dry welding. • Speed of execution. • No enclosures necessary.	• Rapid quenching of the molten pool by the surrounding water. • Underwater handling of the arc is limited. • Hydrogen embrittlement often causes cracks. • Poor visibility makes control difficult.



1. Water vapor,
2. gas bubbles,
3. Special coating,
4. core wire,
5. coating,
6. liquid metal,
7. arc,
8. base material,
9. slag,
10. gas from the melt.

3. Welding metallurgy and electrode development

In underwater welding with coated stick electrodes, three main phenomena play a determining role in the chemical composition and mechanical properties of the weld metal:

1. Due to the surrounding water, which is also dissolved in the arc, the hydrogen and oxygen contents initially increase to relatively high values in the arc and then also in the weld metal. In addition, it should be noted that this is proportional to the water depth and thus the amount of hydrogen and oxygen in the arc can also increase with the water depth.

2. The water pressure influences the metallurgical processes in the arc and causes a change in the chemical composition. This is also caused and intensified by the higher oxygen content. Here, similar to gas-shielded welding under CO2, Mn is reduced and MnO is formed. This also applies to Si and Ni.

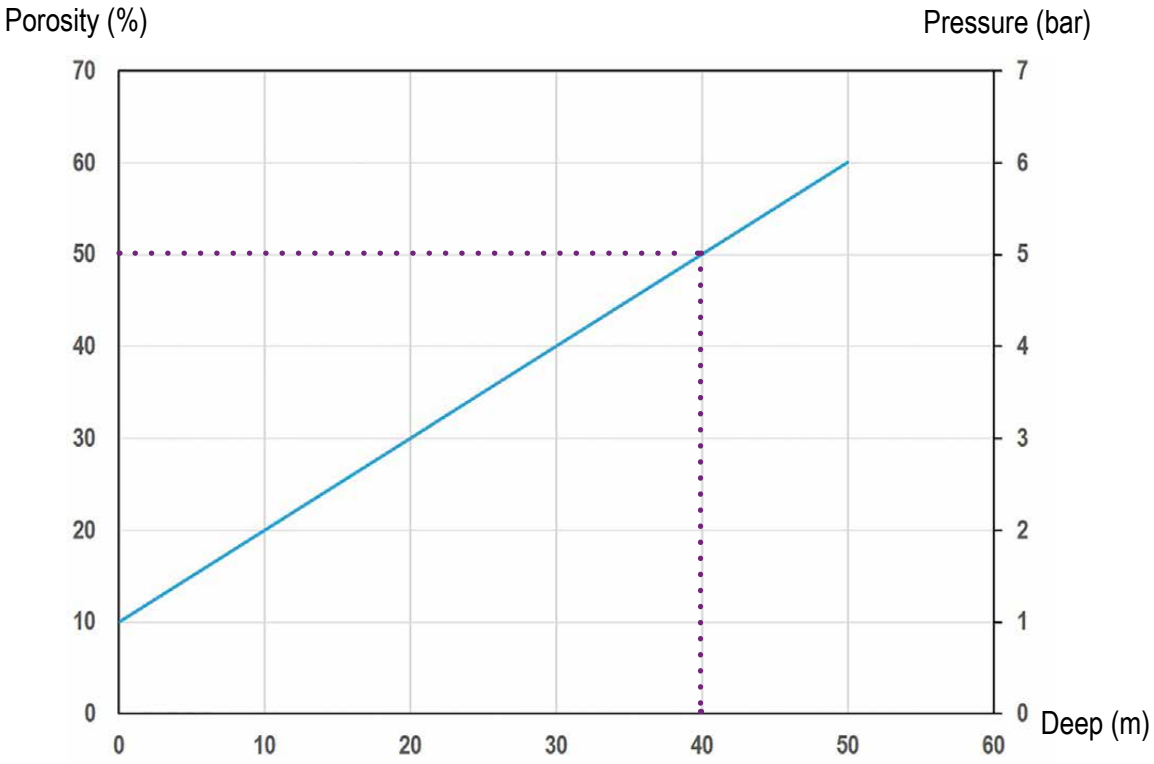
3. Due to the surrounding water, heat dissipation is always three-dimensional and the t 8/5 time extremely short. Moreover, since preheating is rather complicated and difficult to perform in practice, corresponding hardening occurs in the weld metal as well as in the adjacent base material (HAZ). Undesirable bainite and martensite structures are formed.

