

# SHIELD-ARC® HYP+

Low Alloy, Cellulosic, Pipe ■ AWS E7010-P1

## KEY FEATURES

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E7010-P1, E7010-G
<b>ASME SFA-A5.5:</b>	E7010-P1, E7010-G
<b>ABS:</b>	E7010-P1
<b>CWB/CSA W48-06:</b>	E4910-P1
<b>TUV:</b>	DIN EN ISO 2560-A:E

## TYPICAL APPLICATIONS

- Root pass welding of up to X80 grade pipe
- Hot, fill and cap pass of up to X65 grade pipe
- Vertical down welding

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
1/8 (3.2)	14 (350)	ED029511
5/32 (4.0)	14 (350)	ED029513
3/16 (4.8)	14 (350)	ED029509

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @ -29°C (-20°F)
<b>Requirements</b> – AWS E7010-P1	415 (60) min	490 (70) min	22 min	27 (20) min
<b>Typical Results<sup>(3)</sup></b> – As-Welded	435-525 (63-76)	525-635 (76-92)	22-28	27-56 (20-41)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P	%S
<b>Requirements</b> – AWS E7010-P1	0.20 max	1.20 max	0.60 max	0.03 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.13-0.17	0.43-0.63	0.08-0.18	≤ 0.01	≤ 0.01
	%Ni	%Cr	%Mo	%V	
<b>Requirements</b> – AWS E7010-P1	1.00 max	0.30 max	0.50 max	0.10 max	
<b>Typical Results<sup>(3)</sup></b>	0.01-0.02	0.02	0.27-0.31	< 0.01	

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	75-130	90-185	140-225

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer

# SHIELD-ARC® 85

Low Alloy, Cellulosic, Pipe ■ AWS E7010-A1

## KEY FEATURES

- For welding 0.50% molybdenum steel
- Light slag for minimal arc interference
- Deep penetration and superior puddle control
- Clean, visible weld puddle

## TYPICAL APPLICATIONS

- API 5L X42 through X56 grade pipe
- Cross country and in-plant pipe

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E7010-A1
<b>ASME SFA-A5.5:</b>	E7010-A1
<b>ABS:</b>	E7010-A1
<b>CWB/CSA W48-06:</b>	E4910-A1
<b>TUV:</b>	DIN EN ISO 2560-A:E
<b>MIL-E-22200/7:</b>	MIL-7010-A1

## WELDING POSITIONS

All

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED012893
1/8 (3.2)	14 (350)	ED012885
5/32 (4.0)	14 (350)	ED012896
3/16 (4.8)	14 (350)	ED012889

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @ -29°C (-20°F)
<b>Requirements</b> – AWS E7010-A1	390 (57) min	490 (70) min	22 min	Not Specified
<b>Typical Results<sup>(3)</sup></b> – As-Welded Stress-Relieved 1 hr @ 620°C (1150°F)	440-510 (64-74)	540-580 (78-84)	25-30	35-43 (26-32)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P	%S	%Mo
<b>Requirements</b> – AWS E7010-A1	0.12 max	0.60 max	0.40 max	0.03 max	0.03 max	0.40-0.65
<b>Typical Results<sup>(3)</sup></b>	0.07-0.12	0.29-0.59	0.08-0.26	0.01-0.02	≤ 0.01	0.40-0.62

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	50-90	75-130	90-175	140-225

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer

# SHIELD-ARC® 70+

Low Alloy, Cellulosic, Pipe ■ AWS E8010-G, Also meets E8010-P1

## KEY FEATURES

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E8010-G, E8010-P1
<b>ASME SFA-A5.5:</b>	E8010-G, E8010-P1
<b>ABS:</b>	E8010-G
<b>CWB/CSA W48-06:</b>	E5510-G
<b>TUV:</b>	DIN EN ISO 2560-A:E

## TYPICAL APPLICATIONS

- Relatively high silicon pipe
- API 5L X56 through X70 grade pipe
- Cross country and in-plant pipe

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
1/8 (3.2)	14 (350)	ED012841
5/32 (4.0)	14 (350)	ED012849
3/16 (4.8)	14 (350)	ED012845

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
<b>Requirements</b> – AWS E8010-G	460 (67) min	550 (80) min	19 min	Not Specified	Not Specified
<b>Typical Results</b> <sup>(3)</sup> – As-Welded	460-620 (67-90)	585-690 (85-100)	19-31	37-81 (27-60)	26-64 (19-47)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn <sup>(4)</sup>	%Si <sup>(4)</sup>	%P	%S
<b>Requirements</b> – AWS E8010-G	Not Specified	1.00 min.	0.80 min.	0.03 max.	0.03 max.
<b>Typical Results</b> <sup>(3)</sup>	0.13-0.17	0.60-1.20	0.05-0.30	≤ 0.01	≤ 0.01
	%Ni <sup>(4)</sup>	%Cr <sup>(4)</sup>	%Mo <sup>(4)</sup>	%V <sup>(4)</sup>	
<b>Requirements</b> – AWS E8010-G	0.50 min.	0.30 min.	0.20 min.	0.10 min.	
<b>Typical Results</b> <sup>(3)</sup>	0.75-0.97	0.01-0.20	0.35-0.45	0.02-0.04	

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	75-130	90-185	140-225

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>In order to meet the alloy requirements of the "G" designation, the undiluted weld metal shall have the minimum of at least one of the elements listed.

