Recommendations for the storage, redrying and handling of ESAB consumables

XA00097020

Recommendations for covered electrodes

The storage of covered electrodes can be a fairly difficult subject as air always contains moisture and electrode coatings are prone to moisture pick-up. Too much moisture in the coating can produce porosity in the weld or else the hydrogen coming from the moisture causes cracks.

An easy way to avoid all these problems is to use the new VacPac. As long as the vacuum is present, the electrodes are dry. There are no restrictions relating to storage climate.

After the final drying at the factory, the electrodes are normally packed in shrink-film paper boxes. These boxes are not 100% airtight, which explains how moisture in the surrounding atmosphere can enter them and be absorbed by the coating. The speed of the moisture pick-up depends on several factors and, without testing the moisture content, it is difficult to judge whether or not the electrodes in a package have too much moisture in their coating.

If the packages are kept in the storage conditions described below, they can be kept for a maximum of one year for normal use. Care must also be taken during transportation and handling to prevent moisture being re-absorbed.

If there is any doubt about whether an electrode is dry enough, it should be redried at the temperature and time indicated on the label on the package.

However, packing electrodes in VacPac means that there are no restrictions when it comes to storage, other than that the package must be kept at a temperature that does not exceed 50°C.

LMA – Low Moisture Absorption

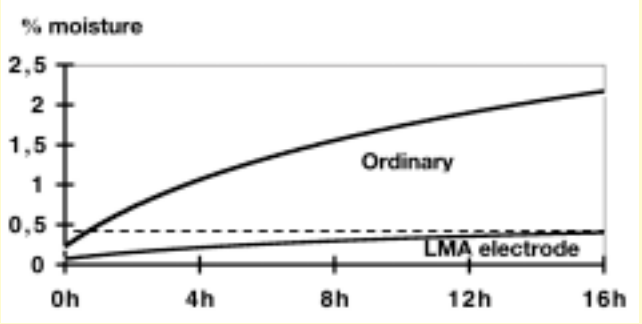

Fig. 1.

For VacPac users, read the VacPac section below.

ESAB introduced the LMA concept for basic electrodes to reduce sensitivity to the re-absorption of moisture. Electrodes with LMA have a lower initial moisture content and the speed of remoistening is much lower than that of normal basic electrodes. The usable time before redrying is therefore increased. This is shown in a climate of 32°C, 75% relative humidity in Figure 1.

Storage

Covered electrodes of any type will pick up moisture only very slowly if they are stored under the following climatic conditions:

At temperatures

5-15°C	max. relative humidity 60%
15-25°C	max. relative humidity 50%
above 25°C	max. relative humidity 40%

During the winter, it is possible to maintain low relative humidity by keeping the temperature in the store-room at least 10°C above the outdoor temperature. During certain periods in the summer and in a tropical climate, sufficiently low relative humidity can be maintained by air dehumidification.

If the electrodes have been stored in a cold place, allow them to reach the ambient temperature before breaking the package.

Redrying

Low-hydrogen basic electrodes should be redried before use whenever there are application requirements relating to weld metal hydrogen content and/or radiographic soundness (not needed for VacPac™).

Acid rutile stainless electrodes and all types of basic electrode may produce pores in the weld if they have not been stored in sufficiently dry conditions. Redrying the electrodes will restore their usability.

Mild steel rutile and acid electrodes normally need no redrying.

Cellulose electrodes must not be redried.

Electrodes which are seriously damaged by moisture can normally not be redried with first-class results. These electrodes should be scrapped.

Holding oven

The holding oven is used for intermediate storage to avoid moisture pick-up in the coating of low-hydrogen electrodes and acid rutile stainless electrodes. The electrodes which should be stored in the holding oven are:

1. Electrodes that have been redried
2. Electrodes that have been removed from their hermetically-sealed container
3. Electrodes that are regarded as

being in good condition and are transferred directly from the storeroom after unpacking.

Holding oven temperature: 120-150°C.