3.1 Impacts:

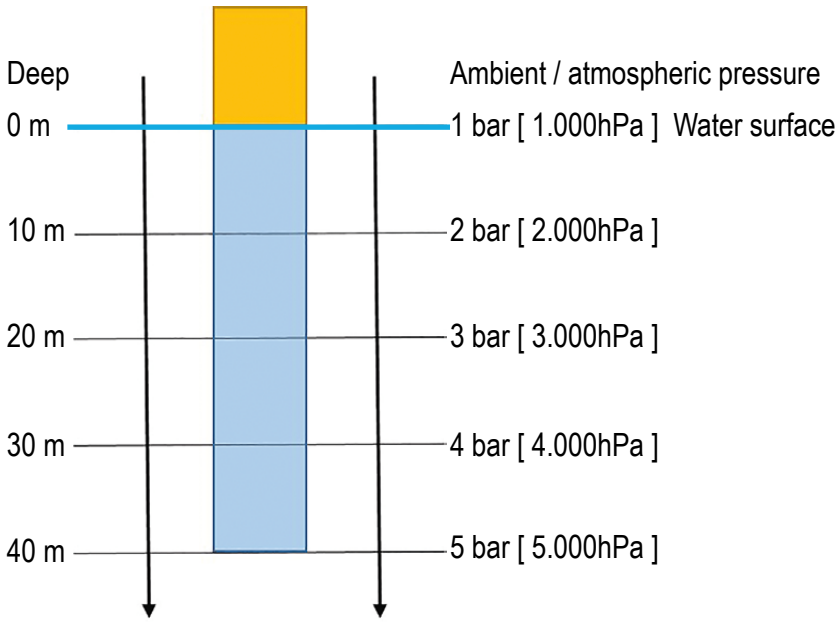
- Water dissociates into oxygen and hydrogen, which dissolves in the melt. The result is gas inclusions, defects, porosity.

- Water inclusions, as hydrogen combines with oxygen to form water vapor after some time

The diagram shows the dependence of porosity on water depth



The diagram shows the dependence of the pressure on the water depth



4. What distinguishes the CEWELD® AquaForce from other electrodes?

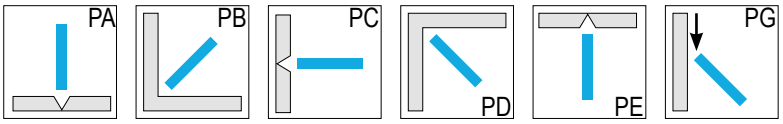
AquaForce LC Is an underwater electrode with a highly basic coating combined with an extremely low carbon core rod

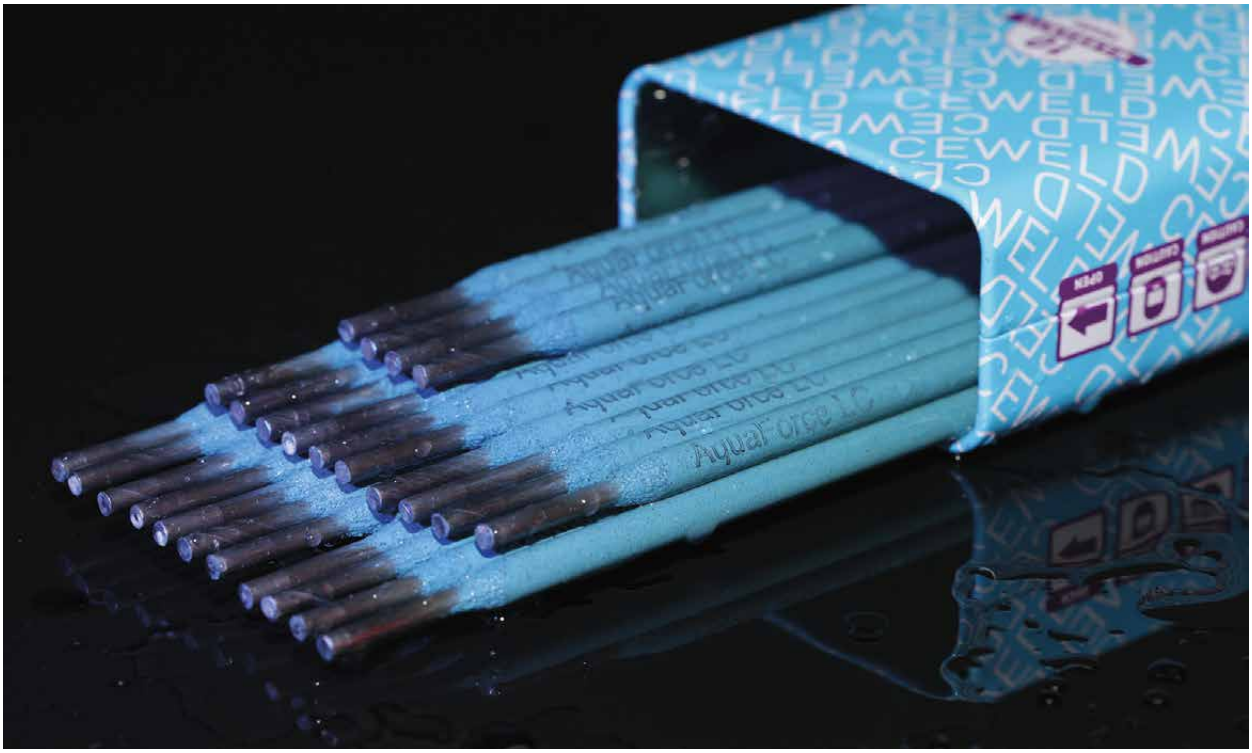
AquaForce HR Is an underwater electrode, with very high deposition rate, without porosity. An effective throat thicknes of more than 4.0 mm is possible in one layer.

