

Corrosion Resistance of Sheath Materials

Notes

1. This solution involves a mixture of various chemical compounds whose identity and proportions are unknown or subject to change without prior knowledge. Check supplier to confirm choice of sheath materials plus alternate sheath materials that may be used.
2. Caution – Flammable materials that may be used.
3. Chemical composition varies widely. Check supplier for specific recommendations.
4. Direct immersion heaters not practical. Use clamp-on heaters on outside surface.
5. Element watt density should not exceed 20 watts/sq. in.
6. For concentrations greater than 15%, element watt density should not exceed 20 watts/sq. in.
7. See suggested watt density chart.
8. Remove crusts at liquid level.
9. Clean often.
10. Do not exceed 12 watts/sq. in.
11. Passivate stainless steel and Incoloy.

A – Good

B – Fair

C – Depends upon conditions

X – Unsuitable

Blank – Data unavailable

SHEATH MATERIAL

| SOLUTION | IRON STEEL | COPPER | 304, 321, 347 SS | 316 SS | INCOLOY 800 | TITANIUM | QUARTZ | PTFE | *NOTES |
|------------------------------|-------------------|---------------|-----------------------------|---------------|------------------------|-----------------|---------------|-------------|----------------|
| ACETIC ACID | X | X | B | A | B | A | A | A | |
| ACETONE | BC | A | B | A | A | A | A | A | NOTE 2 |
| ALCOHOL | B | A | B | A | A | A | A | A | NOTE 1 |
| ALCORITE | | | | | | | A | | NOTE 1 |
| ALKALINE CLEANERS | | | B | | | | | X | NOTE 1, NOTE 9 |
| ALKALINE SOAKING CLEANERS | B | | | | | | | | NOTE 1 |
| ALODINE | | | | A | | | | | NOTE 1 |
| ALUMINUM BRIGHT DIP | | | | | | | A | A | NOTE 1 |
| ALUMINUM CHLORIDE | X | X | X | X | X | C | A | A | NOTE 1 |
| ALUMINUM CLEANERS | C | X | A | A | A | B | X | | NOTE 1 |

| SOLUTION | | | | | | | | | *NOTES |
|------------------------|------------|--------|------------------|--------|-------------|----------|--------|------|----------------|
| | IRON STEEL | COPPER | 304, 321, 347 SS | 316 SS | INCOLOY 800 | TITANIUM | QUARTZ | PTFE | |
| ALUMINUM SULPHATE | X | X | BC | BC | BC | A | A | A | NOTE 1 |
| ALUM | X | X | X | BC | X | X | A | A | NOTE 1 |
| AMMONIA | A | X | B | A | C | A | A | A | |
| AMMONIUM BIPIUORIDE | X | X | X | B | X | X | X | A | |
| AMMONIUM CHLORIDE | X | X | C | C | C | B | A | A | |
| AMMONIUM HYDROXIDE | BC | X | A | A | A | A | X | A | |
| AMMONIUM NITRATE | A | X | A | A | BC | C | A | A | |
| AMMONIUM PERSLPHATE | X | X | C | B | C | | A | A | |
| AMMONIUM SULPHATE | X | X | C | B | A | A | A | A | |
| AMYL ALCOHOL | A | A | B | B | B | A | A | A | NOTE 2 |
| ANILINE | C | X | A | A | B | A | A | A | |
| ANODIZING | X | X | X | X | X | X | A | A | |
| ARP-28 | | | | | | | | A | NOTE 1 |
| ARP-80 BLACKENING SALT | | | | | | | A | | NOTE 1 |
| ARSENIC ACID | X | C | B | B | B | X | A | A | |
| ASPHALT | A | X | BC | B | A | A | A | | NOTE 2 |
| BARIUM HYDROXIDE | B | X | B | B | B | AC | A | A | |
| BARIUM SULPHATE | C | B | B | B | AC | A | A | A | |
| BLACK NICKEL | | | | | | | A | A | NOTE 5 |
| BLACK OXIDE | | | A | | | | | | NOTE 5 |
| BORIC ACID | X | C | BC | BC | A | A | A | A | |
| BRASS CYANIDE | | | A | | | | | | NOTE 1 |
| BRIGHT NICKEL | | | | | | A | A | | NOTE 1, NOTE 5 |
| BRONZE PLATING | A | | A | | | | | | NOTE 1 |
| BUTANOL | BC | A | A | A | A | B | A | A | NOTE 2 |
| CADMIUM BLACK | | | | | | | A | | NOTE 1 |
| CADMIUM PLATING | | | A | | | | | | NOTE 1 |
| CALCIUM CHLORATE | B | X | BC | BC | B | B | | A | |
| CALCIUM CHLORIDE | B | B | BC | B | B | A | A | A | |
| CARBON DIOXIDE-DRY GAS | B | BC | A | A | A | AC | A | X | |
| CARBON DIOXIDE-WET GAS | X | X | B | B | A | BC | A | A | |
| CARBONIC ACID | B | X | A | A | AC | A | A | A | |
| CARBON TETRACHLORIDE | C | AC | A | A | A | A | A | A | |
| CASTOR OIL | A | AC | BC | B | A | | A | A | |
| CAUSTIC ETCH | A | C | A | A | A | A | X | | NOTE 5 |
| CHLORINE GAS-DRY | C | C | C | BC | A | X | A | B | |
| CHLORINE GAS-WET | X | X | X | X | X | X | A | B | |
| CHLOROACETIC ACID | X | X | X | X | C | A | A | A | |
| CHROMIC ACETATE | | | | | | | A | | NOTE 1 |
| CHROMIC ACID | X | X | X | X | X | A | A | X | |
| CHROMIC ANODIZING | | | | | | | A | | NOTE 1 |
| CHROMYLITE | | | | | | | A | | NOTE 1 |
| CITRIC ACID | X | X | BC | A | AC | A | A | A | |