Precautions on site

Keep the electrodes in electrically-heated quivers at a minimum temperature of 70°C.

After work, return the remaining electrodes to the holding oven.

Redrying conditions

Redrying temperatures and holding times are specified on the package label.

The redrying temperature is the temperature in the bulk of the electrodes.

The redrying time is measured from the point at which the redrying temperature has been reached.

Do not stack more than four layers of electrodes in the redrying oven.

It is recommended not to redry covered electrodes more than three times.

A summary of recommended redrying conditions for ESAB electrodes is given in Table 1.

Table 1. Recommended redrying temperatures, holding time two hours for OK electrodes

80°C	150°C	200°C	250°C	300°C	350°C	
43.32	50.10	39.95	33.30	53.16	38.48	67.62
46.00	94.25	63.35	33.65	61.10	38.65	67.70
46.16	94.55	67.15	63.53	61.41	38.85	68.12
46.64		67.75	63.80	61.81	38.95	68.17
92.18		68.15	67.13	63.10	48.00	73.08
92.78		83.28	67.45	63.20	48.04	73.68
		83.65	68.60	63.32	48.08	73.78
		84.58	68.81	63.41	48.15	73.79
		85.65	69.21	63.53	48.30	74.46
		86.08	84.42	63.71	48.68	74.78
		92.26	84.52	68.82	53.00	74.79
		92.45	86.20	69.33	53.18	75.65
		92.58	93.13	83.50	53.35	75.75
			92.15	84.60	53.68	75.78
				84.78	55.00	76.18
				92.86	61.30	76.28
					61.50	76.35
					63.30	76.96
					63.34	76.98
					64.30	78.16
					67.50	83.29
					67.52	86.28
					67.60	92.35

ESAB equipment for the dry storage and redrying of electrodes

PK 1 dry-storage container
The PK 1 is a light and handy dry-storage container for electrodes. It is easy to carry around. The storage temperature is around 100°C.

PK 5 drying equipment
The PK 5 is a combined drying and dry-storage system for most types of electrode. The drying time at full effect is one to seven hours depending on the type of electrode. The temperature is thermostatically controlled and ranges from 50-300°C. The electrodes should be stored in the PK 5 without packaging.

SK 40 dry-storage cabinet

The SK 40 is a dry-storage cabinet with four removable shelves for storing electrodes. The electrodes should be stored without packing. The cabinet is equipped with a thermometer, thermostat and control lamp.

PK 410 drying cabinet
The PK 410 is a robust cabinet for the drying and dry storage of electrodes. The drying temperature

can be regulated between 0°C and 450°C. The dry-storage temperature is around 150°C. The PK 410 is equipped with a control lamp, electronic thermometer and electronic thermostat.

The PK 410 also has a seven-day timer. This timer makes it possible to change automatically from drying to dry storage for selected times and temperature ranges.

Discoloration in the coating
If the colour of the electrodes changes during storage, they should be scrapped or an ESAB representative should be contacted.

Damaged coating
Mechanically damaged electrodes on which parts of the coating are missing will not perform correctly and should be scrapped.

VacPac™
Electrodes in VacPac™ will not pick up any moisture during storage. They require no redrying before use, provided that the package is undamaged. This is indicated by a vacuum in the package.

Handling VacPac™ electrodes
Protect VacPac™ from damage at all times.

The outer board packaging offers extra protection from mechanical damage to the metal foil. Handle the single inner metal foil with special care.

Do not use a knife or any other sharp object to open the outer board packaging.

Figure 2 shows how much easier it is to handle VacPac electrodes compared with ordinary packed electrodes.