# SHIELD-ARC® 90

Low Alloy, Cellulosic, Pipe ■ AWS E9010-G

## KEY FEATURES

- Light slag for minimal arc interference
- Deep penetration
- Clean, visible weld puddle
- Superior puddle control

## WELDING POSITIONS

All

## CONFORMANCES

AWS A5.5/A5.5M: E9010-G

ASME SFA-A5.5: E9010-G

## TYPICAL APPLICATIONS

- Hot pass welding of up to X80 grade pipe, when followed by low hydrogen fill and cap
- API 5L X70 through X80 grade pipe
- Cross country pipe

## DIAMETERS / PACKAGING

Diameter mm (in)	Length in (mm)	50 lb (22.7 kg) Easy Open Can
3.2 (1/8)	14 (350)	EDS01693
4.0 (5/32)	14 (350)	EDS01694
5.0 (3/16)	14 (350)	EDS01695

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf)	
				@ -29°C (-20°F)	@ -46°C (-50°F)
<b>Requirements</b> - AWS E9010-G	530 (77) min	620 (90) min	17 min.	Not Specified	Not Specified
<b>Typical Results</b> <sup>(3)</sup> - As-Welded	530-605 (77-88)	620-690 (90-100)	17-29	45-94 (33-69)	28-62 (21-46)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn <sup>(4)</sup>	%Si <sup>(4)</sup>	%P	%S
<b>Requirements</b> - AWS E9010-G	Not Specified	1.00 min	0.80 min	0.03 max	0.03 max
<b>Typical Results</b> <sup>(3)</sup>	0.13-0.18	0.55-0.79	0.08-0.22	0.01-0.02	≤ 0.01
	%Ni <sup>(4)</sup>	%Cr <sup>(4)</sup>	%Mo <sup>(4)</sup>	%V <sup>(4)</sup>	
<b>Requirements</b> - AWS E9010-G	0.50 min	0.30 min	0.20 min	0.10 min	
<b>Typical Results</b> <sup>(3)</sup>	0.66-0.77	0.01-0.06	0.43-0.70	≤ 0.01	

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3.2 mm (1/8 in)	4.0 mm (5/32 in)	4.8 mm (3/16 in)
DC+	75-130	80-185	140-225

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>In order to meet the alloy requirements of the "G" designation, the undiluted weld metal shall have the minimum of at least one of the elements listed.

# EXCALIBUR® 7018-A1 MR®

Low Alloy, Low Hydrogen ■ AWS E7018-A1 H4R

## KEY FEATURES

- Designed for welding 0.50% molybdenum steel
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E7018-A1 H4R
<b>ASME SFA-A5.5:</b>	E7018-A1 H4R
<b>ABS:</b>	E7018-A1 H4R
<b>CWB/CSA W48-06:</b>	E4918-A1

## TYPICAL APPLICATIONS

- Fabrication and maintenance welding
- Pressure vessels and pressure piping
- Applications requiring stress-relieved conditions

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032893	ED032873	ED032875	ED032876 ED032877
1/8 (3.2)	14 (350)				
5/32 (4.0)	14 (350)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf) @ -29°C (-20°F)
<b>Requirements</b> - AWS E7018-A1 H4R	390 (57) min	490 (70) min	22 min	Not Specified
<b>Typical Results<sup>(3)</sup></b> - Stress-Relieved 1 hr @ 620°C (1150°F)	470-500 (68-72)	565-585 (82-85)	25-32	60-130 (46-96)
Stress-Relieved 8 hrs @ 620°C (1150°F) <sup>(4)</sup>	450-485 (65-70)	545-570 (79-83)	27-32	50-107 (38-79)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P
<b>Requirements</b> - AWS E7018-A1 H4R	0.12 max	0.90 max	0.80 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.04-0.06	0.55-0.80	0.35-0.55	≤ 0.01
	%S	%Mo	Diffusible Hydrogen (mL/100g weld metal)	
<b>Requirements</b> - AWS E7018-A1 H4R	0.03 max	0.40-0.65	4.0 max	
<b>Typical Results<sup>(3)</sup></b>	≤ 0.01	0.45-0.65	2-4	

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(5)</sup>	Current (Amps)		
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	60-110	85-160	110-210
AC	65-120	90-170	115-220

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry Specific Data (Not AWS Requirement). <sup>(5)</sup>Preferred polarity is listed first.

# EXCALIBUR® 8018-B2 MR®

Low Alloy, Low Hydrogen ■ AWS E8018-B2 H4R

## KEY FEATURES

- Designed for welding 1.25% chromium, 0.50% molybdenum steel
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E8018-B2 H4R
<b>ASME SFA-A5.5:</b>	E8018-B2 H4R
<b>CWB/CSA W48-06:</b>	E5518-B2

## TYPICAL APPLICATIONS

- Power generation
- Petrochemical
- Pressure vessels
- Process piping
- Applications requiring stress-relieved conditions

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032878	ED032879	ED032881	ED032882 ED032883
1/8 (3.2)	14 (350)				
5/32 (4.0)	14 (350)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -29°C (-20°F)
<b>Requirements</b> - AWS E8018-B2 H4R	460 (67) min	550 (80) min	19 min	Not Specified
<b>Typical Results<sup>(3)</sup></b>				
Stress-Relieved 1 hr @ 690°C (1275°F)	540-585 (78-85)	640-685 (93-99)	24-26	71-127 (52-94)
Stress-Relieved 8 hrs @ 690°C (1275°F) <sup>(4)</sup>	495-540 (72-78)	605-640 (88-93)	25-28	64-127 (47-83)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P
<b>Requirements</b> - AWS E8018-B2 H4R	0.05-0.12	0.90 max	0.80 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.08-0.11	0.65-0.80	0.35-0.55	≤ 0.02
	%S	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld metal)
<b>Requirements</b> - AWS E8018-B2 H4R	0.03 max	1.00-1.50	0.40-0.65	4.0 max
<b>Typical Results<sup>(3)</sup></b>	≤ 0.01	1.05-1.30	0.40-0.60	2-4

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(5)</sup>	Current (Amps)		
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	60-110	85-160	110-210
AC	65-120	90-170	115-220

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry Specific Data (Not AWS Requirement). <sup>(5)</sup>Preferred polarity is listed first.