AquaForce MG Is an underwater electrode, which shows a remarkably fine scale weld seam surface, without porosity with self-dissolving slag

All electrodes are suitable for the following welding positions:

Welding positions:





Certilas Nederland B.V. | Gloxinialaan 2, 6851 TG Huissen, The Netherlands | info@certilas.com | www.certilas.com | Rev.2021.

5. Technical data of the CEWELD® AquaForce electrodes

5.1 CEWELD® AquaForce LC technical data

STANDARD CLASSIFICATION	EN ISO 2560-A: E 42 2 RB 4 1 DIN 2302 : E 42 2 Z RB 10 fr (PA,PB,PC,PD,PE,PG) AWS 5.1 : E 7016 AWS 5.35 : UWE 7016 3A

TYPICAL ANALYSIS OF THE PURE WELD METAL (%)

C	Mn	Si	P	S
0,05	0,45	0,2	< 0,025	< 0,025

TYPICAL QUALITY VALUES OF THE PURE WELD METAL ACCORDING TO ISO

Rp0,2 MPa (ksi)	Rm MPa (ksi)	Charpy V J (ft-lbf) ISO-V		
		20°C (-4°F)	0°C (0°F)	-20°C (-4°F)
> 420 (67)	500 - 640 (78 - 95)	- -	> 36 (27)	> 27 (20)

All values were determined without prior heat treatment

5.2. CEWELD® AquaForce LC Benefits

- The first underwater electrode with basic coating and extremely low C-content.
- Single coated electrode with an additional coating, with high insulating effect and excellent protection against water.
- Low oxygen content in the weld metal
- High notched impact strength
- Good ductility
- Low hydrogen content in weld metal
- Lower hardness in the fusion line (HAZ)
- No porosity
- Excellent overhead weldability

5.3 CEWELD® AquaForce HR technical data

STANDARD CLASSIFICATION	EN ISO 2560-A: E 42 0 R 4 1 DIN 2302 : E 42 0 R 10 fr (PA,PB,PC,PD,PE,PG) AWS 5.1 : E 7014 AWS 5.35 : UWE 7014 3A

TYPICAL ANALYSIS OF THE PURE WELD METAL (%)

C	Mn	Si	P	S
0,075	0,75	0,6	< 0,025	< 0,025

TYPICAL QUALITY VALUES OF THE PURE WELD METAL ACCORDING TO ISO

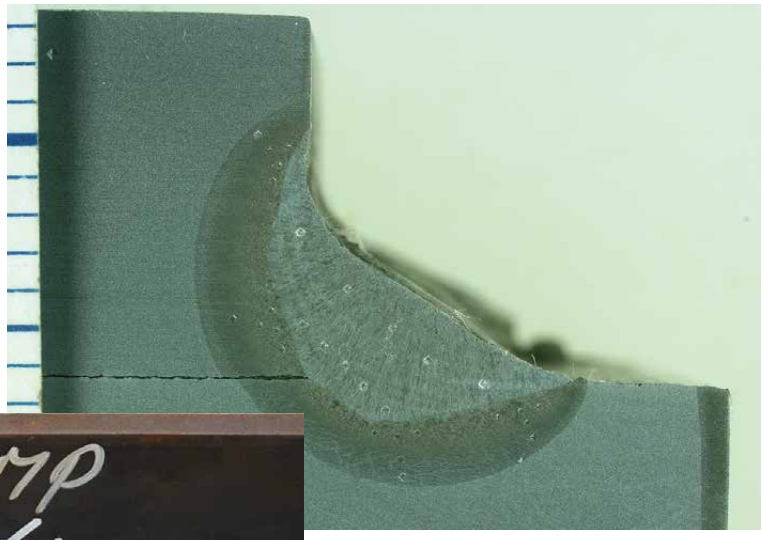
Rp0,2 MPa (ksi)	Rm MPa (ksi)	Charpy V J (ft-lbf) ISO-V		
		20°C (-4°F)	0°C (0°F)	-20°C (-4°F)
> 420 (67)	500 - 640 (78 - 95)	> 47 (35)	> 36 (27)	- -

All values were determined without prior heat treatment

5.4 CEWELD® AquaForce HR Benefits

- Flat fillet welds up to an a-measurement of 4 mm in one layer with very good penetration possible
- Double coated electrode with additional coating, thus maximum resistance to moisture absorption
- Excellent drop seam properties (PG / 3Fd)
- Good notched impact strength
- Very good ductility
- Low hydrogen content in weld metal
- Lower hardness in the fusion line (HAZ)
- No porosity
- Higher output resulting in 35% more power

