



CHROME-MOLY ALLOY

Welding Consumables





Your Single Source

In an era of unprecedented competition in the global industrial market, quality and experience matter. When it comes to welding consumables, Lincoln Electric knows quality and has the experience.

Since 1963, the Metrode® brand has earned a reputation as the worldwide leader in alloyed welding consumables. The acquisition of Metrode in 2006 enabled Lincoln Electric to provide the widest possible range of alloyed consumables from a single source and represented a perfect partnership in terms of portfolio of products, innovative R&D and technical support.

Metrode products from Lincoln Electric are designed to meet the most stringent specifications for composition and mechanical properties for demanding industries including offshore, power generation, petrochemical, LNG and nuclear.

Lincoln Electric pairs more than 60 years of industry-leading experience in these applications with over a century of welding expertise. We know the industry requirements, we know the applications, and we stock the consumables. For one stop shopping for any welding consumable need – get Lincoln Electric.



Chrome-Moly Steels: The Basics

Chrome-moly steels are commonly referred to as “Creep Strength Enhanced Ferritic Steels” (**CSEF**) and are commonly used in **high heat applications** for creep resistance. These consumables perform well at service temperatures from **400°C** (752°F) to **625°C** (1157°F)

Chrome-moly is primarily used in industry for its creep, corrosion, and wear resistance. It can be used at high temperatures (up to 600° C) and has excellent hardenability, mechanical properties, and high ease of fabrication.

Chromium Cr

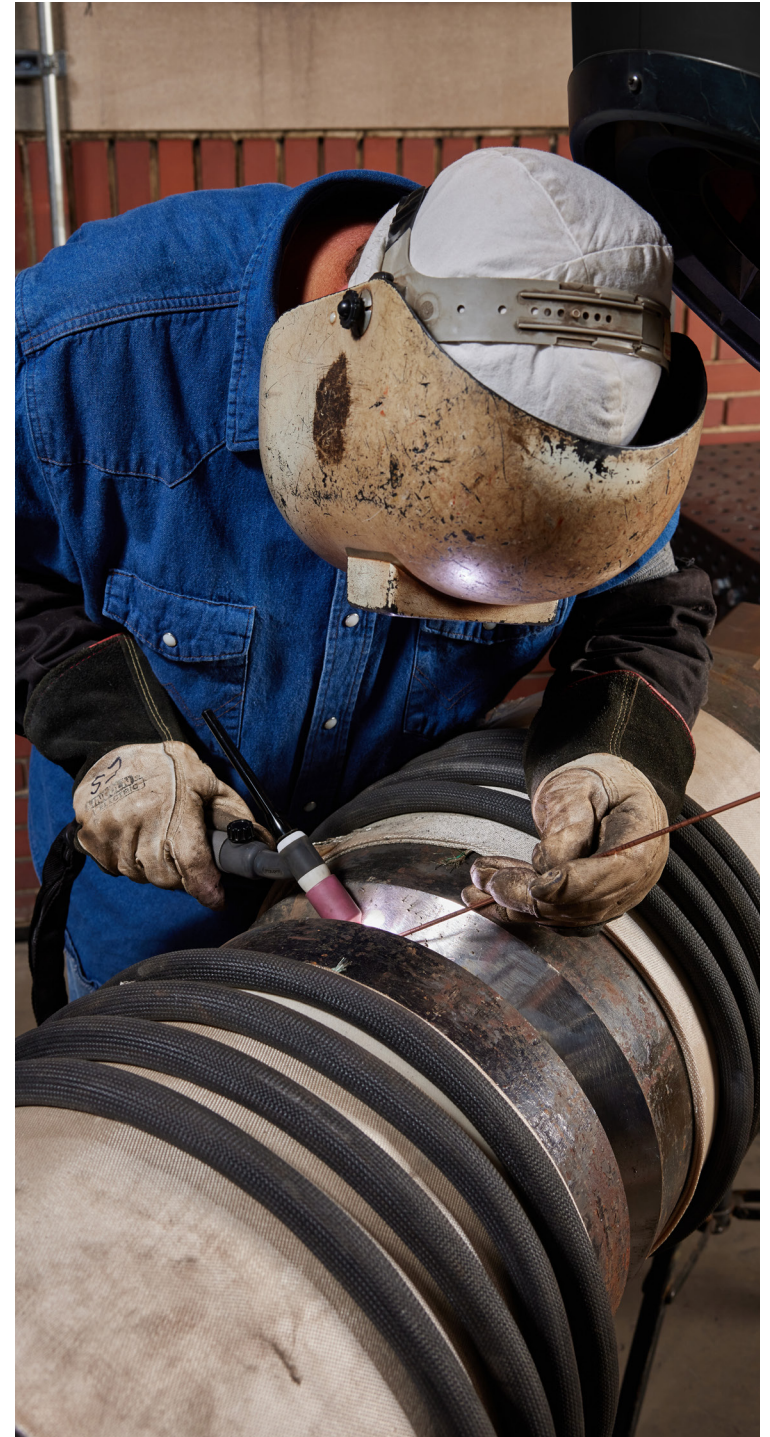
Improves creep strength and oxidation (corrosion) resistance