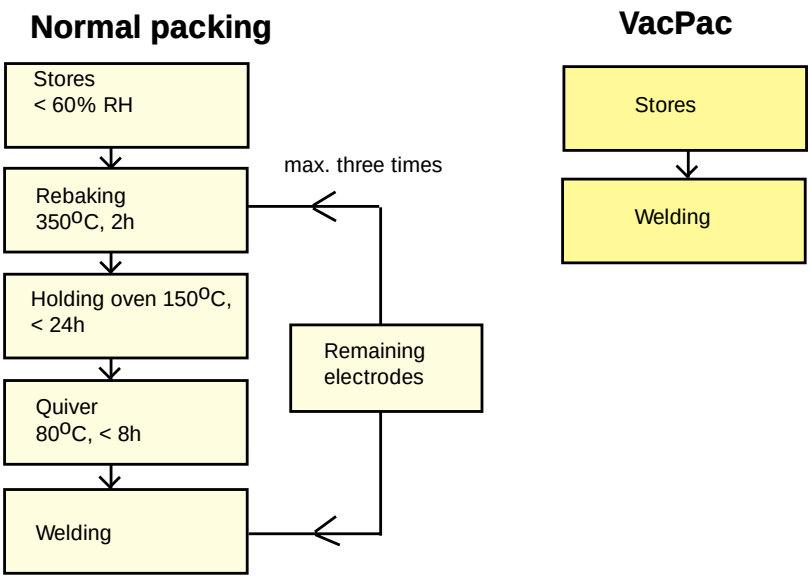

Fig 2. Comparison of procedures for guaranteeing dry electrodes in a workshop between normal packaging and VacPac™.

Before using VacPac™ electrodes

Check that the protective foil still contains a vacuum. If the vacuum has been lost, redry the electrodes before use. Before opening the package, make sure that it has the same temperature as the ambient air.

Cut open the protective foil at one end. Leave the foil on the package.

Do not take out more than one electrode at a time, thereby ensuring that the remaining electrodes are still protected inside the package. Put the lid back on the plastic box.

Discard or redry electrodes that have been exposed to the atmosphere in an opened VacPac™ for more than 12 hours.

Recommendations for OK Flux

ESAB fluxes for SAW have excellent storage properties and as-delivered OK Fluxes have a moisture content with a nominal level of no more than 0.05% determined at 1,000°C.

It is of great importance for the quality of the weld metal that the moisture content is kept as low as possible. OK Fluxes are delivered in a moisture-resistant paper bag with a plastic lining bag, 25 kg Bucket, 250 kg BigBarrel and 500-

1,000 kg BigBag. However, it is possible for OK Fluxes to pick up moisture during inappropriate handling, storage or transport. This is generally indicated by porous slag and/or pores on the weld. ESAB has drawn up guidelines for handling to avoid this.

1 OK Flux must be stored dry to prevent remoistening. As a rule, the climate conditions in the store should not exceed 60% relative humidity at a temperature of 20°C ± 10°C.

2 Flux bags should not be exposed to direct moisture such as rain or snow.

If the above conditions are met, OK Flux has the following storage times:

Buckets and BigBarrels	max. 3 years
Paper bags	max. 2 years
BigBag	max. 6 months

During long production stoppages, flux in open flux containers on the welding machine or at the welding site should be taken back to the storeroom or kept in an oven at 150°C ± 25°C.

If for any reason OK Flux has been remoistened, it can normally be restored by redrying it in a drying oven. The following values for temperature and time apply.

Fused OK Flux:	200 ± 50°C
Bonded OK Flux:	300 ± 25°C

Suitable flux quantities depend on the design and ventilation of the oven, but the height of the flux layer should not exceed 50 mm. Rebaked flux should be stored at 150 ± 25°C until use.

Fluxsilo JS 200 is an electrically heated oven for keeping flux dry. It has a capacity of 200 litres and the temperature can be regulated between 0-300°C – thermostatically controlled.

Redrying temperature: 300°C for two to four hours

Storage volume: 200 l

Flux hopper size: 500 x 500 x 1,700 mm

Fluxtork JK 50 is an electrically heated cabinet and storage silo that can dry 50 kg of flux for about three hours. The temperature then drops to 150°C within 12 hours.