Macro of a fillet weld vertical down (PG/3Fd) with very good fusion penetration



Fillet weld vertical down (PG / 3Fd) in 1 2 3 layers

5.5 CEWELD® AquaForce MG technical data

STANDARD CLASSIFICATION	EN ISO 2560-A: E 42 0 RR 4 1 DIN 2302 : E 42 0 Z RR 10 fr (PA,PB,PC,PD,PE,PG) AWS 5.1 : E 6013 AWS 5.35 : UWE 6013 3A

TYPICAL ANALYSIS OF THE PURE WELD METAL (%)

C	Mn	Si	P	S
0,08	0,60	0,40	< 0,025	< 0,025

TYPICAL QUALITY VALUES OF THE PURE WELD METAL ACCORDING TO ISO

Rp0,2 MPa (ksi)	Rm MPa (ksi)	Charpy V J (ft-lbf) ISO-V		
		20°C (-4°F)	0°C (0°F)	-20°C (-4°F)
> 420 (67)	500 - 640 (78 - 95)	- -	> 36 (27)	- -

All values were determined without prior heat treatment

5.6 CEWELD® AquaForce MG Benefits

- **Flat fillet welds up to an a-measurement of 4 mm possible in one layer with very good penetration.**
- **RR type, thick coated rutile electrode with an additional special coating, for maximum resistance to moisture absorption.**
- **Excellent drop weld properties (PG / 3Fd).**
- **Very easy slag release.**
- **Good notched impact strength**
- **Very good ductility**
- **Low hydrogen content in weld metal**
- **Lower hardness in the fusion line**

Macro of a pure weld metal without pores

Cover layers with fine scaled seam surface without porosity or inclusions

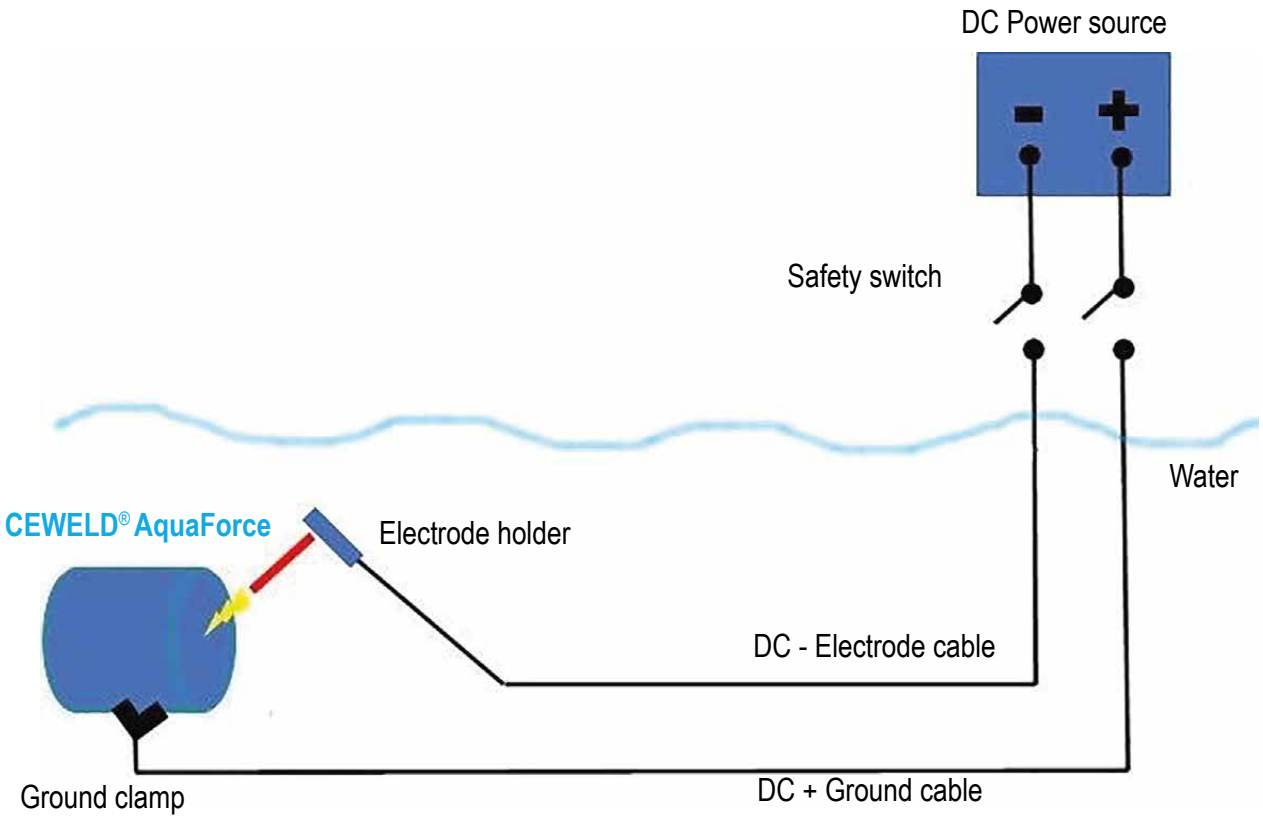
6 What else to consider?