Molybdenum Mo

Improves strength and high temperature creep resistance

Vanadium V

Grain refiner that reduces susceptibility to temper embrittlement and improves resistance to hydrogen attack and helps maintain good creep performance





Quality, Technology, Customer Satisfaction and Availability

Commitment to Quality

Quality is paramount for Metrode and Lincoln Electric. Our products are lot controlled and tested with actual chemistry and typical mechanical results for each lot ensuring consistency and reliability. We know the quality of the consumable is critical to the quality of the weld. With that in mind, we've built a reputation on a stringent quality assurance program that results in the highest quality, most dependable alloy consumable in the industry

R&D for the Future

Staying competitive is a matter of staying in front of the technology curve for materials, welding and manufacturing. Metrode and Lincoln Electric have made this our business for decades by maintaining a keen awareness of not just the current market needs but also what's on the horizon in the way of new alloys and evolving technical requirements



Technical Support

Metrode and the Lincoln Electric Company bring a combination of nearly 200 years of quality, expertise and service to the welding industry. All of this, delivered by a knowledgeable staff, is the backbone of Lincoln Electric's success. The story starts with world-class products and innovative manufacturing solutions, but it doesn't end there. Our long-term partnership with our customers include ongoing technical support that maximizes the Metrode and Lincoln Electric experience well beyond the initial purchase stage.

Availability

A key element in our Chrome-Moly portfolio is prioritizing our stocking levels, and we understand the importance of availability for our customers. These consumables are readily stocked in high usage areas such as the Gulf Coast and West Coast for quick turnarounds. Whether your job requires SMAW, GTAW, GMAW, SAW, or FCAW, we have you covered.

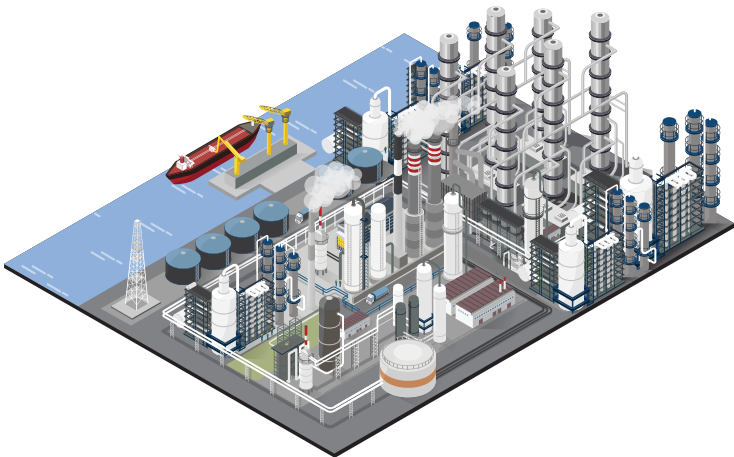
Industry Applications



Coal Liquefaction and Gasification Plants

Coal liquefaction is the process of converting coal to liquid hydrocarbons for use as fuels, such as diesel and gasoline. This differs from coal gasification as this is the process of using very high temperatures to convert coal into a gas mixture referred to as syngas which is used primarily for electricity generation. The high temperature creep resistance of chrome-moly welding consumables makes them an ideal choice for both applications.