# EXCALIBUR® 8018-C1 MR®

Low Alloy, Low Hydrogen ■ AWS E8018-C1 H4R

## KEY FEATURES

- Designed to produce a nominal 2.25% nickel deposit
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E8018-C1 H4R
<b>ASME SFA-A5.5:</b>	E8018-C1 H4R
<b>CWB/CSA W48-06:</b>	E5518-C1

## TYPICAL APPLICATIONS

- Low temperature applications
- Refrigerated ammonia tanks
- Liquefied gas storage, piping and transportation
- Weathering steels
- Applications requiring stress-relieved conditions

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032596	ED030876
1/8 (3.2)	14 (350)	ED032597	ED030877
5/32 (4.0)	14 (350)		ED030878
3/16 (4.8)	14 (350)		ED030879
1/4 (6.4)	18 (450)		ED030880

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf) @ -59°C (-75°F)
<b>Requirements</b> – AWS E8018-C1 H4R	460 (67) min	550 (80) min	19 min	20 (27) min
<b>Typical Results<sup>(3)</sup></b> Stress-Relieved 1 hr @ 610°C (1125°F)	460-525 (67-76)	565-615 (82-89)	24-32	79-129 (58-95)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P
<b>Requirements</b> – AWS E8018-C1 H4R	0.12 max	1.25 max	0.80 max	0.03 max
<b>Typical Results<sup>(3)</sup></b> – As-Welded	0.05-0.09	0.89-1.25	0.17-0.53	≤ 0.02
	%S	%Ni	Diffusible Hydrogen (mL/100g weld deposit)	
<b>Requirements</b> – AWS E8018-C1 H4R	0.03 max	2.00-2.75	4.0 max	
<b>Typical Results<sup>(3)</sup></b> – As-Welded	≤ 0.01	2.00-2.58	1-3	

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(5)</sup>	Current (Amps)					
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)	7/32 in (5.6 mm)	1/4 in (6.4 mm)
DC+	70-110	90-160	130-210	180-300	250-330	300-400
AC	80-120	100-160	140-210	200-300	270-370	325-430

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Preferred polarity is listed first.

# EXCALIBUR® 8018-C3 MR®

Low Alloy, Low Hydrogen ■ AWS E8018-C3 H4R



## KEY FEATURES

- Designed to produce a 1% nickel deposit
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E8018-C3 H4R
<b>ASME SFA-A5.5:</b>	E8018-C3 H4R
<b>ABS:</b>	E8018-C3 H4R
<b>CWB/CSA W48-06:</b>	E5518-C3
<b>EN ISO 2560-B:</b>	E5518-N2 A U H5

## TYPICAL APPLICATIONS

- Shipbuilding
- Piping and gas storage tanks
- Weathering steels
- Cross country pipe repair

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032599	ED030892, ED034039*
1/8 (3.2)	14 (350)	ED032600	ED030893, ED034040*
5/32 (4.0)	14 (350)		ED030894, ED034041*
3/16 (4.8)	14 (350)		ED030895, ED034042*
7/32 (5.6)	18 (450)		ED030897, ED034315*
1/4 (6.4)	18 (450)		ED030896

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## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @ -40 °C (-40 °F)
<b>Requirements</b> – AWS E8018-C3 H4R	470-550 (68-80)	550 (80) min	24 min	27 (20) min
<b>Typical Results<sup>(3)</sup></b> – As-Welded	505-590 (73-86)	550-675 (80-98)	24-32	81-163 (60-120)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P	%S
<b>Requirements</b> – AWS E8018-C3 H4R	0.12 max.	0.40-1.25	0.80 max.	0.03 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.04-0.07	0.40-1.25	0.23-0.46	≤ 0.01	≤ 0.009
	%Ni	%Cr	%Mo	%V	Diffusible Hydrogen (mL/100g weld deposit)
<b>Requirements</b> – AWS E8018-C3 H4R	0.80-1.10	0.15 max	0.35 max	0.05 max	4.0 max
<b>Typical Results<sup>(3)</sup></b>	0.81-1.09	0.04-0.06	0.07-0.27	≤ 0.01	1-2

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(4)</sup>	Current (Amps)					
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)	7/32 in (5.6 mm)	1/4 in (6.4 mm)
DC±	70-110	90-160	130-210	180-300	250-330	300-400
AC	80-120	100-160	140-210	200-300	270-370	325-425

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Preferred polarity is listed first.



# EXCALIBUR® 9018-B3 MR®

Low Alloy, Low Hydrogen ■ AWS E9018-B3 H4R

## KEY FEATURES

- Designed for all-position welding of 2.25% chromium, 1% molybdenum low alloy steels
- Premium arc performance
- Square coating burn-off
- Easy strike, re-strike and slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E9018-B3 H4R
<b>ASME SFA-A5.5:</b>	E9018-B3 H4R
<b>CWB/CSA W48-06:</b>	E6218-B3

## TYPICAL APPLICATIONS

- 2.25% chromium, 1% molybdenum steels
- Petrochemical
- Power generation
- Pressure vessels
- Applications requiring stress-relieved conditions
- Process piping

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	8 lb (3.6 kg) Easy Open Can 24 lb (10.9 kg) Master Carton	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED032884	ED032885	ED032887	ED032888 ED032889
1/8 (3.2)	14 (350)				
5/32 (4.0)	14 (350)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf) @ -40°C (-40°F)
<b>Requirements</b> – AWS E9018-B3 H4R	530 (77) min	620 (90) min	17 min	Not Specified
<b>Typical Results<sup>(3)</sup></b>				
Stress-Relieved 1 hr @ 690°C (1275°F)	595-605 (86-88)	705-715 (102-104)	20-23	57-72 (42-53)
Stress-Relieved 8 hrs @ 690°C (1275°F) <sup>(4)</sup>	530-580 (77-84)	650-685 (94-99)	20-24	43-107 (32-79)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P
<b>Requirements</b> – AWS E9018-B3 H4R	0.05-0.12	0.90 max	0.80 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.07-0.1	0.65-0.79	0.39-0.49	≤0.01
	%S	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld metal)
<b>Requirements</b> – AWS E9018-B3 H4R	0.03 max	2.00-2.50	0.90-1.20	4.0 max
<b>Typical Results<sup>(3)</sup></b>	≤0.01	2.21-2.46	1.03-1.13	2-4

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(5)</sup>	Current (Amps)		
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	60-110	85-160	110-210
AC	65-120	90-170	115-220

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry Specific Data (Not AWS Requirement). <sup>(5)</sup>Preferred polarity is listed first.

