



ATOM ARC® 9015-B9 HISTORICAL DATA



ATOM ARC® 9018-B9



Actual Chemical Analysis*

Chemical Analysis	Min	Median	Max
C	0.080	0.099	0.124
Mn	0.59	0.85	0.99
Si	0.12	0.19	0.30
P	0.004	0.009	0.011
S	0.007	0.009	0.010
Cr	8.04	8.60	9.60
Ni	0.15	0.25	0.45
Mo	0.90	0.99	1.11
Nb	0.02	0.04	0.09
Al	<0.001	0.001	0.002
Co	0.002	0.008	0.010
Cu	0.01	0.05	0.12
V	0.16	0.21	0.29
N	0.032	0.040	0.052
As	<0.0002	0.0010	0.0030
Sb	<0.0004	0.0010	0.0021
Sn	0.0002	0.002	0.0093
Fe	Rem	Rem	Rem

* This data is compiled from 21 different lots within the time period of January 2007 to May 2008.

Actual Mechanical Analysis**

Mechanical Analysis	Min		Median		Max	
	1400°F (760°C) @ 2 hrs.	1375°F (765°C) @ 1 hr.	1400°F (760°C) @ 2 hrs.	1375°F (765°C) @ 1 hr.	1400°F (760°C) @ 2 hrs.	1375°F (765°C) @ 1 hr.
Yield (ksi)	83.5	88.4	86.5	96.6	89.3	121.9
Tensile (ksi)	105.2	107.4	107.5	115.1	109.1	137.9
% Elongation	22	17	22	21	24	23
X-Factor	11	8	12	12	14	14
Diffusible H ₂ (ml/100gr)	1.2	0.6	2.1	1.75	3.2	3.2
Charpy V-notch @ 68°F (Ft.-lbs)	49.8	n/a	58.4	n/a	67	n/a

** The data above was derived in the PWHT condition through March 2008 at 1 hour at 1375°F +/- 25°F. As of April 2008, the specification has changed to 1400°F +/- 25°F at 2 hours. This data is compiled from 21 different tests within the time period of January 2007 to May 2008.



Atom Arc 9018-B9 is designed to weld the modified 9% Cr - 1% Mo steels known by the designations T91, P91 or Grade 91. These steels are designed to provide improved creep strength, toughness, fatigue and oxidation, and corrosion resistance at elevated temperatures.

This electrode is specially formulated with a combined Mn + Ni < 1.20% max. and meets numerous customers' specifications while producing an X-Factor < 15 MAX.

Classification and Approvals

■ AWS/ASME SFA 5.5: E9018-B9H4R

Application

This electrode is used to weld high temperature pipe, heat exchangers and boiler units.

Preheat Information

The recommended preheat temperature for 9CrMo steels is 400-500°F depending on thickness. Post weld heat treatment is generally required.

Complimentary Products

GTAW (Tigrod ER90S-B9)
FCAW (Dual Shield B9)

Electrode Imprint Marking

9018-B9H4R

Typical Mechanical Properties

Stress Relieved 1 hr. @ 1375°F (746°C)

	ksi	MPa
Yield Strength	103	711
Tensile Strength	119	821
Elongation % in 2"	19%	

Stress Relieved 2 hr. @ 1400°F (760°C)

	ksi	MPa
Yield Strength	85	587
Tensile Strength	105	724
Elongation % in 2"	25%	

Typical Undiluted Weld Metal Analysis

C	Mn	Si	P	S	Cr	Mo	X-Factor
0.1%	0.8%	0.17%	0.008%	0.009%	8.5%	1%	<15

Storage and Reconditioning

Store open electrodes @ 225°F (107°C) to 300°F (150°C)
Recondition electrodes @ 700°F (370°C) for 1 hour

Ordering Information

AA 9018-B9 3/32x14x10# HS 255067845
AA 9018-B9 1/8x14x10# HS 255067852
AA 9018-B9 5/32x14x10# HS 255067860
AA 9018-B9 3/16x14x10# HS 255067878