Typical Applications: Piping, Pressure Vessels, Valves, Fittings



Oil Refineries

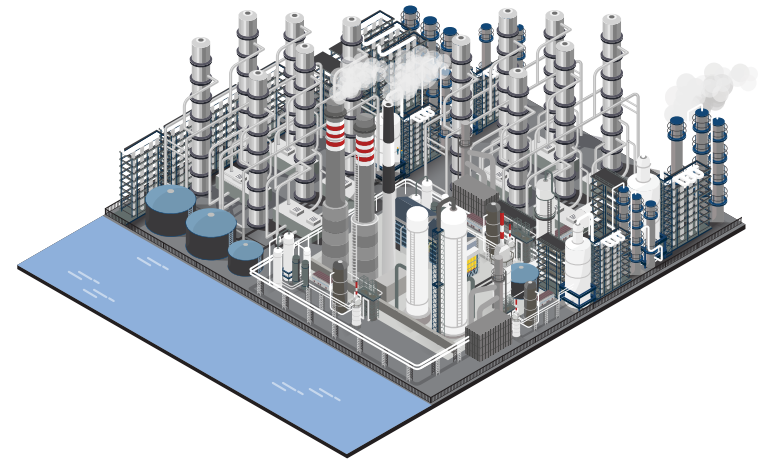
Oil refineries turn crude oil into a refined useable product through several processes at elevated temperatures. In these higher heat areas of an oil refinery such as hydrocracking, chrome-moly alloys are used to avoid creep and to provide corrosion resistance in areas susceptible to hydrogen corrosion.

Typical Applications: Fractionators, Fluid Catalytic Cracking Unit (FCCU), Hydrocracker Unit (HCU), process piping, pressure vessels

Petro-Chemical

The petrochemical industries use crude oil and processes the crude into chemicals such as ethylene, naphtha, propane, diesel and propylene. These chemicals are used for the manufacture of a wide variety of goods including textiles, plastics, paints, construction materials, medical equipment, packaging materials and more. The production of these chemicals requires high heat and pressures in different phases of the process and chrome-moly materials are used for creep resistance as well as corrosion resistance.

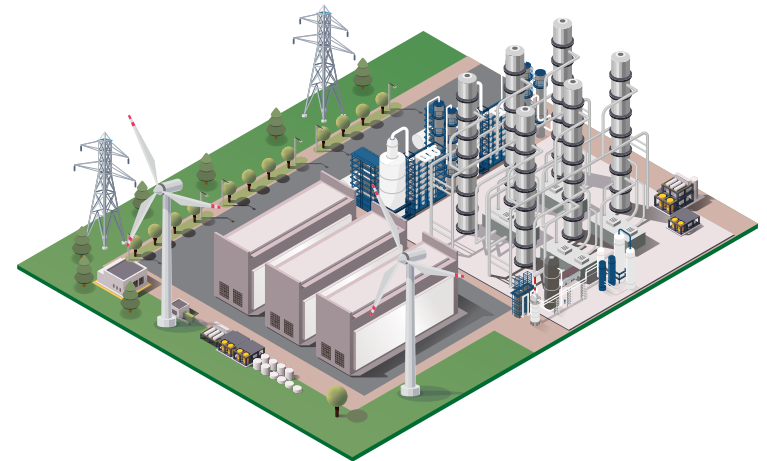
Typical Applications: Fractionators, Fluid Catalytic Cracking Unit (FCCU), Hydrocracker Unit (HCU), Piping, Pressure Vessels



Power Plants

Power plants use coal or natural gas for fuel to generate heat and steam that eventually turns a steam turbine to generate electricity. The steam generating and transportation of the steam through piping networks in the facility require chrome-moly steels (and other alloys) to resist creep and corrosion at high operating temperatures.