# EXCALIBUR® 9018M MR®

Low Alloy, Low Hydrogen ■ AWS E9018M H4R

## KEY FEATURES

- Designed to produce weld deposits with 620 MPa (90 ksi) tensile strength
- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E9018M H4R
<b>ASME SFA-A5.5:</b>	E9018M H4R
<b>ABS:</b>	E9018M H4R
<b>CWB/CSA W48-06:</b>	E6218-M H4R (E9018M H4R)

## TYPICAL APPLICATIONS

- High strength steel, such as HY-80, HY-90 and ASTM A514
- Cross country pipe repair
- DC welding

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)	ED032602	ED030868
1/8 (3.2)	14 (350)	ED032603	ED030869
5/32 (4.0)	14 (350)		ED030870
3/16 (4.8)	14 (350)		ED030871

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @ -50°C (-60°F)
<b>Requirements</b> – AWS E9018M H4R	540-620 (78-90) min	620 (90) min	24 min	27 (20) min
<b>Typical Results<sup>(3)</sup></b> – As-Welded	540-620 (78-90)	620-705 (90-102)	24-37	27-122 (20-90)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P	%S
<b>Requirements</b> – AWS E9018M H4R	0.10 max	0.60-1.25	0.80 max	0.03 max	0.03 max.
<b>Typical Results<sup>(3)</sup></b>	0.04-0.07	0.90-1.10	0.30-0.50	0.01-0.02	≤ 0.01
	%Ni	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)	
<b>Requirements</b> – AWS E9018M H4R	1.40-1.80	0.15 max	0.35 max	4.0 max	
<b>Typical Results<sup>(3)</sup></b>	1.50-1.80	0.05-0.12	0.25-0.35	1-3	

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	70-110	90-160	130-210	180-300

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer

# EXCALIBUR® 10018-D2 MR®

Low Alloy, Low Hydrogen ■ AWS E10018-D2 H4R

## KEY FEATURES

- Capable of exceeding 550 MPa (80 ksi) yield strength after 12 hours at 635°C (1175°F) on 4130 AISI steel
- Premium arc performance
- Q2 Lot® - Certificate showing actual deposit chemistry available online
- Easy strike and re-strike
- Effortless slag removal

## WELDING POSITIONS

All, except vertical down

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	25 lb (11.3 kg) Easy Open Can	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	12 (300)	ED033162	
1/8 (3.2)	14 (350)		
5/32 (4.0)	14 (350)		ED033163
3/16 (4.8)	14 (350)		ED033164
7/32 (5.6)	18 (450)		ED033330
			ED033331

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft•lbf) @ -51°C (-60°F)	Hardness <sup>(4)</sup> HV <sub>10</sub>
<b>Requirements</b> – AWS E10018-D2 H4R	600 (87) min	690 (100) min	16 min	27 (20) min	Not Specified
<b>Typical Results</b> <sup>(3)</sup> – Stress-Relieved 1 hr @ 620°C (1150°F)	650-715 (94-104)	725-780 (105-113)	22-25	56-69 (41-51)	219-242
<i>Welded on AISI 4130 Steel</i>					
<b>Typical Results</b> <sup>(3)</sup> – Stress-Relieved 12 hrs @ 620°C (1150°F) <sup>(4)</sup>	560-580 (81-84)	650-675 (94-98)	24-25	47-68 (35-50)	210-214

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P
<b>Requirements</b> – AWS E10018-D2 H4R	0.15 max	1.65-2.00	0.80 max	0.03 max
<b>Typical Results</b> <sup>(3)</sup>	0.08-0.12	1.69-1.91	0.35-0.49	0.01-0.02
	%S	%Ni	%Mo	Diffusible Hydrogen (mL/100g weld deposit)
<b>Requirements</b> – AWS E10018-D2 H4R	0.03 max	0.90 max	0.25-0.45	4.0 max
<b>Typical Results</b> <sup>(3)</sup>	≤0.01	0.68-0.77	0.34-0.39	2-3

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)		
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)
DC+	60-110	85-160	110-210
AC	65-120	90-170	115-220

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry specific data, not required by AWS. <sup>(5)</sup>Preferred polarity is listed first.  
NOTE: Additional test data available upon request.

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E10018-D2 H4R
<b>ASME SFA-A5.5:</b>	E10018-D2 H4R
<b>ABS:</b>	3YQ620 H5
<b>Lloyd's Register:</b>	3Y62 H5
<b>DNV Grade:</b>	3Y62 H5
<b>CWB/CSA W48-06:</b>	E6918-D2

## TYPICAL APPLICATIONS

- Chromium-molybdenum and other low alloy steels, including AISI 4130, 4140, 8630 and ASTM A182 and A336 Grades F22
- Carbon-manganese and other low alloy steels
- Offshore and subsea components
- Process piping
- Meets NACE MR0175/ISO15156-2

# EXCALIBUR® 11018M MR®

Low Alloy, Low Hydrogen ■ AWS E11018M H4R

## KEY FEATURES

- Premium arc performance
- Square coating burn-off
- Easy strike and re-strike
- Effortless slag removal

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS A5.5/A5.5M:</b>	E11018M H4R
<b>ASME SFA-A5.5:</b>	E11018M H4R
<b>ABS:</b>	4YQ690 H5
<b>DNV Grade:</b>	4 YM69 H5
<b>CWB/CSA W48-06:</b>	E7618-M H4R