6.1 What requirements for the power source we recommend:

Power: **350 A at 60 % duration of use**
Max. Open circuit voltage OCV: **< 65 Volt (National rules must be observed)**
Voltage range in CV mode: **10 - 38 Volt**
Ampere range in CC mode: **5 - 425 Ampere**
Vertical down weld
Unrestricted generator operation and connection to long mains supply lines
Robust construction suitable for construction site, shock-proof housing

6.2 What to consider when welding:

- Angle of attack of the electrode: should be about 70 degrees.
- Current range: 130 - 220 amps, depending on diameter.
- Standard DC inverter machines are used, which have a built-in electrical OCV reduction switch to ensure zero OCV at power-up. When the welder touches the workpiece, the OCV switch is activated and the OCV increases to allow the welder to strike an arc and begin welding.



7. Standards:

GUIDE TO DIN 2302: COVERED ELECTRODES FOR MANUAL METAL ARC WELDING OF NON-ALLOY AND FINE GRAIN STEELS IN A WET HYPERBARIC ENVIRONMENT

Symbol	Tensile Strength	Yield Strength
	MPa	min. MPa
35	440-570	355
38	470-600	380
42	500-640	420

PA = Flat position
PB = Horizontal-vertical position
PC = Transverse position
PD = Horizontal overhead position
PE = Overhead position
PF = Vertical up position
PG = Vertical down position

Symbols for welding position according to ISO 6947

E = Covered electrode for manual metal arc

E	42	2	-	B	6	(PA,PG,PD)	sa

Symbol	Impact Energy Charpy-V Temp °C for 27J min.
Z	No requirements
A	20
0	0
2	-20

Symbol	Coating type
R	Rutile
RR	Rutile (thick coated)
RA	Rutile-Acid
RB	Rutile-Basic
B	Basic

Symbol for salt content of water
The test conditions under which the classification requirements were met shall be indicated by the following symbols:

- sa salt water;
- fr fresh water (sweet water).
  Sweet water tests include tests in salt water but not vice versa.

NOTE
The salt content of the water improves the ignition characteristics due to the better ionisation..

Symbol	Chemical composition of all-weld metal, % *		
	Mn	Mo	Ni
No symbol	2.0	–	–
Mo	1,40	0.3 - 0.6	–
MnMo	1.4 - 2.0	0.3 - 0.6	–
1Ni	1,40	–	0.6 - 1.2
Z	Any other agreed composition		

Symbol for water depth
The mean water depth, in m, at which welding was performed shall be specified as symbol without unit. The depth shall be measured on the test seam with a precision of ± 250 mm. The greatest depth shall be measured on the lowest point of the test seam and the smallest depth shall be measured on the highest point of the test seam.

GUIDE TO AWS A5.35: ELECTRODES FOR UNDERWATER WET SHIELDED METAL ARC WELDING

Prologue:
The welding electrodes covered by this specification utilize the following system to classify the welding electrodes:
(1) Type of current
(2) Filler metal type by general chemical composition
(3) AWS classification of electrode by AWS specification, when applicable
(4) Weld metal integrity (Y), based on soundness and mechanical properties
(5) Welding position (Z)

Electrode Classifications:

Classifications:		Type of Current	General Filler Metal Chemical Composition
A5.35	5.35M		
UWE60XX-YZ	UWE43XX-YZ	Direct, electrode positive or negative	Ferritic steel
UWE70XX-YZ	UWE49XX-YZ	Direct, electrode positive or negative	Ferritic steel
UWE3XX-16-YZ	UWE3XX-16-YZ	Direct, electrode positive	Austenitic stainless steel
UWENiXX-YZ	UWENiXX-YZ	Direct, electrode positive	Nickel alloy

Classification and Designators by Specification and Properties:

Classifications:		Weld Metal Soundness/ Mechanical Property Level Y) [a]	AWS-Specification [b]
A5.35	5.35M		
UWE60XX-YZ	UWE43XX-YZ	1, 2 oder 3	A5.1/A5.1M
UWE70XX-YZ	UWE49XX-YZ	1, 2 oder 3	A5.1/A5.1M
UWE3XX-16-YZ	UWE3XX-16-YZ	1, 2 oder 3	A5.4/A5.4M
UWENiXX-YZ	UWENiXX-YZ	1, 2 oder 3	No applicable AWS Specification.

a Determine “Level” identification based on testing and examination results**.**
b Where an electrode (used on the surface, with no auxiliary coating) meets all the requirements of an applicable AWS specification and classification, including the chemical composition and mechanical property requirements, the “E” designation of the classification number shall indicate such (e.g., E6013 for AWS A5.1/A5.1M and E310 for AWS A5.4/A5.4M). Where an electrode does not conform to a particular AWS specification, the “E” designation shall show the primary alloy element followed by “XX” (e.g., ENiXX)..