Typical Applications: Steam Generation Equipment, Steam Piping, Steam Turbine Castings, Steam Chests, Valve Bodies, Boiler Superheaters, Headers



CHROME-MOLY PRODUCT SELECTION MATRIX

Grade 11 [Weld Metal – B2] 1 1/4 Cr + 1/2 Mo

Materials to be Welded	Welding Process	Classification AWS/ EN	Product Name	Diameter mm (in)	Part Number
ASTM A182 F11 & F12 A199 T11 A200 T11 A213 T11 & T12 A217 WC6 & WC11 A234 WP11 & WP12 A335 P11 & P12 A387 Gr 11&12 BS 1501 Gr 620 & 621 1502 Gr 620 1503 Gr 620 & 621 1504 Gr 621 3059 Gr 620/460 3100 Gr B2 3604 Gr 620/440 & 621	GTAW	AWS A5.28: ER80S-B2 EN ISO 21952-B: 1CM	Lincoln® ER80S-B2	1.6 [1/16]	ED034343
				2.4 [3/32]	ED034344
				3.2 [1/8]	ED034345
			ER80S-B2 TIG	2.4 [3/32]	TER80SB2-24
				3.2 [1/8]	TER80SB2-32
		AWS A5.28: ER80S-B2 AWS A5.28M: ER55S-B2 ASME SFA-5.28: ER80S-B2	SuperArc® Orbital TIG ER80S-B2	0.9 [0.035]	ED034465
				1.1 [0.045]	ED034466
				0.9 [0.035]	ED034469
				1.1 [0.045]	ED034470
	SMAW	AWS A5.5 : E8018-B2 H4R EN ISO 3580-A : E CrMo1 B 3 2 H5 EN ISO 3580-B : E 5516-1CM	CHROMET® 1X	2.5 [3/32]	CHROMET1X-25-1
				3.2 [1/8]	CHROMET1X-32-1
				4.0 [5/32]	CHROMET1X-40-1
				5.0 [3/16]	CHROMET1X-50-1
		AWS A5.5: E8018-B2 H4R ASME SFA-A5.5: E8018-B2 H4R CWB/ CSA W48-06: E5518-B2	Excalibur® 8018-B2 MR	2.5 [3/32]	ED032878
				2.5 [3/32]	ED032881
				3.2 [1/8]	ED032879
				3.2 [1/8]	ED032882
	GMAW	AWS A5.28: ER80S-B2 EN ISO 21952-B: 1CM	ER80S-B2 MIG	4.0 [5/32]	ED032883
				0.8 [0.030]	MER80SB2-08
				0.9 [0.035]	MER80SB2-09
				1.0 [0.040]	MER80SB2-10
	FCAW	AWS A5.29: E81T1-B2C/M-H4 EN ISO 17634-B: T55T1-1C/M-1CM	CORMET™ 1	1.2 [0.047]	MER80SB2-12
				1.2 [0.047]	CORM1-12N
	SAW	AWS A5.23: EB2R EN ISO: S CrMo1	Lincolnweld® LA-92 [EB2]	2.4 [3/32]	EDS30783
				3.2 [1/8]	EDS26960
				4.0 [5/32]	EDS26961
		EN ISO 14174: S A FB 1	Lincolnweld® 822	Flux	ED036223