## TYPICAL APPLICATIONS

- Quenched and tempered steels, such as A514, A517 and A709
- Crane booms
- Trailer frames
- General fabrication of high strength steels

## DIAMETERS / PACKAGING

Diameter in (mm)	Length in (mm)	10 lb (4.5 kg) Easy Open Can 30 lb (13.6 kg) Master Carton	50 lb (22.7 kg) Easy Open Can
3/32 (2.4)	14 (350)		ED031975
1/8 (3.2)	14 (350)	ED032607	ED031976
5/32 (4.0)	14 (350)	ED032608	ED031977
3/16 (4.8)	14 (350)		ED031978

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf) @ -50°C (-60°F)
<b>Requirements</b> – AWS E11018M H4R	680-760 (98-110)	760 (110) min	20 min	27 (20) min
<b>Typical Results<sup>(3)</sup></b> – As-Welded	690-758 (100-110)	765-807 (111-117)	20-26	76-103 (56-76)

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/A5.5M

	%C	%Mn	%Si	%P	%S
<b>Requirements</b> – AWS E11018M H4R	0.10 max	1.30-1.80	0.60 max	0.03 max	0.03 max
<b>Typical Results<sup>(3)</sup></b>	0.04-0.05	1.55-1.80	0.40-0.55	≤ 0.02	0.01-0.03
	%Ni	%Cr	%Mo	Diffusible Hydrogen (mL/100g weld deposit)	
<b>Requirements</b> – AWS E11018M H4R	1.25-2.50	0.40 max	0.25-0.50	4.0 max	
<b>Typical Results<sup>(3)</sup></b>	2.0-2.5	0.02-0.20	0.40-0.50	1-4	

## TYPICAL OPERATING PROCEDURES

Polarity	Current (Amps)			
	3/32 in (2.4 mm)	1/8 in (3.2 mm)	5/32 in (4.0 mm)	3/16 in (4.8 mm)
DC+	70-110	90-160	130-210	180-300

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer

# CHROMET® 1X

Low Alloy, Low Hydrogen ■ AWS E8018-B2

## KEY FEATURES

- Designed for prolonged elevated temperatures up to 550°C (1022°F)
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F)
- Designed for welding 1.25% chromium, 0.50% Molybdenum steels
- Trace elements are controlled to ensure low Bruscato (X-Factor < 15 ppm) and Wantanbe (J-Factor < 180 ppm) factors

## WELDING POSITIONS

All

## DIAMETERS / PACKAGING

Diameter mm (in)	4.2 kg (9.3 lb) Easy Open Can	5.0 kg (11 lb) Easy Open Can	5.6 kg (12.3 lb) Easy Open Can
2.5 (3/32)	CHROMET1X-25	CHROMET1X-32	ED033564, CHROMET1X-40* ED033571, CHROMET1X-50*
3.2 (1/8)			
4.0 (5/32)			
5.0 (3/16)			

\* The Metrode part number will be replacing the current EDO numbers after the inventory has been depleted.

## MECHANICAL PROPERTIES<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf)		Hardness HV <sub>10</sub> <sup>(4)</sup> @ PWHT
				@ 20°C (68°F)	@ -30°C (-22°F)	
<b>Requirements</b> - AWS E8018-B2	460	550 (80) min	19	47	–	–
<b>Typical Performance</b>						
As-Welded						
1 hr @ 690°C (1274°F)	525	610	25	160	100	300
Stress-Relieved						
5 hr @ 690°C (1274°F)	515	610	29	200	160	220
5 hr @ 690°C (1274°F) + SC <sup>(7)</sup>	490	595	29	200	140	190

## DEPOSIT COMPOSITION<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	%C	%Mn <sup>(5)</sup>	%Si <sup>(5)</sup>	%S	%P	%Cr
<b>Requirements</b> - AWS E8018-B2	0.05 - 0.1	0.5 - 0.9	0.15 - 0.3	0.015 max	0.012 max	1.00 - 1.40
<b>Typical Results</b>	0.06	0.70	0.25	0.012	0.009	1.25
	%Mo	%Cu	%Sn	%As	%Sb	X-Factor <sup>(6)</sup>
<b>Requirements</b> - AWS E8018-B2	0.45 - 0.65	0.15 max	0.005 max	0.01 max	0.005 max	15 max.
<b>Typical Results</b>	0.55	<0.05	0.002	0.003	<0.002	–

## TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in)			
	2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (3/16)
DC+	70 - 110	80 - 140	100 - 180	140 - 240
AC	70 - 110	80 - 140	100 - 180	140 - 240

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry specific data, not required by AWS. <sup>(5)</sup>Mn+Si < 1.10%. <sup>(6)</sup>X = (10P + 5Sb + 4 Sn + As) / 100 (elements in ppm).

<sup>(7)</sup>SC = Step Cooling NOTE: Additional test data available upon request.

# CHROMET® 2X

Low Alloy, Low Hydrogen ■ AWS E9018-B3

## KEY FEATURES

- Designed for prolonged elevated temperatures up to 600°C (1112°F)
- Refineries where corrosion resistance to sulphur bearing crude oil is at 250-450°C (482-842°F)
- Designed for all-position welding of 2.25% chromium, 1% molybdenum low alloy steels
- Trace elements are controlled to ensure low Bruscato (X-Factor < 15 ppm) and Wantanbe (J-Factor < 180 ppm) factors

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.5</b>	E9018-B3
<b>BS EN ISO 3580-A</b>	E CrMo1 B 3 2
<b>BS EN ISO 3580-B</b>	E 6216-2C1M
<b>BS 2493</b>	2CrMo B H
<b>DIN 8575</b>	ECrMo 2 B 2 6

## TYPICAL APPLICATIONS

- Petro-Chemical
- Power Plants
- Piping
- Turbine Casting
- Steam Chests
- Valve Bodies
- Boiler Superheaters

## DIAMETERS / PACKAGING

Diameter mm (in)	4.1 kg (9 lb) Easy Open Can	4.6 kg (10 lb) Easy Open Can	5.7 kg (13 lb) Easy Open Can
2.5 (3/32)	CHROMET2X-25*	CHROMET2X-32*	ED033574, CHROMET2X-40* CHROMET2X-50*
3.2 (1/8)			
4.0 (5/32)			
5.0 (3/16)			

\* The Metrode part number will be replacing the current EDO numbers after the inventory has been depleted.