Inspection Requirements [a,b]:

Classifications:		Visual	Magnetic Particle [d]	Liquid Penetrant [e]	Radiographic Test [f]
A5.35	5.35M				
UWE60XX-YZ	UWE43XX-YZ	Required	Required	NR	Required
UWE70XX-YZ	UWE49XX-YZ	Required	Required	NR	Required
UWE3XX-16-YZ	UWE3XX-16-YZ	Required	NR	Required	Required
UWENiXX-YZ	UWENiXX-YZ	Required	NR	Required	Required

a Test assembly shall be as shown in AWS
b NR = Not required.
c Visual testing procedures shall be as specified in AWS D3.6M.
d Magnetic particle testing procedures shall be in accordance with ASTM E709.
e Liquid penetrant testing procedures shall be in accordance with ASTM E165.
f Radiographic procedures shall be in accordance with ASTM E94.

Testing Requirements a,b,c of All-Weld-Metal:

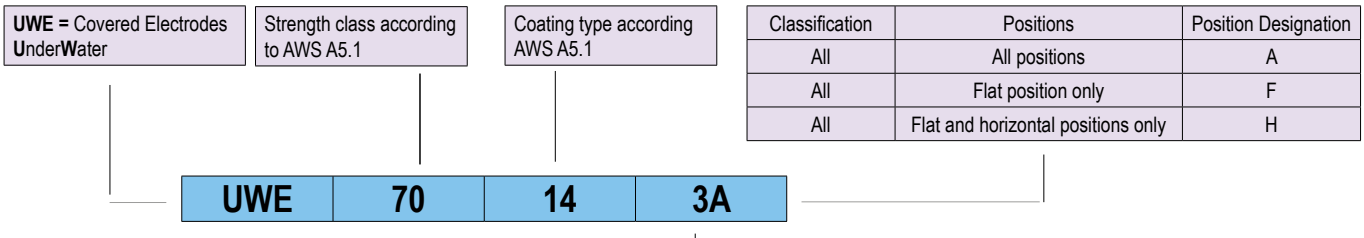
Electrode Classifications:		Tension Test	Impact Test	Chemical Analysis
A5.35	5.35M			
UWE60XX-YZ	UWE43XX-YZ	Required	Required	Required
UWE70XX-YZ	UWE49XX-YZ	Required	Required	Required
UWE3XX-16-YZ	UWE3XX-16-YZ	Required	NR	Required
UWENiXX-YZ	UWENiXX-YZ	Required	NR	Required

a Test assembly shall be as shown in AWS
b See Clause 10 for additional testing requirements.
c NR = Not required.
d Testing procedures shall be in accordance with AWS B4.0 or AWS B4.0M and the applicable reference documents specified.
e Testing procedures shall be in accordance with ASTM E415, ASTM E353, ASTM E354, or other applicable ASTM standard.

GUIDE TO AWS A5.35: ELECTRODES FOR UNDERWATER WET SHIELDED METAL ARC WELDING

Examples of electrode classification.:
(1) **UWE6013-2A:** Ferritic steel electrode (Table 1), similar to the E6013 classification of AWS A5.1, meeting the Level 2 quality standards, qualified for all position welding.
(2) **UWE7014-1F:** Ferritic steel electrode (Table 1), similar to the E7014 classification of AWS A5.1, meeting the Level 1 quality standards, qualified for the flat position only.
(3) **UWE310-16-3H**: Austenitic stainless steel electrode, similar to the E310-16 classification of AWS A5.4, meeting the Level 3 quality standards, qualified for flat and horizontal welding only.
(4) **UWENiXX-1A:** Nickel electrode, meeting the Level 1 quality standards, qualified for all position welding.

Example classification CEWELD® AquaForce HR according to AWS 5.35



Classification	Positions	Position Designation
All	All positions	A
All	Flat position only	F
All	Flat and horizontal positions only	H