Recommendations for aluminium wires

Base Metal:
Position base metal vertically and space apart to provide for air circulation and minimise condenses contact points.

Store inside, preferably in a heated room with as constant a temperature as possible. Humidity control is also desirable, if it can be achieved.

Electrode:
Store in a heated room with uniform temperature control and, if possible, with humidity control as well.

Hold weld metal in the welding area for 24 hours before unpacking to allow its temperature to equalise with that of the surrounding area.

Store unpacked material in a heated cabinet.

Use dust covers on all welding equipment.

Atmospheric conditions affect weld quality

Many fabricators experience welding problems at different times of the year. Moisture (H_2O) is a prime source of hydrogen. At arc temperatures, water breaks down releasing hydrogen atoms that cause porosity in weldments. Shielding gas supplies are controlled to very low moisture content (-57°C dew point or lower). Likewise, the atmospheric conditions in a fabricating facility need to be controlled to prevent moisture condensation from forming on electrode or base metal.

Aluminium, which is allowed to repeatedly come into contact with

Dew point conditions versus relative humidity:

(Tair - Tmetal)° °C	Relative Humidity %	(Tair - Tmetal)° °C	Relative Humidity %
0	100	12	44
1	93	13	41
2	87	14	38
3	81	15	36
4	75	16	34
5*	70*	18	30
6	66	20	26
7	61	22	23
8	57	24	21
9	53	26	18
10	50	28	16
11	48	30	14

water, will eventually form a hydrated oxide (AlOH) coating. Moisture from condensation present on either the electrode or the base metal can cause two problems during welding:

Porosity caused by hydrogen generated from the breakdown of water or from the breakdown of hydrated oxide (AlOH) present on the metal surfaces.

Entrapment of the actual oxide (AlOH) present on the metal surfaces, in the weldment.

Terms:

Relative Humidity - The ratio of the quantity of water vapour present in the atmosphere to the quantity which would saturate the air at the existing temperature. Relative humidity is expressed as a percentage number and needs to be monitored in the welding area. Dip tanks, cleaning stations, etc, affect relative humidity.

Dew Point - The temperature at which condensation of water vapour in the air takes place. Moisture will condense on metal surfaces when their temperature is equal to or below the dew point. For each relative humidity percentage, there is a corresponding dew point.

Air Temperature - The temperature of the air in the welding area at any given time.

Metal or Electrode Temperature - The temperature of the electrode or base metal at any given time.

(Tair - Tmetal)° - Temperature of the air minus the temperature of the metal shown in °C.

The above chart shows the relative humidity at which detrimental water condense will form for a number of given differential temperatures.

* Example - If the relative humidity in the weld area is 70%, the base metal and electrode must be no colder than 5°C below the air temperature to prevent moisture condensation.

Conclusion:
In an aluminium welding shop, the uniformity of air and metal temperatures is important especially when the relative humidity is high. Electrode and base metal should be allowed to stabilise to the weld area temperature. The electrode should not be opened in the weld area for 24 hours after entry from a cooler storage area. The base metal should be cleaned and brushed with a clean stainless steel brush prior to welding. ESAB recommends mild alkaline solutions and commercial degreasers that do not evolve toxic fumes during welding. Welders should wipe joint edges with a clean cloth dipped in a volatile petroleum based solvent. All surfaces must be thoroughly dried after cleaning.

Recommendations for cored and solid wires

When it comes to wires, the object is once again to avoid contact with water or moisture. It is most important to avoid direct contact with water.This could take the form of rain or the condensation of moisture on a cold wire.

To avoid condensation, keep the wire in the original packaging and, if necessary, leave the wire to warm up to at least the ambient temperature before opening the package.

Other hydrogen-containing substances. like oil, grease and corrosion. or substances that could absorb moisture must also be avoided on the surface of the wires.

If the wire is kept in its original unopened packaging in a climate of 10-30°C, < 65% RH, its shelf life is regarded as virtually unlimited.

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