## MECHANICAL PROPERTIES<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf)		Hardness HV <sub>10</sub> <sup>(4)</sup> AW PWHT
				@ 20 °C (68 °F)	@ -30 °C (-22 °F)	
<b>Requirements - AWS E9018-B3</b>	540 min	630 min	17 min	47 <sup>(2)</sup> min	–	–
<b>Typical Performance</b>						
As-Welded						
1 hr @ 690 °C (1274 °F)	570	670	22	140	80	220 - 250
Stress-Relieved						
5 hr @ 690 °C (1274 °F)	560	660	27	170	140	195
5 hr @ 690 °C (1274 °F) + SC <sup>(7)</sup>	550	650	25	170	110	205

## DEPOSIT COMPOSITION<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	%C	%Mn <sup>(5)</sup>	%Si <sup>(5)</sup>	%S	%P	%Cr
<b>Requirements - AWS E9018-B3</b>	0.05 - 0.10	0.50 - 0.90	0.15 - 0.3	0.015 max	0.012 max	2.00 - 2.50
<b>Typical Results</b>	0.06	0.70	0.25	0.012	0.01	2.25
	%Mo	%Cu	%Sn	%As	%Sb	X-Factor <sup>(6)</sup>
<b>Requirements - AWS E9018-B3</b>	0.90 - 1.20	0.15 max	0.005 max	0.010 max	0.005 max	15 max
<b>Typical Results</b>	1.05	<0.05	0.002	0.003	<0.002	–

## TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in)			
	2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (3/16)
DC+	70 - 110	80 - 140	100 - 180	140 - 240
AC	70 - 110	80 - 140	100 - 180	140 - 240

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer. <sup>(4)</sup>Industry specific data, not required by AWS. <sup>(5)</sup>Mn+Si < 1.10%. <sup>(6)</sup>X = (10P + 5Sb + 4Sn + As) / 100 (elements in ppm).

<sup>(7)</sup>SC = Step Cooling. NOTE: Additional test data available upon request.

# CHROMET™ 5

Low Alloy Steel ■ AWS E8015-B6

## KEY FEATURES

- Moisture resistant coating provides low amounts of weld metal hydrogen levels for a superior weld
- Designed for high strength and improved corrosion resistance with hot hydrogen gas, super-heated steam, and Sulphur crude oils

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS 5.5</b>	E8015-B6
<b>BS EN ISO 3580-A</b>	E CrMo5 B 3 2 H5
<b>BS EN ISO 3580-B</b>	E 6216-5Cm

## TYPICAL APPLICATIONS

- Piping
- Steam Generating Power Plant
- Pressure Vessels
- Oil Refineries

## DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	12.0 kg (26 lb) Carton	13.5 kg (30 lb) Carton	17.1 kg (38 lb) Carton	16.8 kg (37 lb) Carton
2.5 (3/32)	350 (13.78)	CHROMET5-25	CHROMET5-32	CHROMET5-40	CHROMET5-50
3.2 (1/8)	380 (14.96)				
4.0 (5/32)	450 (17.72)				
5.0 (3/16)	450 (17.72)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf)		Hardness HV
				@20 °C (68 °F)	@-10 °C (14 °F)	
<b>Requirements</b> AWS E8015-B6	460 (67) min	550 (80) min	19	-	-	-
<b>Typical Performance<sup>(3)</sup></b> As-Welded	500 (73) min	610 (88) min	25	150	80	210

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5

	%C	%Mn	%Si	%S	%P
<b>Requirements</b> AWS E8015-B6	0.05-0.10	0.50-1.0	0.80 max	0.025 max	0.025 max
<b>Typical Performance<sup>(3)</sup></b>	0.06	0.8	0.40	0.01	0.015
	%Cr	%Ni	%Mo	%Cu	
<b>Requirements</b> AWS E8015-B6	4.0-6.0	0.40 max	0.45-0.65	0.3 max	
<b>Typical Performance<sup>(3)</sup></b>	5	0.2	0.55	0.05	

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(4)</sup>	2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)	5.0 mm (3/16 in)
DC+	70-110	80-140	100-180	140-240

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer <sup>(4)</sup> Preferred polarity is listed first.

# CHROMET™ 9

Low Alloy Steel ■ AWS E8015-B8 H4

## KEY FEATURES

- Designed for corrosion resistance in elevated temperatures up to 600°C (1112°F)
- Moisture resistant coating provides low amounts of weld metal hydrogen levels for a superior weld
- Smooth arc performance in all positions

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS 5.5</b>	E8015-B8 H4
<b>BS EN ISO 3580-A</b>	E CrMo9 B 3 2 H5
<b>BS EN ISO 3580-B</b>	E 6216-9C1M

## TYPICAL APPLICATIONS

- Oil Refineries
- Power Plants
- Piping
- Pressure Vessels
- Heat Exchangers

## DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	11.7 kg (26 lb) Carton	13.5 kg (30 lb) Carton	17.4 kg (38 lb) Carton	16.5 kg (36 lb) Carton
2.5 (3/32)	350 (13.78)	CHROMET9-25	CHROMET9-32	CHROMET9-40	CHROMET9-50
3.2 (1/8)	380 (14.96)				
4.0 (5/32)	450 (17.72)				
5.0 (3/16)	450 (17.72)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf)		Hardness HV
				@20 °C (68 °F)	@-10 °C (14 °F)	
<b>Requirements</b> AWS E8015-B8 H4	460 (67) min	590 (86) min	19 min	34 min	-	-
<b>Typical Performance<sup>(3)</sup></b> After 2 hours of PWHT at 720 °C (1330 °F)	600 (87)	710 (103)	22	90	25	235

