

Electrodes for Shielded Metal Arc Welding (SMAW) or stick electrodes must be properly stored in order to deposit quality welds. When stick electrodes absorb moisture from the atmosphere, they must be dried in order to restore their ability to deposit quality welds. Electrodes with too much moisture may lead to cracking or porosity. Operational characteristics may be affected as well. If you've experienced unexplained weld cracking problems, or if the stick electrode arc performance has deteriorated, it may be due to your storage methods or re-drying procedures.

Follow these simple storage, exposure and redrying techniques to ensure the highest quality welds, as well as the best operational characteristics from your stick electrodes.

### **Storing Low Hydrogen Stick Electrodes**

Low hydrogen stick electrodes must be dry to perform properly. Unopened Lincoln hermetically sealed containers provide excellent protection in good storage conditions. Opened cans should be stored in a cabinet at 250 to 300°F (120 to 150°C)

Low hydrogen stick electrode coatings that have picked up moisture may result in hydrogen induced cracking, particularly in steels with a yield strength of 80,000 psi (550 MPa) and higher.

Moisture resistant electrodes with an "R" suffix in their AWS classification have a high resistance to moisture pickup coating and, if properly stored, will be less susceptible to this problem, regardless of the yield strength of the steel being welded. Specific code requirements may indicate exposure limits different from these guidelines.

All low hydrogen stick electrodes should be stored properly, even those with an "R" suffix. Standard EXX18 electrodes should be supplied to welders twice per shift. Moisture resistant types may be exposed for up to 9 hours.

When containers are punctured or opened, low hydrogen electrodes may pick up moisture. Depending upon the amount of moisture, it will damage weld quality in the following ways:

1. A greater amount of moisture in low hydrogen electrodes may cause porosity. Detection of this condition requires x-ray inspection or destructive testing. If the base metal or weld metal exceeds 80,000 psi (550 MPa) yield strength, this moisture may contribute to under-bead or weld cracking.

2. A relatively high amount of moisture in low hydrogen electrodes causes visible external porosity in addition to internal porosity. It also may cause excessive slag fluidity, a rough weld surface, difficult slag removal, and cracking.



3. Severe moisture pickup can cause weld cracks in addition to under-bead cracking, severe porosity, poor appearance and slag problems.

**Redrying Low Hydrogen Stick Electrodes**

Redrying, when done correctly, restores the electrodes' ability to deposit quality welds. Proper redrying temperature depends upon the electrode type and its condition.

One hour at the listed final temperature is satisfactory. DO NOT dry electrodes at higher temperatures. Several hours at lower temperatures is not equivalent to using the specified requirements.

Electrodes of the E8018 and higher strength classifications should be given no more than three one-hour re-dries in the 700 to 800°F (370 to 430°C) range. This minimizes the possibility of oxidation of alloys in the coating resulting in lower than normal tensile or impact properties.

Any low hydrogen electrode should be discarded if excessive redrying causes the coating to become fragile and flake or break off while welding, or if there is a noticeable difference in handling or arc characteristics, such as insufficient arc force.



Electrodes to be redried should be removed from the can and spread out in the oven because each electrode must reach the drying temperature.

**Redrying Conditions - Low Hydrogen Stick Electrodes**

		Final Redrying Temperature	
Condition	Pre-drying Temperature(1)	E7018, E7028	E8018, E9018
		Electrodes exposed to air for less than one week;	N/A

no direct contact with water.		(340 to 400°C)	
Electrodes which have come in direct contact with water or which have been exposed to high humidity.	180 to 220°F (80 to 105°C)	650 to 750°F (340 to 400°C)	700 to 800°F (370 to 430°C)

(1) Pre-dry for 1 to 2 hours. This will minimize the tendency for coating cracks or oxidation of the alloys in the coating.

### Storing and Redrying Non-Low Hydrogen Electrodes

Electrodes in unopened Lincoln cans or cartons retain the proper moisture content indefinitely when stored in good condition.

If exposed to humid air for long periods of time, stick electrodes from opened containers may pick up enough moisture to affect operating characteristics or weld quality. If moisture appears to be a problem, store electrodes from the opened containers in heated cabinets at 100 to 120°F (40 to 50°C).

Some electrodes from wet containers or long exposure to high humidity can be re-dried. Adhere to the procedures in the following table for each type.



### Redrying Conditions - Non-Low Hydrogen Stick Electrodes

Stick Electrode	Electrode Group	Final Redrying Temperature	Time
E6010; E6011; E7010-A1 E7010-G; E8010-G E9010-G;	<b>Fast Freeze</b> - excessive moisture is indicated by a noisy arc and high spatter, rusty core wire at the holder end or objectionable coating blisters while welding.  <b>Re-baking of this group of stick electrodes is not recommended.</b>	Not Recommended	N/A
E7024; E6027;	<b>Fast Fill</b> - excessive moisture is indicated by a noisy or "digging" arc, high spatter, tight slag, or undercut. Pre-dry unusually damp electrodes for 30 - 45 minutes at 200°F to	400 to 500°F (200 to 260°C)	30 - 45 minutes

	230°F (90 - 110°C) before final drying to minimize cracking of the coating.		
E6012 E6013 E7014 E6022	<b>Fill Freeze</b> - Excessive moisture is indicated by a noisy or "digging" arc, high spatter, tight slag or undercut. Pre-dry unusually damp electrodes for 30 - 45 minutes at 200° - 230°F (90° - 110°C) before final drying to minimize cracking of the coating	300 to 350°F (150 to 180°C)	20 - 30 minutes

*(1) Pre-dry for 1 to 2 hours. This will minimize the tendency for coating cracks or oxidation of the alloys in the coating.*

Using longer drying times or higher temperatures can easily damage the electrodes. For drying, remove the electrodes from the container and spread them out in the furnace because each stick electrode must reach the drying temperature.