Grade 92 [Weld Metal – B92 or -G] 9 Cr + 1/2 Mo + 1/4 V + W + B

Materials to be Welded	Welding Process	Classification AWS/ EN	Product Name	Diameter mm (in)	Part Number
ASTM A182 F92 (forgings) A213 T92 (seamless tubes) A335 P92 (seamless pipes) A369 FP92 (forged & bored pipes) A387 Gr 92 (plates)	GTAW	AWS A5.28: ER90S-G EN ISO 21952-A: W ZCrMoWVNb 9 0.5 1.5	9CRWV	2.0 [5/64]	T9CRWV-20
				2.4 [3/32]	T9CRWV-24
				3.2 [1/8]	T9CRWV-32
	SMAW	AWS A5.5: E9015-B92 H4 EN ISO 3580-A: E ZCrMoWVNb 9 0.5 2 B 3 2 H5	CHROMET® 92	2.5 [3/32]	CH92-25-1
				3.2 [1/8]	CH92-32-1
				4.0 [5/32]	CH92-40-1
	SAW	AWS A5.23: EG [92] EN ISO 21952-A: S ZCrMoWVNb 9 0.5 1.5	9CRWV	2.4 [3/32]	SA9CRWV-24
				3.2 [1/8]	SA9CRWV-32
				Flux	FXLA490SA-25SRB
		EN ISO 14174: S A FB 1 55 AC H5	LA490		

CHROME-MOLY PRODUCT SELECTION MATRIX

Grade 22 (Weld Metal – B3) 2 1/4 Cr + 1 Mo

Materials to be Welded	Welding Process	Classification AWS/ EN	Product Name	Diameter mm (in)	Part Number
ASTM A182 F22 A199 T21 & T22 A200 T21 & T22 A217 WC9 A234 WP22 A335 P22 A387 Gr 21 & 22 BS 1501 Gr 622 1503 Gr 622 1504 Gr 622 3059 Gr 622/640 & 622/490 3100 Gr B3 3604 Gr 622 Cr-Mo-V Steels BS 1503 Gr 660 BS 1504 Gr 660 BS 3100 Gr B7 BS 3604 Gr 660	GTAW	AWS A5.28: ER90S-B3 EN ISO 21952-B: 2C1M	Lincolnweld® ER90S-B3	1.6 (1/16)	ED034357
				2.4 (3/32)	ED034358
				3.2 (1/8)	ED034359
			ER90S-B3 TIG	2.4 (3/32)	TER90SB3-24
				3.2 (1/8)	TER90SB3-32
		AWS A5.28: ER90S-B3 AWS A5.28M: ER62S-B3 ASME SFA-5.28: ER90S-B3	SuperArc® Orbital TIG ER90S-B3	1.1 (0.045)	ED034468
				0.9 (0.035)	ED034471
	SMAW	AWS A5.5: E9018-B3 H4 EN ISO 3580-A: E CrMo2 B 3 2 H5 EN ISO 3580-B: E 6216-2C1M	CHROMET® 2X	2.5 (3/32)	CHROMET2X-25-1
				3.2 (1/8)	CHROMET2X-32-1
				4.0 (5/32)	CHROMET2X-40-1
				5.0 (3/16)	CHROMET2X-50-1
		AWS A5.5: E9018-B3 H4 EN ISO 1599: E CrMo2 B 22 H5	CROMO E225	3.2 (1/8)	W100287666
				4.0 (5/32)	W100287667
				5.0 (3/16)	W100287668
				2.5 (3/32)	ED032884
		AWS A5.5: E9018-B3 H4R ASME SFA-A5.5: E9018-B3 H4R CWB/ CSA W48-06: E6218-B3	Excalibur® 9018-B3 MR	2.5 (3/32)	ED032887
				3.2 (1/8)	ED032885
				3.2 (1/8)	ED032888
				4.0 (5/32)	ED032889
	GMAW	AWS A5.28: ER90S-B3 EN ISO 21952-B: 2C1M	ER90S-B3 MIG	0.8 (0.030)	MER90SB3-08
				0.9 (0.035)	MER90SB3-09
				1.0 (0.040)	MER90SB3-10
				1.2 (0.047)	MER90SB3-12
	FCAW	AWS A5.29: E91T1-B3C/M-H4 EN ISO 17634-B: T62T1-1C/M-2C1M	CORMET™ 2	1.2 (0.047)	CORM2-12N
	SAW	AWS A5.23: EB3R EN ISO 24598-1: S CrMo2	Lincolnweld® LA-93 (EB3)	2.4 (3/32)	ED032185
				2.4 (3/32)	EDS30784
				3.2 (1/8)	EDS26962
				4.0 (5/32)	EDS26963
		EN ISO 14174: S A FB 1	Lincolnweld® 822	Flux	ED036223