ATOM ARC® 9018-B9 HISTORICAL DATA



DUAL SHIELD® B9

Actual Chemical Analysis*

Chemical Analysis	Min	Median	Max
C	0.080	0.098	0.124
Mn	0.69	0.84	1.11
Si	0.12	0.17	0.25
P	0.004	0.008	0.013
S	0.007	0.009	0.014
Cr	8.04	8.55	9.51
Ni	0.19	0.27	0.51
Mo	0.85	1.00	1.18
Nb	0.02	0.04	0.10
Al	0.001	0.003	0.010
Co	<0.001	0.007	0.020
Cu	0.010	0.04	0.14
V	0.16	0.19	0.22
N	0.032	0.039	0.051
As	<0.0002	<0.0002	0.0028
Sb	<0.0004	0.0010	0.0017
Sn	0.0002	0.0020	0.0077
Fe	Rem	Rem	Rem

* This data is compiled from 8 different lots within the time period of March 2007 to February 2008.



Actual Mechanical Analysis**

Mechanical Analysis	Min	Median	Max
	1400°F (760°C) @ 2 hrs.		
Yield (ksi)	93	96	124
Tensile (ksi)	112	115	141
% Elongation	18	20	23
X-Factor	8	12	14
Diffusible H2 (ml/100gr)	0.3	1.7	1.9
Charpy V-notch (Ft.-lbs)	39	60	80

** The data above was derived in the PWHT condition at 1 hour at 1375°F +/- 25°F.
This data is compiled from 8 different tests within the time period of March 2007 to February 2008.



Dual Shield B9 is an all-position flux cored electrode designed for the welding of modified 9% chromium creep resistant steels, such as ASTM A335 Grade P91 or ASTM A213 T91. This product is specially formulated with a combined Mn + Ni < 1.20% to meet a variety of customer specifications.

Dual Shield B9 product is packaged on wire spool basket to allow for the product to be placed in a heated storage oven. In addition, the wire is packaged in a vacuum-sealed foil bag to prevent moisture pick up until the sealed bag has been opened.

Classification and Approvals

■ AWS/ASME A5.29: E91T1-B9M-H8

Application

Dual Shield B9 has been formulated for use with 75% Argon/ 25% CO₂ shielding gas. This product operates well out-of-position, especially in the 6 o'clock position on pipe producing a flat to slightly convex weld bead.

Shielding Gas

75% Ar/25% CO₂

Complimentary Products

SMAW (Atom Arc 9015-B9 and/or 9018-B9)
GTAW (Tigrod ER90S-B9)

Typical Mechanical Properties

Stress Relieved 2 hr. @ 1400°F (760°C)

Shielded Gas: 75% Ar / 25% CO ₂	ksi	MPa
Yield Strength	87	600
Tensile Strength	107	738
Elongation % in 2"	21%	

Typical Charpy V-Notch

Impact Properties

Testing Temperature	Condition	Ft.-lbs	J
70°F (20°C)	Stress Relieved 2 hr. @ 1400°F (760°C)	30	40

Typical Undiluted Weld Metal Analysis, 75% Ar/25% CO₂

C	Mn	Si	P	S	Cr	Mo	X-Factor
0.1%	0.96%	0.18%	0.009%	0.008%	8.9%	1%	<15

Immediately from the vacuum-sealed bag the diffusible Hydrogen is 4ml/100 g weld metal.

X-Factor: < 15

Mn + Ni ration is < 1.20%

Storage and Reconditioning*

Store open electrodes at 300°F (150°C)
Recondition electrodes at 300°F (150°C) for 1 hour

*Note: If packaged on a plastic spool, remove spool from plastic bag before placing in oven. Store at 125°F (52°C).