Evaluation Requirements For Level (Y) Designation	UWE60XX-YZ [UWE43XX-YZ]	UWE70XX-YZ [UWE49XX-YZ]	UWE3XX-16-YZ	UWENiXX-YZ
Chemical composition	1)	1)	1)	1)
Visual testing Level 1, 2, and 3	2)	2)	2)	2)
Magnetic particle testing Level 1, 2, and 3	MIL-STD-2035A Class 2	MIL-STD-2035A Class 2	Not applicable	Not applicable
Liquid penetrant testing Level 1, 2, and 3	Not required	Not required	MIL-STD-2035A Class 2	MIL-STD-2035A Class 2
Radiographic testing Level 1	MIL-STD-2035A Class 3	MIL-STD-2035A Class 3	MIL-STD-2035A Class 3	MIL-STD-2035A Class 3
Radiographic testing Level 2	3)	3)	3)	3)
Radiographic testing Level 3	AWS D3.6M Class B	AWS D3.6M Class B	AWS D3.6M Class B	AWS D3.6M Class B
Tensile strength (ksi [MPa]), min. Levels 1, 2, and 3	60 [430]	70 [490]	75 [520]	85 [590]
Yield Strength (ksi [MPa]), min. Level 1	48 [330]	51 [350]	50 [340]	65 [450]
Yield Strength (ksi [MPa]), min Level 2 / 3	46 [320]	46 [320]	Not required	Not required
Elongation (%) in 2 in [50 mm], min. Level 1	8	8	8	8
Elongation (%) in 2 in [50 mm], min. Level 2	6	6	6	6
Elongation (%) in 2 in [50 mm], min. Level 3	4	4	4	4
Reduction in area (%)	Report for information only	Report for information only	Report for information only	Report for information only
Average impact test (ft-lb bei 28F [-2°C]), min. Level 1	4) 30 ft·lbf.[50 Joule]	4) 30 ft·lbf.[50 Joule]	Not applicable	Not applicable
Average impact test (ft-lb bei 28F [-2°C]), min. Level 2	4) 25 ft·lbf.[40 Joule]	4) 25 ft·lbf.[40 Joule]	Not applicable	Not applicable
Average impact test (ft-lb bei 28F [-2°C]), min. Level 3	4) 15 ft·lbf.[20 Joule]	4) 15 ft·lbf.[20 Joule]	Not applicable	Not applicable

Notes:
1 Chemical composition shall meet the requirements of the applicable filler metal specification (for electrodes with no auxiliary coating).
2 Welds shall meet the visual acceptance criteria specified for AWS D3.6M Class B welds.
3 Weld shall meet the Class 3 requirements of MIL-STD-2035A, except porosity less than 1/16 in [1.5 mm] diameter may be disregarded.
4 Percent shear and lateral expansion shall be reported for information only.

GUIDE TO AWS A5.1: CARBON STEEL ELECTRODES FOR SHIELDED METAL ARC WELDING

E = Covered electrode for manual metal arc

Designates an electrode for military requirements. Greater toughness, low H2

Designates that the electrode (E 7016, E 7018, E 7024) meets the requirements for improved toughness – and ductility

Symbol	Hydrogen content ml/100g weld metal
H2	2
H4	4
H8	8
H16	16

E	70	18	M

E	70	18	-1	HZ	R

Designates that the electrode meets the requirements of the moisture pick-up test (optional for all basic electrodes except E 7018M, for which the test is mandatory hydrogen limits for weld metal

AWS Classification	Tensile Strength min. ksi	Tensile Strength min. MPa	Yield Strength min. ksi	Yield Strength min. MPa	Elongation min. %	Impact Energy Charpy-V J/°C	Welding Position	Type of coating	Type of Current AC	Type of Current DC
E 6010	60	430	48	330	22	27 / –30	1	Cellulosic sodium	–	+pol
E 6011	60	430	48	330	22	27 / –30	1	Cellulosic potasium	x	+ pol
E 6012	60	430	48	330	17	Not spec.	1	Rutile/ Titan sodium	x	– pol
E 6013	60	430	48	330	17	Not spec.	1	Rutile/ Titan pottassium	x	+/– pol
E 6019	60	430	48	330	22	27 / –20	1	Rutile/Iron oxide titania potassium	x	+/– pol
E 6020	60	430	48	330	22	Not spec.	2	Acid / High iron oxide	x	c) +/– pol
E 6022	60	430	Not spec.	Not spec.	Not spec.	Not spec.	2	Acid / High iron oxide	x	– pol
E 6027	60	430	48	330	22	27 / –30	2	Acid, high recovery /High iron oxide, iron powder	x	c) +/– pol
E 7014	70	490	58	400	17	Not spec.	1	Rutile / Iron powder, titania	x	+/– pol
E 7014	70	490	58	400	17	Not spec.	1	Rutile / Iron powder, titania	x	+/– pol
E 7015	70	490	58	400	22	27 / –30	1	Basic / Low hydrogen sodium	–	+pol
E 7016	70	490	58	400	22	27 / –30	1	Basic / Low hydrogen potassium	x	+ pol
E 7018	70	490	58	400	22	27 / –30	1	Basic / Low-hydrogen potassium, iron powder	x	+ pol
E 7018 M	a)	490	b)	b)	24	67 / –30	1	Basic / Low-hydrogen iron powder	–	+pol
E 7024	70	490	58	400	17	Not spec.	2	Rutile, high recovery / Iron powder, titania	x	+/– pol
E 7027	70	490	58	400	22	27 / –30	2	Acid, high recovery / High iron oxide, iron powder	x	c) +/– pol
E 7028	70	490	58	400	22	27 / –20	2	Basic, high recovery Low-hydrogen potassium, iron powder	x	+pol
E 7048	70	490	58	400	22	27 / –30	4	Basic / Low-hydrogen potassium, iron powder	x	+ pol