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|----------------------------|------------|--------|---------------------|--------|-------------|----------|--------|------|------------------------|
| CLEAR CHROMATE | | | | A | | A | A | | NOTE 1 |
| COBALT NICKEL | | | | | | | A | | NOTE 1, NOTE 5 |
| COD LIVER OIL | | | A | A | A | | | | |
| COPPER ACID | | | | | | | A | A | NOTE 1 |
| COPPER BRIGHT | | | A | | | | | | NOTE 1 |
| COPPER BRIGHT ACID | | | | | | | A | | NOTE 1 |
| COPPER CHLORIDE | X | X | X | X | B | A | A | A | |
| COPPER CYANIDE | | X | B | B | B | AC | A | A | |
| COPPER FLUOBORATE | | | B | B | B | | | A | |
| COPPER NITRATE | X | X | A | A | BC | B | A | A | |
| COPPER PYROPHOSPHATE | | | A | | | | | | NOTE 1 |
| COPPER STRIKE | A | | A | | | | | | NOTE 1 |
| COPPER SULPHATE | X | X | B | B | B | A | A | A | |
| CREOSOTE | A | BC | B | B | B | A | A | | NOTE 2 |
| CRESYLIC ACID | BC | | B | A | C | B | A | A | NOTE 2 |
| DEIONIZED WATER | - | - | - | - | - | - | - | - | SEE WATER |
| DEOXIDIZER (ETCHING) | | | | | | | A | | NOTE 1 |
| DEOXIDIZER (3AL-13) | | | A | A | | | | | NOTE 1, NON CHROMATE |
| DICHROMIC SEAL | X | | A | A | | | | | |
| DIETHYLENE GLYCOL | AC | B | A | A | B | A | A | A | |
| DIVERSEY-DS9333 | | | | | | | A | | NOTE 1 |
| DIVERSEY-511 | | | | | | | A | | NOTE 1, NOTE 5 |
| DUR-NU | | | | | | A | A | | NOTE 1, NOTE 5 |
| ELECTRO CLEANER | A | | A | | | | | | NOTE 1 |
| ELECTRO POLISHING | | | | | | | A | | NOTE 1 |
| ELECTROLESS NICKEL | | | | | | A | A | A | NOTE 1 |
| ELECTROLESS TIN (ACID) | | | | | | | A | A | NOTE 1 |
| ELECTROLESS TIN (ALKALINE) | | | | A | | A | | | NOTE 1 |
| ENTHONE ACID-80 | | | | | | | | A | NOTE 1 |
| ETHER | B | B | A | A | B | B | A | A | NOTE 2 |
| ETHYL CHLORIDE | B | B | A | A | A | A | A | A | NOTE 2 |
| ETHYLENE GLYCOL | A | B | B | A | A | A | A | A | NOTE 5 |
| FATTY ACIDS | X | C | A | A | AC | A | A | A | |
| FERRIC CHLORIDE | X | X | BC | B | BC | AC | A | A | |
| FERRIC NITRATE | X | X | B | B | X | | A | | |
| FERRIC SULPHATE | X | C | BC | AC | C | A | A | A | |
| FLUOBORATE (HIGH SPEED) | | | | | | | A | A | NOTE 1 |
| FLUORINE GAS – DRY | X | X | AC | A | C | X | C | C | |
| FORMALDEHYDE | X | B | AC | AC | B | A | A | A | |
| FORMIC ACID | X | C | AC | B | B | C | A | A | |
| FREON | B | C | A | A | A | | | | |
| FUEL OIL – NORMAL | A | B | A | A | A | A | | | NOTE 2, NOTE 3, NOTE 7 |
| FUEL OIL – ACID | X | X | C | B | C | A | | | NOTE 2, NOTE 3, NOTE 7 |
| GASOLENE-REFINED | B | B | B | B | B | | A | | NOTE 2, NOTE 5 |
| GASOLENE-SOUR | B | X | B | B | C | | A | A | NOTE 2, NOTE 3, NOTE 5 |