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5

	%C	%Mn	%Si	%S	%P
<b>Requirements</b> AWS E8015-B8 H4	0.05-0.10	0.50-1.0	0.60 max	0.025 max	0.025 max
<b>Typical Performance<sup>(3)</sup></b>	0.06	0.75	0.35	0.012	0.015
	%Cr	%Ni	%Mo	%Cu	
<b>Requirements</b> AWS E8015-B8 H4	8.0-10.0	0.40 max	0.90-1.20	0.3 max	
<b>Typical Performance<sup>(3)</sup></b>	9	0.2	1	<0.05	

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(4)</sup>	2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)	5.0 mm (3/16 in)
DC+	70-110	80-140	100-180	140-240

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer <sup>(4)</sup> Preferred polarity is listed first.



# CHROMET® 9-B9

Low Alloy, Low Hydrogen ■ AWS E9015-B9

## KEY FEATURES

- Improved long term creep properties
- Can weld equivalent (P91) 9CrMo steels
- Designed to weld the modified steels T91, P91 or Grade 91, which are designed to provide improved creep strength, toughness fatigue and oxidation, and corrosion resistance at elevated temperatures.

## WELDING POSITIONS

All

## CONFORMANCES

AWS A5.5 E9015-B9  
BS EN ISO 3580-B E 6216-9C1MV

## TYPICAL APPLICATIONS

- Intended for high integrity structural service at elevated temperature
- Main Steam Piping
- Power Plants
- Oil Refineries
- Coal Liquefaction Plants
- Gasification Plants

## DIAMETERS / PACKAGING

Diameter mm (in)	4.5 kg (10 lb) Easy Open Can	5 kg (11 lb) Easy Open Can	5.5 kg (12 lb) Easy Open Can
2.5 (3/32)	ED033379, CH9B9-25*	ED033380, CH9B9-32* CH9B9-40	CH9B9-50
3.2 (1/8)			
4.0 (5/32)			
5.0 (3/16)			

\* The Metrode part number will be replacing the current EDO numbers after the inventory has been depleted.

## MECHANICAL PROPERTIES<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft·lbf) @ 20°C (68°F)	Hardness HV10 <sup>(4)</sup> @ PWHT
<b>Requirements</b> - AWS E9015-B9	530 (77) min	620 (90) min	17 min.	–	–
<b>Typical Results<sup>(3)</sup></b> As-Welded 2 hr @ 760°C (1400°F)	590 (86)	710 (103)	22.5	75 (55)	450
Stress-Relieved 550°C (1022°F)	>360 (52)	>450 (65)	–	–	–
600°C (1112°F)	>255 (37)	>375 (54)	–	–	–
650°C (1202°F)	>175 (25)	>285 (41)	–	–	–

## DEPOSIT COMPOSITION<sup>(1)</sup> - As Required per AWS A5.5/A5.5M

	%C	%Mn <sup>(5)</sup>	%Si <sup>(5)</sup>	%S	%P	%Cr
<b>Requirements</b> - AWS E9015-B9	0.08 - 0.12	0.40 - 0.75	0.30 max	0.01 max	0.01 max	8.0 - 10.0
<b>Typical Results<sup>(3)</sup></b>	0.10	0.55	0.25	0.008	0.008	9.0
	%Ni <sup>(5)</sup>	%Mo	%Nb	%V	%Cu	%Al
<b>Requirements</b> - AWS E9015-B9	0.2 - 0.4	0.85 - 1.2	0.03 - 0.07	0.15 - 0.25	0.25 max	0.04 max
<b>Typical Results<sup>(3)</sup></b>	0.3	1.0	0.04	0.20	0.05	<0.01

## TYPICAL OPERATING PROCEDURES

Polarity	Amperage mm (in)			
	2.5 (3/32)	3.2 (1/8)	4.0 (5/32)	5.0 (0.19)
DC+	70 - 110	80 - 140	100 - 180	140 - 240
AC	70 - 110	80 - 140	100 - 180	140 - 240

<sup>(1)</sup>Typical all weld metal. <sup>(2)</sup>Measured with 0.2% offset. <sup>(3)</sup>See test results disclaimer <sup>(4)</sup>Industry specific data, not required by AWS.

<sup>(5)</sup>Ni + Mn < 1.0%. Nickel is below 0.4% (as parent metal) although AWS allows up to 1.0%Ni. See Chromet 9MV-N or Chromet 9MVN+ for variant with 0.4 - 1.0%Ni conforming to BS EN ISO specification.

NOTE: Additional test data available upon request.

# CHROMET™ 9MV-N

Low Alloy Steel ■ AWS E9015-B9 H4

## KEY FEATURES

- Developed with additional amounts of niobium, vanadium, and nitrogen to improve toughness and long term creep resistance
- Designed to provide creep resistance in high integrity structural services with elevated temperatures

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

**AWS 5.5** E9015-B9 H4  
**BS EN ISO 3580-A** E CrMo91 B 3 2

## TYPICAL APPLICATIONS

- Power Generating Plants
- Main Steam Piping
- Turbine Casting
- Oil Refineries
- Coal Liquefaction and Gasification Plants

## DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	12.9 kg (28 lb) Carton	15.0 kg (33 lb) Carton	17.4 kg (38 lb) Carton	16.5 kg (36 lb) Carton
2.5 (3/32)	350 (13.78)	CH9MVN-25	CH9MVN-32	CH9MVN-40	CH9MVN-50
3.2 (1/8)	380 (14.96)				
4.0 (5/32)	450 (17.72)				
5.0 (3/16)	450 (17.72)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Lateral Expansion mm (mils)	Charpy V-Notch J (ft•lbf) @20°C (68°F)	Hardness After PWHT	Hardness As Welded
<b>Requirements</b> AWS E9015-B9 H4	530 (77) min	620 (90) min	17 min	-	47	-	-
<b>Typical Performance<sup>(3)</sup></b> After 2 hours PWHT at 760°C (1400°F)	640 (93)	720 (104)	22	1.0	65	250	450