A 5.1	USN	C	Mn	Si	P	S	Ni	Cr	Mo	V	
E 6010	W06010	0,20	1,2	1,00	N.S.	N.S.	0,30	0,20	0,30	0,08	N.S.
E 6011	W06011										
E 6012	W06012										
E 6013	W06013										
E 6019	W06019										
E 6020	W06020										
E6027	W06027										
E 6018	W06018	0,03	0,60	0,40	0,025	0,15	0,30	0,20	0,30	0,08	N.S.
E 7015	W07015	0,15	0,125	0,90	0,035	0,035	0,30	0,20	0,30	0,08	1,50
E 7016	W07016	0,15	1,60	0,75	0,035	0,035	0,30	0,20	0,30	0,08	1,75
E 7018	W07018	0,15	1,60	0,75	0,035	0,035	0,30	0,20	0,30	0,08	1,75
E 7014	W07014	0,15	1,25	0,90	0,035	0,035	0,30	0,20	0,30	0,08	1,50
E 7024	W07024	0,15	1,25	0,90	0,035	0,035	0,30	0,20	0,30	0,08	1,50
E 7027	W07027	0,15	1,60	0,75	0,035	0,035	0,30	0,20	0,30	0,08	1,75
E 7028	W07028	0,15	1,60	0,90	0,035	0,035	0,30	0,20	0,30	0,08	1,75
E7048	W07048										
E 7018M	W07018	0,12	0,4-1,6	0,80	0,030	0,20	0,25	0,15	0,35	0,05	N.S.

Symbol	Welding Position
1	All positions except vertical-down F,V,OH,H
2	Flat and H-V fillets
4	All positions but in the vertical, V-down only

DESIGN CLASSES FOR WET UNDERWATER WELDING.

<table>
<tr><th>Class</th><th>UA</th><th>UB</th><th>UC</th><th>UD</th></tr>
<tr><td>Type of impact</td><td>non-load-bearing components
(e.g. sealing seams)</td><td>Supporting structures, mainly
dormant stresses,
Water depth
up to 20 m</td><td>Supporting structures, mainly
dormant stresses,
Water depth
over 20 m [1)]</td><td>Supporting structures, not
predominantly static
stressed [2)]</td></tr>
<tr><td>Quality requirements according to</td><td>DIN EN ISO 3834-4</td><td>DIN EN ISO 3834-3</td><td colspan="2">DIN EN ISO 3834-2</td></tr>
<tr><td>Underwater welder</td><td colspan="4">Certified underwater welders (at least 2 permanently employed) according to DIN EN ISO 15618-1 or AWS D 3.6M.
The scope of the test must correspond to the area of application of the welder/operator.
Training and testing for welding under atmospheric conditions
(according to DIN EN 287-1 or DIN EN ISO 9606-1) do not qualify for welding in wet environments</td></tr>
<tr><td rowspan="2">Welding instruction,
welding procedure qualification,
Welding procedure test</td><td colspan="4">A welding procedure specification (WPS according to DIN EN ISO 15609-1) is required.</td></tr>
<tr><td></td><td colspan="3">For steels with yield strengths > 360 N/mm 2, the method of acceptance of provisional welding procedure specifications via DIN EN ISO 15613
(production weld test) or DIN EN ISO 15614-1 (welding procedure qualification).
If the weld shape on the component deviates from the weld shape of the welding procedure test
or production control test, it must be verified again by means of a production control test.
A production control test shall also be performed for yield strengths ≤ 360 MPa if the carbon equivalent CEV [3)] is > 0.40.</td></tr>
<tr><td rowspan="3">Level of technical
knowledge of the
welding supervisor according to
DIN EN ISO 14731</td><td rowspan="3">no special
requirements</td><td>Technical
Basic knowledge
Welding specialist
according to DVS-IIW 1170</td><td>Special technical
Knowledge
Welding technician
according to DVS-IIW 1170</td><td>Extensive technical
Knowledge
Welding engineer
according to DVS-IIW 1170</td></tr>
<tr><td colspan="3">or persons with comparable, sufficient and verifiable, practical experience</td></tr>
<tr><td colspan="3">The welding coordinator shall be permanently employed by the manufacturing company and shall meet the requirements for qualification as welding coordinator for underwater welding specified in section 5.2.2.
In classes UC and UD, the use of an external welding coordinator is possible if the conditions according to section 5.2.2.1 are met.</td></tr>
<tr><td colspan="5">1) All components subjected to predominantly static loads for structures designed in accordance with the basic steel construction standards.
2) All components of class UC and components requiring special knowledge of fatigue strength of connections, e.g. hydraulic steel components according to DIN 19704.
3) Carbon equivalent value according to IIW CEV = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15</td></tr>
</table>

Netherlands:
Certilas Nederland BV
Gloxinialaan 2
6851 TG Huissen
info@certilas.nl

Germany:
Certilas GmbH
Philipp-Mayer-Strasse 4
DE 67304 Eisenberg / Pfalz
Mail.GmbH@certilas.com

France:
Certilas SAS
10 rue Jean Lhomer
78710 Rosny sur Seine
France@certilas.com

www.certilas.com

EN-2022