Stainless Steels

DATA SHEET **B-81**

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NUCLEAR 316L CONSUMABLES

Alloy type

316L austenitic stainless steels conforming to RCC-M for joining 316L base materials used in nuclear applications.

Materials to be welded

ASTM	BS EN & DIN
316L	1.4401/1.4404
316	1.4436
316LN	1.4406/1.4429
CF3M	1.4408
CF8M	1.4437

UNS
S 31603
S 31600
S 31653

Applications

Used to weld 316L (19/12/3) stainless steels for applications in the nuclear industry requiring conformance to the RCC-M code.

Standard 316L consumables for general purpose fabrication can be found in data sheet B-32. 316H consumables for elevated temperature service can be found in data sheets C-12 and C-13. Controlled ferrite 316L consumables for cryogenic applications can be found in data sheet B-38.

Microstructure

Austenite with a controlled level of ferrite, 5-15FN.

Welding guidelines

No preheat, maximum interpass temperature 250°C; no PWHT required.

Additional information

Requirements are taken from the relevant consumable data sheets in the French RCC-M code.

For consumable qualification data sheets (B-90 and B-92) in accordance with RCC-M S 5142 please contact Metrode Technical Department.

Related alloy groups

See data sheet B-80 for related 308L consumables conforming to the RCC-M requirements.

Products available

Process	Product	Specification
MMA	**Ultramet 316L(N)**	AWS E316L-16
TIG	**316S92(N)**	AWS ER316L

ULTRAMET 316L(N)

Rutile MMA electrode

Product description

MMA electrode – special rutile flux coated 308L electrode on high purity 304L core wire. Versatile downhand and positional capability, **Ultramet 316L(N)** has a controlled composition and ferrite content designed to meet the requirements of the RCC-M data sheet S 2925.

Recovery is about 110% with respect to core wire, 65% with respect to whole electrode.

Specifications

AWS A5.4	E316L-16
BS EN 1600	E 19 12 3 L R 3 2
RCC-M	S 2925

ASME IX Qualification

QW432 F-No 5, **QW442** A-No 8

Composition (weld metal wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	Cu	Co	N	FN *
min	--	0.5	--	--	--	18.00	12.00	2.5	--	--	--	5
max	0.035	2.0	0.90	0.025	0.025	20.00	13.0	3.00	0.75	0.20	--	15
typ	<0.025	0.7	0.6	0.01	0.02	19.5	12.5	2.6	<0.1	0.04	0.1	8

* Ferrite calculated in accordance with DeLong diagram.

All-weld mechanical properties

As welded			min +20°C	typical +20°C	min +350/+360°C	typical +350/+360°C
Tensile strength		MPa	520	600	--	470/470
0.2% Proof stress		MPa	320	500	140/130	340/340
Elongation on 4d		%	30	38	--	33/30
Elongation on 5d		%	30	36	--	--
Reduction of area		%	--	55	--	50/50
Impact energy	+20°C	J	60 (42) *	65	--	--

* Minimum average (minimum individual value).

Operating parameters

DC +ve or AC (OCV: 50V min)

ø mm	2.5	3.2	4.0
min A	60	75	100
max A	90	120	155

Packaging data

ø mm	2.5	3.2	4.0
length mm	300	350	350
kg/carton	11.4	13.5	13.5
pieces/carton	627	411	261

Storage

3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin is satisfactory for longer than a working shift of 8h. Excessive exposure of electrodes to humid conditions will cause some moisture pick-up and increase the risk of porosity.
For electrodes that have been exposed:
Redry 200 – 300°C/1-2h to restore to as-packed condition. Maximum 400° C, 3 cycles, 10h total.
Storage of redried electrodes at 50 – 200°C in holding oven or heated quiver: no limit, but maximum 6 weeks recommended. Recommended ambient storage conditions for opened tins (using plastic lid): < 60% RH, > 18°C.

Fume data

Fume composition, wt % typical:

Fe	Mn	Cr	Ni	Mo	Cu	F *	OES (mg/m^3)
8	5	5	0.8	-	< 0.2	16	1

316S92(N)

316L solid wire

Product description

Solid wire for TIG welding that meets the requirements of RCC-M data sheet S 2915.

Specifications

AWS A5.9	ER316L
BS EN ISO 14343-A	W 19 12 3 L
BS EN ISO 14343-B	SS316L
RCC-M	S 2915

ASME IX Qualification

QW432 F-No 6, **QW442** A-No 8

Composition (wire wt %)

	C	Mn	Si	S	P	Cr	Ni	Mo	Cu	Co	FN *
min	--	1.00	0.30	--	--	18.00	12.00	2.5	--	--	5
max	0.030	2.50	0.60	0.020	0.025	20.00	14.00	3.00	0.3	0.20	15
typ	0.01	1.7	0.4	0.01	0.015	19	12.5	2.6	0.15	0.04	10

* Ferrite calculated in accordance with DeLong diagram.

All-weld mechanical properties

As welded			min +20°C	typical +20°C	min +350/+360°C	typical +350/+360°C
Tensile strength		MPa	520	605	--	410/410
0.2% Proof stress		MPa	210	465	140/130	280/280
Elongation on 4d		%	--	48	--	30/30
Elongation on 5d		%	30	33	--	--
Impact energy	+20°C	J	60 (42) *	110	--	--

* Minimum average (minimum individual value).

Typical operating parameters

	TIG
Shielding	Argon
Current	DC-
Diameter	2.4mm
Parameters	100A, 12V

Packaging data

ø mm	TIG
1.6	2.5kg tube
2.4	2.5kg tube

Fume data

MIG fume composition (wt %) (TIG fume negligible)

Fe	Mn	Cr^3	Ni	Mo	Cu	OES (mg/m^3)
32	12	16	8	< 0.5	< 0.5	3.1