Ordering Information

DS B9 045x15#PSP VP 242250041
DS B9 045x33#BAWS VP 242250033
DS B9 1/16x33#BAWS VP 242250017



DUAL SHIELD® B9



TIGROD® ER90S-B9

Actual Chemical Analysis Historic Data*

Chemical Analysis	Min	Median	Max
C	0.090	0.095	0.110
Mn	0.80	0.96	1.15
Si	0.13	0.18	0.22
P	0.003	0.009	0.012
S	0.006	0.008	0.010
Cr	8.13	8.93	9.61
Ni	0.04	0.19	0.25
Mo	0.92	0.99	1.11
Nb	0.02	0.03	0.00
Al	0.001	0.002	0.003
Co	<0.001	0.001	0.003
Cu	0.010	0.033	0.040
V	0.170	0.220	0.250
N	0.028	0.031	0.034
As	<0.0002	0.0005	0.0005
Sb	<0.0004	0.0005	0.0027
Sn	0.0018	0.0050	0.0081
Fe	Rem	Rem	Rem

* This data is compiled from 8 different lots within the time period of February 2007 to May 2008.

Actual Mechanical Analysis Historic Data**

Mechanical Analysis	Min	Median	Max
	1400°F (760°C) @ 2 hrs.		
Yield (ksi)	82	88	90
Tensile (ksi)	104	107	109
% Elongation	20	22	22
X-Factor	5	9.5	10
Diffusible H2 (ml/100gr)	2.2	4.9	6.5
Charpy V-notch @ 70°F(Ft.-lbs)	22	29.6	34.6

** The data above was derived in the PWHT condition at 1400°F +/- 25°F at 2 hours. This data is compiled from 8 different tests within the time period of February 2007 to May 2008.



TIGROD ER90S-B9 is a solid bare rod for TIG welding of modified 9% chromium-moly creep resistant steels, such as ASTM A335 Grade P91 or ASTM A213 T91.

TIGROD ER90S-B9 is embossed on both ends with the alloy identification.

Classification and Approvals

■ AWS A5.28: ER90S-B9

Shielding Gas

100% Argon

Complimentary Products

SMAW (Atom Arc 9018-B9 and/or 9015-B9)
FCAW (Dual Shield B9)

Typical Mechanical Properties

Stress Relieved 1 hr. @ 1275°F (690°C)

	ksi	MPa
Yield Strength	80	552
Tensile Strength	94	649
Elongation % in 2"	27%	

Stress Relieved 1 hr. @ 1300°F (704°C)

	ksi	MPa
Yield Strength	76	524
Tensile Strength	93	642
Elongation % in 2"	25%	

Typical Undiluted Weld Metal Analysis

C	Mn	Si	P	S	Cr	Mo	X-Factor
0.1%	0.6%	0.5%	0.01%	0.01%	2.4%	0.9%	<15

Storage and Reconditioning

Store open electrodes in a dry place.

Ordering Information

TIGROD ER90SB9 1/16X36X10#T30# CT E2 259967289
 TIGROD ER90SB9 3/32X36X10#T30# CT E2 259967198
 TIGROD ER90SB9 1/8X36X10#T30# CT E2 259967206
 TIGROD ER90SB9 5/32X36X10#T30# CT E2 259967141



**ATOM ARC 9015-B9
CERTIFIED MATERIAL TEST REPORT**



**ATOM ARC® 9018-B9
CERTIFIED MATERIAL TEST REPORT**

**Certificate of Analysis
Certified Materials Test Report**

Tradename
Atom Arc 9015-B9

Diffusible Hydrogen to AWS A4.3

	GC
Average Value ml/100 gr	2.6

Classification
E9015-B9H4R

Actual Mechanical Properties

Stress Relieved 2 hr. @ 1400°F (760°C)

	ksi	MPa
Yield Strength	81.5	562
Tensile Strength	103.1	711
Reduction in Area	60%	
Elongation % in 2"	25%	

Class
AWS A5.5: 2006, ASME SFA 5.5, SEC. II, PART C,
2007 EDITION, 2008a ADDENDA

Diameter
1/8"

Length/Pkg Type
14"

Heat/PKG Code No.
090072

Lot No.
4F924K01

**Actual Charpy V-Notch
Impact Properties**

Testing Temperature	Condition	Ft.-lbs	J
70°F (21°C)	Stress Relieved 2 hr @ 1400°F (760°C)	77	104