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5

	%C	%Mn	%Si	%S	%P	%Cr	%Ni
<b>Requirements</b> AWS E9015-B9 H4	0.08-0.12	0.50-1.20	0.30 max	0.01 max	0.01 max	8.0-10.0	0.4-0.8
<b>Typical Performance<sup>(3)</sup></b>	0.1	0.6	0.25	0.008	0.01	9	0.7
	%Mo	%Cu	%N	%Nb	%V	%SN	Ni+Mn
<b>Requirements</b> AWS E9015-B9 H4	0.85-1.2	0.25 max	0.03-0.07	0.04-0.07	0.15-0.25	<0.008 max	1.5 max
<b>Typical Performance<sup>(3)</sup></b>	1	0.05	0.05	0.05	0.2	0.003	1.3

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(4)</sup>	2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)	5.0 mm (3/16 in)
DC+	70-110	80-140	100-180	140-240

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer <sup>(4)</sup> Preferred polarity is listed first.

# E9018-D1

Low Alloy Steel ■ AWS E9018-D1

## KEY FEATURES

- Moisture resistant coating provides low amount of weld metal hydrogen levels for a superior weld
- Developed to resist sulphide-induced stress corrosion cracking
- Improved sub-zero toughness

## WELDING POSITIONS

All, except vertical down

## CONFORMANCES

<b>AWS 5.5</b>	E9018-D1
<b>BS 2493</b>	MnMoBH

## TYPICAL APPLICATIONS

- Offshore Oil Pipework
- Fittings

## DIAMETERS / PACKAGING

Diameter mm (in)	Length mm (in)	12.0 kg (26 lb) Carton	13.8 kg (30 lb) Carton	15.9 kg (35 lb) Carton	16.8 kg (37 lb) Carton
2.5 (3/32)	350 (13.78)	E9018D1-25	E9018D1-32	E9018D1-40	E9018D1-50
3.2 (1/8)	380 (14.96)				
4.0 (5/32)	450 (17.72)				
5.0 (3/16)	450 (17.72)				

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5

	Yield Strength <sup>(2)</sup> MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %	Charpy V-Notch J (ft-lbf)		Hardness HV
				@-30°C (-22°F)	@-50°C (-58°F)	
<b>Requirements</b> AWS E9018-D1	550 (80) min	630 (91) min	17 min	47 min	30 min	-
<b>Typical Performance<sup>(3)</sup></b> As-Welded	605 (88)	670 (97)	25	90	55	210

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5

	%C	%Mn	%Si	%S	%P
<b>Requirements</b> AWS E9018-D1	0.10 max	1.25-1.75	0.80 max	0.025 max	0.025 max
<b>Typical Performance<sup>(3)</sup></b>	0.07	1.5	0.4	0.01	0.015
	%Cr	%Ni	%Mo	%Cu	
<b>Requirements</b> AWS E9018-D1	-	-	0.25-0.45	-	
<b>Typical Performance<sup>(3)</sup></b>	0.15	0.15	0.35	0.05	

## TYPICAL OPERATING PROCEDURES

Polarity <sup>(4)</sup>	Amperage			
	2.5 mm (3/32 in)	3.2 mm (1/8 in)	4.0 mm (5/32 in)	5.0 mm (3/16 in)
DC+	70-110	80-140	100-180	140-240

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer <sup>(4)</sup> Preferred polarity is listed first.

# TUFMET™ 3Ni.B

Low Alloy Steel ■ AWS E8018-C2-H4

## KEY FEATURES

- Moisture resistant coating
- 3.5% nickel alloyed electrode designed for cryogenic applications down to -80°C (-112°F)

## WELDING POSITIONS

All

## CONFORMANCES

<b>AWS A5.5</b>	E8018-C2 -H4
<b>BS EN ISO 25600-A</b>	E 46 6 3Ni B 42
<b>BS EN ISO 25600-B</b>	E5518-N7 P

## TYPICAL APPLICATIONS

- Cryogenic plant construction and piping
- Petrochemical Industry
- Applications specifying impact properties down to -60°C (-76°F)

## DIAMETERS / PACKAGING

Diameter mm (in)	4.5 kg (10 lb) Easy Open Can	4.0 kg (8.8 lb) Easy Open Can	5.6 kg (12.3 lb) Easy Open Can
2.5 (3/32)	TM3NIB-25	TM3NIB-32	TM3NIB-40
3.2 (1/8)			
4.0 (5/32)			

## MECHANICAL PROPERTIES<sup>(1)</sup> – As Required per AWS A5.5/5.5M

	0.2% Proof Stress MPa (ksi)	Tensile Strength MPa (ksi)	Elongation %		Impact energy J (ft•lbf)	
			4.0 dia	5.0 dia	@-60°C (-76°F)	@-75°C (-103°F)
<b>Requirements</b> AWS E2594T1/4	460 min (67 min)	560-680 (80-100)	19 min	20	-	30
<b>Typical Performance<sup>(3)</sup></b>	540 (78)	620 (90)	>22	25	100	>90

## DEPOSIT COMPOSITION<sup>(1)</sup> – As Required per AWS A5.5/5.5M

	%C	%Mn	%Si	%S	%P	%Ni
<b>Requirements</b> AWS E8018-C2	0.10 max	0.30-1.25	0.80 max	0.020 max	0.030 max	3.00-3.75
<b>Typical Performance<sup>(3)</sup></b>	0.05	0.5	0.3	0.01	0.015	3.3

<sup>(1)</sup> Typical all weld metal <sup>(2)</sup> Measured with 0.2% offset <sup>(3)</sup> See test results disclaimer