

904L STAINLESS STEELS

STAINLESS STEELS

ALLOY TYPE

904L is a nominally 20%Cr-25%Ni-5%Mo-2%Cu fully austenitic alloy with good corrosion resistance.

MATERIALS TO BE WELDED

| ASTM - ASME | DIN |
|---------------------|---------------|
| N08904 | 1.4505 |
| | 1.4506 |
| BS | 1.4536 |
| 1449: 904S13 | 1.4539 |
| 1504: 364C11 (cast) | 1.4585 |
| | 1.4500 (cast) |

Proprietary alloys

- Uddelholm 904L
- 2RK65 (Sandvik)
- Cronifer 1925LC (VDM)
- 254SLX (Avesta Polarit)
- Uranus B6 & B6M (Creusot Loire)

Suitable for copper-free variants of the above alloys and also to overmatch leaner alloys such as 317L, 317LN, 317LM, 317LMN, 1.4439, 1.4440 and S31726.

APPLICATIONS

These consumables give a fully austenitic, low carbon weld metal with molybdenum and copper, with good resistance to corrosion in sulphuric, phosphoric and other inorganic and organic acids.

They are not normally chosen for resistance to corrosion in concentrated nitric acid. For service in severe chloride pitting media, overmatching nickel-base weld metal is recommended, see alloy 625 (data sheet D-20).

It is the preferred weld metal for some lower alloy austenitics such as Creusot UHB 34L and UHB 734L for wet process phosphoric acid service.

Applications include tanks and process vessels, piping systems, agitators and rotors and cast pumps and valves for use in the fertiliser, phosphoric, sulphuric and acetic acid plants, and in salt and seawater environments. It is also used in some offshore applications, including overlays on mild and low alloy steels.

MICROSTRUCTURE

In the as-welded condition the weld metal microstructure is fully austenitic.

WELDING GUIDELINES

No preheat or PWHT is required, interpass should be controlled to 150°C maximum and heat input should also be controlled particularly with larger diameter MMA electrodes.

PRODUCTS AVAILABLE

| Process | Product | Specification |
|---------|----------------|---------------|
| MMA | Ultramet 904L | E385-16 |
| | Ultramet B904L | E385-15 |
| TIG/MIG | 20.25.4Cu | ER385 |

ULTRAMET 904L

RUTILE MMA ELECTRODE FOR ALLOY 904L

PRODUCT DESCRIPTION

MMA electrode (formerly 21.26.5.CuNb.R) with a special rutile flux on low carbon, high purity austenitic stainless steel core wire. Careful control of carbon, silicon, manganese and molybdenum contents to give resistance to microfissuring. Recovery is about 130% with respect to core wire, 65% with respect to whole electrode.

SPECIFICATIONS

| | |
|----------------|------------------------|
| AWS A5.4M | E385-16 |
| BS EN ISO 3581 | E 20 25 5 Cu N L R 5 2 |

ASME IX QUALIFICATION

| | |
|-------|--------|
| QW432 | F-No 5 |
| QW442 | A-No 9 |

WELDING POSITIONS (ISO/ASME)



PA/1G



PB/2F



PC/2G



PF/3Gu



PE/4G

CHEMICAL COMPOSITION (WELD METAL WT %)

| | C | Mn | Si | S | P | Cr | Ni | Mo | Cu | Nb | N |
|---------|------|-----|------|-------|-------|------|------|-----|-----|------|------|
| Min. | -- | 1.0 | -- | -- | -- | 19.5 | 24.0 | 4.2 | 1.2 | -- | -- |
| Max. | 0.03 | 2.5 | 0.90 | 0.02 | 0.030 | 21.5 | 26.0 | 5.2 | 2.0 | 0.5 | 0.25 |
| Typical | 0.02 | 1.2 | 0.55 | 0.015 | 0.02 | 20.5 | 25 | 4.6 | 1.5 | 0.02 | 0.09 |

ALL-WELD MECHANICAL PROPERTIES

| As-welded | Min. | typical |
|---------------------------|------|---------|
| Tensile strength (MPa) | 560 | 620 |
| 0.2% proof strength (MPa) | 320 | 420 |
| Elongation (%) 4d | 30 | 38 |
| 5d | 25 | 35 |
| Reduction of area % | -- | 50 |
| Impact ISO*-V(I) -196°C | -- | 50 |
| Hardness cap/mid HV | -- | 185/200 |

TYPICAL OPERATING PARAMETERS, DC +VE OR AC (OCV: 70V MIN)

| Diameter (mm) | 2.5 | 3.2 | 4.0 |
|---------------|-----|-----|-----|
| min. A | 60 | 75 | 100 |
| max. A | 90 | 120 | 155 |

PACKAGING DATA

| Diameter (mm) | 2.5 | 3.2 | 4.0 |
|---------------|------|------|------|
| Length (mm) | 300 | 350 | 350 |
| kg/carton | 12.0 | 13.5 | 14.1 |
| Pieces/carton | 504 | 360 | 213 |

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 150 – 250°C/1-2h to restore to as-packed condition. Maximum 250°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 | Ni | Cr | Mo | Cu | F* | OES (mg/m ³) |
|----|----|----|----|-----|-----|----|--------------------------|
| 8 | 8 | 2 | 7 | 1.5 | 0.5 | 18 | 0.7 |

* F=28% for basic coated Ultramet B904L but this does not affect the OES.