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|--|---------------|--------|---------------------|--------|----------------|----------|--------|------|------------------------|
| NICKEL PLATE-BRIGHT | X | | C | C | | B | A | A | NOTE 1, NOTE 5 |
| NICKEL PLATE-DULL | X | | C | C | | B | A | A | NOTE 1, NOTE 5 |
| NICKEL PLATE-WATTS SOL. | | | | | | A | A | A | NOTE 1, NOTE 5 |
| NICKEL SULPHATE | X | C | B | B | C | | A | A | |
| NICKEL COPPER STRIKE (CYANIDE FREE) | | | AC | AC | | | | | NOTE 1 |
| NITRIC ACID | X | X | AC | AC | AC | A | A | A | |
| NITRIC HYDROCHLORIC ACID | X | X | BC | BC | X | X | A | A | |
| NITRIC 6% PHOSPHORIC ACID | | | | A | | | A | A | NOTE 1 |
| NITRIC SODIUM CHROMATE | | | | A | | | A | A | NOTE 1 |
| NITROBENZENE | B | BC | B | B | B | A | A | A | NOTE 2 |
| OAKITE #67 | | | A | | | | | | NOTE 1 |
| OIL | A | A | A | A | A | A | A | | NOTE 7 |
| OLEIC ACID | BC | B | AC | AC | AC | AC | A | A | |
| OXALIC ACID | X | B | X | B | AC | X | A | A | |
| PAINT STRIPPER (HIGH ALKALINE TYPE) | A | | | | | | | | NOTE 1 |
| PAINT STRIPPER (SOLVENT TYPE) | | | | A | | | | | NOTE 1, NOTE 2 |
| PARAFFIN | A | A | A | A | A | | | | NOTE 2, NOTE 7 |
| PERCHLOROETHYLENE | A | B | AC | AC | A | A | A | | |
| PETROLEUM-CRUDE | B | X | B | B | | | A | | NOTE 2, NOTE 3, NOTE 7 |
| PHENOL | B | X | A | A | AC | A | A | A | |
| PHOSPHATE | | | BC | AC | | | X | | NOTE 1, NOTE 5, NOTE 9 |
| PHOSPHATE CLEANER | | | BC | AC | | | | X | NOTE 1, NOTE 5, NOTE 9 |
| PHOSPHATIZING | | | | A | | | | X | NOTE 1, NOTE 5, NOTE 9 |
| PICRIC ACID | X | X | BC | B | BC | | A | A | |
| POTASSIUM ALUMINUM SULPHATE | X | C | C | BC | | A | A | A | NOTE 1 |
| POTASSIUM BICHROMATE | C | C | B | B | B | AC | A | A | |
| POTASSIUM CHLORIDE | BC | X | AC | A | B | A | A | | |
| POTASSIUM CYANIDE | BC | X | B | B | B | X | A | A | |
| POTASSIUM HYDROCHLORIC | | | | | | | A | A | NOTE 1 |
| POTASSIUM HYDROXIDE | BC | X | BC | B | B | X | X | A | |
| POTASSIUM NITRATE | B | BC | B | B | B | A | A | | |
| POTASSIUM SULPHATE | BC | BC | A | A | BC | A | A | A | |
| REYNOLDS BRIGHTENER | | | | | | | A | A | NOTE 1 |
| RHODIUM HYDROXIDE | | | | | | | A | A | |
| ROCHELLE SALT CYANIDE | A | | A | | | | | | NOTE 1 |
| RUTHENIUM PLATING | | | | | | | A | A | NOTE 1 |
| SILVER BROMIDE | X | X | X | X | AC | A | A | A | |
| SILVER CYANIDE | C | X | AC | AC | AC | A | A | A | |
| SILVER LUME | | | A | | | | | | NOTE 1 |
| SILVER NITRATE | X | X | B | AC | AC | A | A | | |
| SOAP SOLUTIONS | BC | BC | BC | BC | AC | | | A | |
| SODIUM-LIQUID METAL | C | X | AC | A | AC | | X | | |