Radiography
Satisfactory

Moisture by RC-412 Method

Out of the Can	0.08
Exposed	0.19

Concentricity 2%

Chemical Analysis

C	Mn	Si	P	S	Cr	Mo	V	Ni
0.09%	0.74%	0.19%	0.009%	0.008%	8.56%	0.96%	0.20%	0.21%
Cu	Al	N	Nb	As	Sb	Sn	X-Factor	
0.04%	<0.01%	0.039%	0.04%	0.0017%	0.0005%	0.0023%	10	

These properties represent a single test performed on a given lot/heat of material. The properties may change on another lot/heat test.

By: K. Wildasin
K. Wildasin, Supervisor, Q.A. Services



**Certificate of Analysis
Certified Materials Test Report**

Tradename
Atom Arc 9018-B9

Diffusible Hydrogen to AWS A4.3

	GC
Average Value ml/100 gr	2.2

Classification
E9018-B9H4R

Class
AWS A5.5: 2006, ASME SFA 5.5, SEC. II, PART C,
2007 EDITION, 2008a ADDENDA

Diameter
1/8"

Length/Pkg. Type
14"

Heat/PKG Code No.
10347

Lot No.
2C926K03

Actual Mechanical Properties

Stress Relieved 2 hr. @ 1400°F (760°C)

	ksi	MPa
Yield Strength	84.8	586
Tensile Strength	105.7	730
Reduction in Area	62%	
Elongation % in 2"	24%	

Radiography
Satisfactory

Moisture by RC-412 Method

Out of the Can	0.06
Exposed	0.17

Concentricity 2%

Chemical Analysis

C	Mn	Si	P	S	Cr	Mo	V	Ni
0.093%	0.80%	0.18%	0.012%	0.010%	9.51%	0.96%	0.21%	0.24%
Cu	Al	N	Nb	As	Sb	Sn	X-Factor	
0.12%	<0.01%	0.044%	0.03%	0.002%	0.001%	0.0047%	14	

These properties represent a single test performed on a given lot/heat of material. The properties may change on another lot/ heat test.

By: K. Wildasin
K. Wildasin, Supervisor, Q.A. Services





DUAL SHIELD® B9
CERTIFIED MATERIAL TEST REPORT



TIGROD® ER90S-B9
CERTIFIED MATERIAL TEST REPORT

Certificate of Analysis
Certified Materials Test Report

Tradename
 Dual Shield B9

Classification
 E91T1-B9M

Class
 AWS A5.29:2005

Diameter
 0.045"

Length/Pkg. Type
 33# Spool

Heat/PKG Code No.
 N/A

Lot No.
 87006

Radiography
 Satisfactory

Diffusible Hydrogen to AWS A4.3

	GC
Average Value ml/100 gr	5.3

This material does meet "H8" Requirements.

Chemical Analysis

C	Mn	Si	P	S	Cr	Mo	V	Ni
0.09%	0.83%	0.14%	0.010%	0.008%	9.14%	1.03%	0.22%	0.21%
Cu	Al	N	Nb	As	Sb	Sn	X-Factor	
0.04%	<0.01%	0.035%	0.03%	0.0005%	0.0005%	0.0037%	12	

These properties represent a single test performed on a given lot/heat of material. The properties may change on another lot/ heat test.

By: K. Wildasin
 K. Wildasin, Supervisor, Q.A. Services



Actual Mechanical Properties
Stress Relieved 2 hr. @ 1400°F (760°C)

	ksi	MPa
Yield Strength	85.5	590
Tensile Strength	105.9	731
Reduction in Area	60%	
Elongation % in 2"	22%	

Actual Charpy V-Notch
Impact Properties

Testing Temperature	Condition	Ft.-lbs	J
70°F (21°C)	Stress Relieved 2 hr @ 1400°F (760°C)	38	52

Certificate of Analysis
Certified Materials Test Report

Tradename
 TIGROD ER90S-B9

Classification
 ER-90S-B9

Class
 AWS A5.28-96, ASME SFA 5.28

Diameter
 1/8"