ULTRAMET B904L

BASIC ALL-POSITIONAL MMA PIPE-WELDING ELECTRODE FOR ALLOY 904L

PRODUCT DESCRIPTION

Special basic flux on low carbon, high purity austenitic stainless steel core wire. Careful control of carbon, silicon, manganese and molybdenum contents to give resistance to microfissuring.

Recovery is about 130% with respect to core wire, 65% with respect to whole electrode.

SPECIFICATIONS

| | |
|----------------|------------------------|
| AWS A5.4M | E385-15 |
| BS EN ISO 3581 | E 20 25 5 Cu N L B 6 2 |

ASME IX QUALIFICATION

| | |
|-------|--------|
| QW432 | F-No 5 |
| QW442 | A-No 9 |

WELDING POSITIONS (ISO/ASME)



PA/1G



PB/2F



PC/2G



PF/3Gu



PE/4G

CHEMICAL COMPOSITION (WELD METAL WT %)

| | C | Mn | Si | S | P | Cr | Ni | Mo | Cu | Nb | N |
|---------|-------|-----|------|-------|-------|------|------|-----|-----|------|------|
| Min. | -- | 1.0 | -- | -- | -- | 19.5 | 24.0 | 4.2 | 1.2 | -- | -- |
| Max. | 0.03 | 2.5 | 0.90 | 0.02 | 0.030 | 21.5 | 26.0 | 5.2 | 2.0 | 0.5 | 0.25 |
| Typical | 0.025 | 2 | 0.4 | 0.005 | 0.02 | 21 | 25 | 4.8 | 1.8 | 0.05 | 0.08 |

ALL-WELD MECHANICAL PROPERTIES

| As welded | Min. | typical |
|---------------------------|------|---------|
| Tensile strength (MPa) | 560 | 620 |
| 0.2% proof strength (MPa) | 320 | 440 |
| Elongation [%] 4d | 30 | 41 |
| 5d | 25 | 38 |
| Reduction of area % | -- | 60 |
| Impact ISO-V(J) +20°C | -- | 50 |
| Hardness cap/mid HV | -- | 190/215 |

OPERATING PARAMETERS, DC +VE

| Diameter (mm) | 2.5 | 3.2 | 4.0 |
|---------------|-----|-----|-----|
| min. A | 60 | 75 | 100 |
| max. A | 90 | 120 | 155 |

PACKAGING DATA

| Diameter (mm) | 2.5 | 3.2 | 4.0 |
|---------------|------|------|------|
| Length (mm) | 300 | 350 | 350 |
| kg/carton | 11.4 | 13.5 | 14.1 |
| Pieces/carton | 471 | 359 | 273 |

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 150 – 250°C/1-2h to restore to as-packed condition. Maximum 250°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 | Ni | Cr | Mo | Cu | F* | OES (mg/m ³) |
|----|----|----|----|-----|-----|----|--------------------------|
| 8 | 8 | 2 | 7 | 1.5 | 0.5 | 18 | 0.7 |

* F=28% for basic coated Ultramet B904L but this does not affect the OES.

20.25.4.Cu

SOLID WIRES FOR TIG AND MIG FOR ALLOY 904L

PRODUCT DESCRIPTION

Solid wire for TIG and MIG welding.

SPECIFICATIONS

| | |
|-------------------|--------------|
| AWS A5.9M | ER385 |
| BS EN ISO 14343-A | 20 25 5 Cu L |
| BS EN ISO 14343-B | SS385 |

ASME IX QUALIFICATION

| | |
|-------|--------|
| QW432 | F-No 6 |
| QW442 | A-No 9 |

CHEMICAL COMPOSITION (WIRE WT %)

| | C | Mn | Si | S | P | Cr | Ni | Mo | Cu |
|---------|-------|-----|------|-------|-------|------|------|-----|-----|
| Min. | -- | 1.0 | 0.25 | -- | -- | 19.5 | 24.0 | 4.2 | 1.2 |
| Max. | 0.025 | 2.5 | 0.50 | 0.015 | 0.020 | 21.5 | 26.0 | 5.2 | 2.0 |
| Typical | 0.01 | 1.7 | 0.3 | 0.001 | 0.015 | 20 | 25 | 4.5 | 1.5 |

ALL-WELD MECHANICAL PROPERTIES

| Typical values as welded | TIG |
|---------------------------|---------|
| Tensile strength (MPa) | 650 |
| 0.2% proof strength (MPa) | 490 |
| Elongation (%) 4d | 35 |
| 5d | 32 |
| Impact ISO-V(J) +20°C | 210 |
| Hardness cap/mid HV | 175/195 |

TYPICAL OPERATING PARAMETERS

| | Shielding | Current | Diameter (mm) | Voltage |
|-----|------------------------|---------|---------------|-----------|
| TIG | Argon* | DC- | 2.4 | 100A, 12V |
| MIG | Ar+2%O ₂ ** | DC+ | 1.2 | 230A, 30V |

* Also required as a purge for root runs.

** Ar-He-CO₂ proprietary mixtures also suitable.

PACKAGING DATA

| Diameter (mm) | 0.8 | 1.2 | 1.6 | 2.0 | 2.4 |
|---------------|------------|------------|------------|------------|------------|
| TIG | | -- | 2.5kg tube | 2.5kg tube | 2.5kg tube |
| MIG | 15kg spool | 15kg spool | -- | -- | -- |

FUME DATA

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

| Fe | Mn | C ³ | Ni | Mo | Cu | OES (mg/m ³) |
|----|----|----------------|----|----|-----|--------------------------|
| 28 | 13 | 16 | 20 | 3 | 2.5 | 2.5 |