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|--|-----------------------|---------------|-----------------------------|---------------|------------------------|-----------------|---------------|-------------|----------------|
| SODIUM BISULPHATE | C | X | BC | BC | BC | BC | A | A | |
| SODIUM BROMIDE | C | C | C | BC | B | C | A | A | |
| SODIUM CARBONATE | C | BC | BC | B | AC | A | C | A | |
| SODIUM CHLORATE | X | BC | BC | B | AC | A | A | A | |
| SODIUM CHLORIDE | C | B | C | C | A | A | A | A | |
| SODIUM CITRATE | X | X | BC | B | AC | A | A | A | |
| SODIUM CYNIDE | X | X | AC | AC | BC | C | A | A | |
| SODIUM DICHROMATE (SODIUM BICHROMATE) | B | X | B | B | | A | A | A | |
| SODIUM HYDROXIDE | C | X | AC | AC | B | AC | X | A | NOTE 8, NOTE 6 |
| SODIUM HYPOCHLORITE | X | X | X | X | X | A | A | A | |
| SODIUM NITRATE | B | C | AC | AC | A | AC | A | A | NOTE 5 |
| SODIUM PEROXIDE | BC | X | BC | B | B | | | A | |
| SODIUM PHOSPHATE | B | B | B | B | B | B | A | A | |
| SODIUM SALICYLATE | B | | B | B | B | | A | A | |
| SODIUM SILICATE | B | X | BC | B | AC | A | | A | NOTE 4 |
| SODIUM SULPHATE | B | BC | AC | A | AC | C | A | A | |
| SODIUM SULPHIDE | X | X | BC | BC | AC | C | C | A | |
| SOLDER BATH | X | X | X | X | X | X | X | X | |
| SODIUM STANNATE | C | | B | B | B | | A | A | |
| STANOSTAR | | | | | | | A | A | NOTE 1 |
| STEARIC ACID | C | BC | BC | A | AC | A | A | | |
| SUGAR SOLUTION | A | A | A | A | A | A | A | A | NOTE 7 |
| SULFAMATE NICKEL | | | | | | A | A | A | NOTE 1 |
| SULFUR | X | X | A | A | A | A | A | | |
| SULFUR CHLORIDE | X | X | BC | BC | AC | | A | A | |
| SULFUR DIOXIDE DRY | AC | BC | B | B | AC | A | A | | |
| SULFURIC ACID | X | X | X | X | X | X | A | A | |
| SULFUROUS ACID | X | X | X | BC | A | A | A | A | |
| TANNIC ACID | X | C | B | B | B | AC | A | A | |
| TIN (MOLTEN) | | X | X | X | | | | X | NOTE 4 |
| TIN-NICKEL PLATING | | | | | | | A | A | NOTE 1 |
| TIN PLATING-ALKALINE | A | | A | | | | | | NOTE 1 |
| TRICHLOROETHANE | A | A | A | A | A | A | A | A | |
| TRICHLORETHYLENE | BC | BC | B | B | AC | A | A | A | |
| TRIETHYLENE GLYCOL | A | A | A | A | A | | A | | |
| TRIOXIDE (PICKLE) | | | | | | | A | A | NOTE 1 |
| TRISODIUM PHOSPHATE | BC | BC | AC | AC | | | X | A | |
| TURCO 4181 (ALK. CLEANER) | | | | A | | | | | NOTE 1 |
| TURCO 4008 (DESCALER) | | | | A | | | | | NOTE 1, NOTE 5 |
| TURCO 4338 (OXIDIZER) | | | | A | | | | | NOTE 1, NOTE 7 |
| TURCO ULTRASONIC SOLUTION | | | | A | | | | | NOTE 1 |
| UBEC | | | | | | | A | | NOTE 1 |
| UDYLITE #66 | | | | | | A | A | A | NOTE 1, NOTE 5 |
| UNICHROME CR-110 | | | | | | | A | A | NOTE 1 |
| UNICHROME 5RHS | | | | | | | A | A | NOTE 1 |

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|----------------------|-----------------------|---------------|-----------------------------|---------------|------------------------|-----------------|---------------|-------------|----------------|
| WATER DEIONIZED | X | X | A | A | A | | | | NOTE 11 |
| WATER DEMINERALIZED | X | X | A | A | A | | | | NOTE 11 |
| WATER PURE | X | X | A | A | A | | | | NOTE 11 |
| WATER POTABLE | X | B | BC | BC | A | A | A | A | |
| WATER SEA | X | BC | C | BC | AC | A | A | A | |
| WATT'S NICKEL STRIKE | | | | | | | A | | NOTE 1 |
| WHISKEY | X | BC | A | A | | | | | NOTE 2 |
| WOOD'S NICKEL STRIKE | | | | | | | A | | NOTE 1 |
| YELLOW DICHROMATE | | | | A | | | A | | NOTE 1 |
| ZINC (MOLTON) | | X | X | X | X | X | | X | |
| ZINC CHLORIDE | X | X | X | B | BC | B | A | A | |
| ZINC PLATING ACID | | | | | | | A | | NOTE 1 |
| ZINC PLATING CYANIDE | A | | A | | | | | | NOTE 1 |
| ZINC PHOSPHATE | | | | A | | | | X | NOTE 1, NOTE 5 |
| ZINCATE | A | | A | | | | | | NOTE 1 |