Length
 14"

Heat/PKG Code No.
 12/2032-3-2

Lot No.
 3-2

Radiography
 Satisfactory

Actual Mechanical Properties

As Welded

	ksi	MPa
Yield Strength	59.4	410
Tensile Strength	89.9	620
Elongation % in 2"	16%	

Chemical Analysis

C	Mn	Si	P	S	Cr	Mo	V	Ni
0.08%	0.51%	0.41%	0.008%	0.009%	8.64%	1.01%	0.20%	0.21%
Cu	Al	N	Ti	X-Factor				
0.14%	0.015%	0.020%	0.01%	10				

These properties represent a single test performed on a given lot/heat of material. The properties may change on another lot/heat test.

By: K. Wildasin
 K. Wildasin, Supervisor, Q.A. Services





Weld Metal Creep Rupture Data

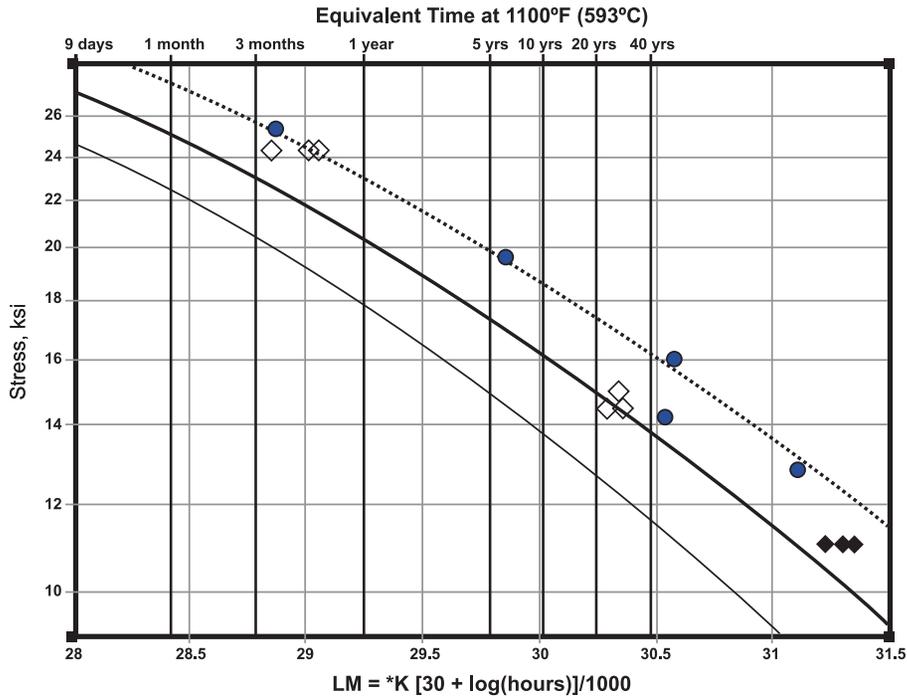


Chart Legend

- ORNL Base Metal Mean
- ORNL Base Metal Min
- ORNL Mean + 1.65*SEE
- Tigrod 90S-B9
- ◇ Atom Arc 9018-B9 & Atom Arc 9015-B9
- ◆ Dual Shield B9

The American Society of Mechanical Engineers



QUALITY SYSTEM
CERTIFICATE

This certificate accredits the named company as having their quality system program verified for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The accreditation granted by this certificate is subject to the provisions of the agreement set forth in the application. Any material produced under this certificate will have been manufactured strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

ESAB Welding & Cutting Products
3325 Middle Road
Ashtabula, Ohio 44005

SCOPE:

Material organization manufacturing and supplying ferrous & nonferrous welding material including shipment of material from qualified material organizations to other parties, qualification of nonaccredited material organizations, utilization of unqualified source material, and approval and control of suppliers at the above location only

AUTHORIZED: April 11, 2008

EXPIRES: March 17, 2011

CERTIFICATE NUMBER: QSC-323

Chairman of The Boiler
And Pressure Vessel Committee

Director, Accreditation and Certification