Grade 22V (Weld Metal – G0) 2 1/4 Cr + 1 Mo _ 1/4 V

Materials to be Welded	Welding Process	Classification AWS/ EN	Product Name	Diameter mm (in)	Part Number
ASTM A182 F22V (forgings) A336 F22V (forgings) A542 D cl 4a (plates) A832 22V (plates)	GTAW	AWS A5.28: ER90S-G	CARBOROD W 225V	2.4 (3/32)	W000289159
	SMAW	AWS A5.5: E9015-G EN ISO 1599: E Z B 22 H5	CROMO E225V	3.2 (1/8)	W100287673
				4.0 (5/32)	W100287674
				5.0 (3/16)	W100287675
	SAW	AWS A5.23: EG EN ISO 24598-A: SZ	OE-CROMO S225V	2.4 (3/32)	OES225V-24-25VCI
				3.2 (1/8)	OES225V-32-25VCI
				4.0 (5/32)	OES225V-4-300
		EN ISO 760: SA FB 155 AC H5	OP CROMO F537	Flux	W000402695

CHROME-MOLY PRODUCT SELECTION MATRIX

Grade 5 (Weld Metal – B6) 5 Cr + 1/2 Mo

Materials to be Welded	Welding Process	Classification AWS/EN	Product Name	Diameter mm (in)	Part Number
Plates ASTM A387 Gr 5 Pipe/Tube ASTM A199 Gr T5 A213 Gr T5 & T5b A234 Gr WP5 (fittings) A335 Gr P5 & P5b BS 3604 Gr HFS 625 & CFS 625	GTAW	AWS A5.28: ER80S-B6 EN ISO 21952-A: CrMo5Si	5CRMO	2.4 (3/32)	T5CRMO-24
	SMAW	AWS A5.5: E8015-B6 H4 EN ISO 3580-A: E CrMo5 B 3 2 H5 EN ISO 3580-B: E 6216-5CM	CHROMET® 5	3.2 (1/8)	T5CRMO-32
				2.5 (3/32)	CHROMET5-25-1
				3.2 (1/8)	CHROMET5-32-1
	SAW	AWS A5.23: EB6 EN ISO 21952-A: CrMo5Si EN ISO 14174: S A FB 1	5CRMO (EB6)	4.0 (5/32)	CHROMET5-40-1
				2.4 (3/32)	SA5CRMO-24
				Flux	ED036223

Grade 9 (Weld Metal – B8) 9 Cr + 1 Mo

Materials to be Welded	Welding Process	Classification AWS/EN	Product Name	Diameter mm (in)	Part Number
Plates ASTM A387 Gr 9 Pipe/Tube ASTM A199 Gr T9 A213 Gr T9 A234 Gr WP9 (fittings) A335 Gr 9 BS 3604 Gr CFS & HFS 629-470 CFS & HFS 629-590	GTAW	AWS A5.28: ER80S-B8 EN ISO 21952-A: CrMo9	9CRMO	2.0 (5/64)	T9CRMO-20
				2.4 (3/32)	T9CRMO-24
				3.2 (1/8)	T9CRMO-32
	SMAW	AWS A5.5: E8015-B8 H4 EN ISO 3580-A: E CrMo9 B 3 2 H5 EN ISO 3580-B: E 6216-9C1M	CHROMET® 9	2.5 (3/32)	CHROMET9-25-1
				3.2 (1/8)	CHROMET9-32-1
				4.0 (5/32)	CHROMET9-40-1
	GMAW	AWS A5.28: ER80S-B8 EN ISO 21952-A: CrMo9	9CRMO	1.2 (0.047)	M9CRMO-12
	SAW	AWS A5.23: EB8 EN ISO 24598-A: SCrMo9	9CRMO (EB8)	2.4 (3/32)	SA9CRMO-24
		EN ISO 14174: S A FB 1	Lincolnweld® 822	Flux	ED036223

CHROME-MOLY PRODUCT SELECTION MATRIX

Grade 91 (Weld Metal – B91) 9 Cr + 1 Mo + 1/4 V

Materials to be Welded	Welding Process	Classification AWS/EN	Product Name	Diameter mm (in)	Part Number
ASTM A182/ A336 F91 (forgings) A213 T91 (seamless tubes) A217 C12A (castings) A234 WP91 A335 P91 (seamless pipes) A369 FP91 A387 Gr 91 (plates)	GTAW	AWS A5.28: ER90S-B91 EN ISO 21952-A: W CrMo91	9CRMV-N	2.0 [5/64]	T9CRMV-N-20
				2.4 [3/32]	T9CRMV-N-24
				3.2 [1/8]	T9CRMV-N-32
	SMAW	AWS A5.5: E9015-B91 H4 EN ISO 3580-B: E 6216-9C1MV	CHROMET® 9-B9	2.5 [3/32]	CH9B9-25-1
				3.2 [1/8]	CH9B9-32-1
				4.0 [5/32]	CH9B9-40-1
				5.0 [3/16]	CH9B9-50-1
	GMAW	AWS A5.28: ER90S-B91 EN ISO 21952-A: G 9C1MV	9CRMV	1.0 [0.040]	M9CRMV-10
				0.8 [0.030]	M9CRMV-N-08
		AWS A5.28: ER90S-B91 EN ISO 21952-A: G CrMo91	9CRMV-N	1.0 [0.040]	M9CRMV-N-10
				1.2 [0.047]	M9CRMV-N-12
	FCAW	AWS A5.29: E91T1-B91C/M-H4 AWS A5.29M: E621T1-B91 C/M-H4 EN ISO 17634B: T69T1-1C/M-9C1MV	SUPERCORE™ F91	1.2 [0.047]	SCF91-12
BS 1503 Gr 91 3059-2 Gr 91	SAW	AWS A5.23: EB91	9CRMV-N	2.4 [3/32]	SA9CRMV-N-24
		EN ISO 24598-A: S CrMo91		3.2 [1/8]	SA9CRMV-N-32
		EN ISO 14174: S A FB 1 55 AC H5	LA490	Flux	FXLA490SA-25SRB

Safety Data Sheets (SDS) and Certificates of Conformance are available on our website at www.lincolnelectric.com

FUMES AND GASES can be hazardous to your health.

- Fumes from the normal use of this product contain significant quantities of potentially hazardous compounds. See consumable product label/insert.
- Keep your head out of the fumes.
- Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area.
- An approved respirator should be used unless exposure assessments are below applicable exposure limits.

TEST RESULTS

Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

CUSTOMER ASSISTANCE POLICY

The Lincoln Electric Company is manufacturing and selling high quality welding equipment, consumables, and cutting equipment. Our challenge is to meet the needs of our customers and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for information or advice about their use of our products. Our employees respond to inquiries to the best of their ability based on information provided to them by the customers and the knowledge they may have concerning the application. Our employees, however, are not in a position to verify the information provided or to evaluate the engineering requirements for the particular weldment. Accordingly, Lincoln Electric does not warrant or guarantee or assume any liability with respect to such information or advice. Moreover, the provision of such information or advice does not create, expand, or alter any warranty on our products. Any express or implied warranty that might arise from the information or advice, including any implied warranty of merchantability or any warranty of fitness for any customers' particular purpose is specifically disclaimed.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

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THE LINCOLN ELECTRIC COMPANY
22801 St. Clair Avenue • Cleveland, OH • 44117-1199 • U.S.A.
Phone: +1.216.481.8100 • www.lincolnelectric.com

