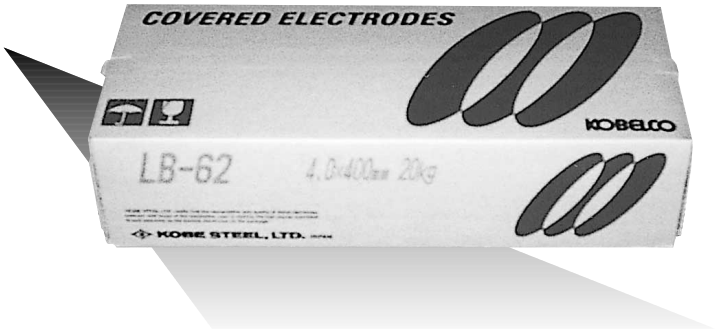
Technical Report

LB-62

(AWS A5.5 E9016-G)



LB-62: An unsurpassed covered electrode for welding storage tanks, pressure vessels, and penstocks using 550-610N/mm² high-strength steel, offering moisture-resistance and extra-low hydrogen.

Moisture-Resistant LB-62 Can Reduce the Need of Redry

The coatings of covered electrodes naturally pick up moisture from the air because of the nature of their raw materials (fluxes). How much moisture is absorbed, however, varies depending on the ingredients in the fluxes. The coating of LB-62 picks up less moisture because the flux is more resistant to moisture when compared with conventional covered electrodes - **Fig. 1**.

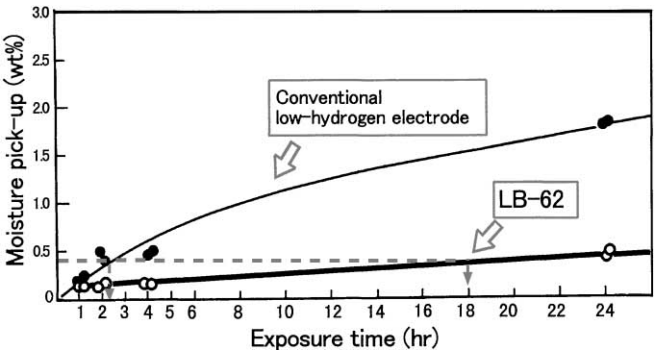


Fig. 1 — Test results of LB-62 and a conventional low-hydrogen electrode in terms of moisture pick-up under the controlled atmosphere: 30℃ × 80%RH.

When a welding job requires that the maximum allowable moisture content of low-hydrogen electrode coatings must be 0.4% by weight, conventional electrodes must be redried approximately every two hours, In contrast, LB-62 can be used longer in a temperature-relative humidity condition of 30℃× 80% RH, as shown in Fig. 1. The temperature-relative humidity combination predominantly affects the rate of moisture pick-up. This superior resistance to moisture makes quality control easier and more economical by reducing the frequency of redrying at fabrication and construction sites, particularly, in such humid job sites as penstocks construction sites.

Extra-Low Hydrogen LB-62 Minimizes the Preheating Temperature

LB-62 is designed and produced so that the deposited metal contains less diffusible hydrogen in comparison with conventional low-hydrogen electrodes. **Fig. 2** shows test results of diffusible hydrogen as functions of moisture pick-up and temperature-relative humidity conditions of the testing atmosphere. The figure illustrates that in LB-62 deposited metal much less diffusible hydrogen evolves than with conventional low-hydrogen electrodes in both as-redried and 4-hour-exposed conditions. In addition, the 4-hour-exposure to the testing atmosphere of 30℃× 80%RH causes a slight increase of diffusible hydrogen compared with the as-redried condition in the case of moisture-resistant LB-62, while a conventional electrode causes a pronounced increase of diffusible hydrogen.

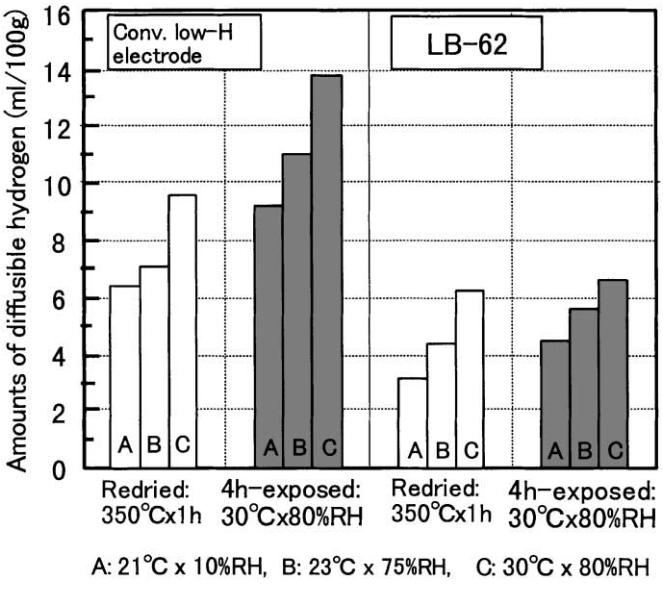


Fig. 2 — A comparison between LB-62 and a conventional low-hydrogen electrode on amounts of diffusible hydrogen evolved from deposited metal

When chemical composition and thickness of the base metal are constant, cold crack susceptibility of welds is increased by diffusible hydrogen in the weld metal. Extra-low hydrogen LB-62, therefore, can decrease crack susceptibility, or it can lower the minimum preheating temperature to prevent cold cracking. It is recommended to preheat work at a temperature range of 50-100℃ depending on chemical composition and thickness of the base metal.

Field-Proven LB-62 Assures Persistent High Quality with a Long History of Reliability in Welding Thick-Section Work

Since it was launched in 1958, LB-62 has seen its features refined and its markets expanded. Nowadays, the main applications of LB-62 are seen in the fabrication of storage tanks, pressure vessels, and penstocks (**Fig. 3**). In order to cope with strict requirements needed in the fabrication of such equipment, Kobe Steel pursues keen quality control.

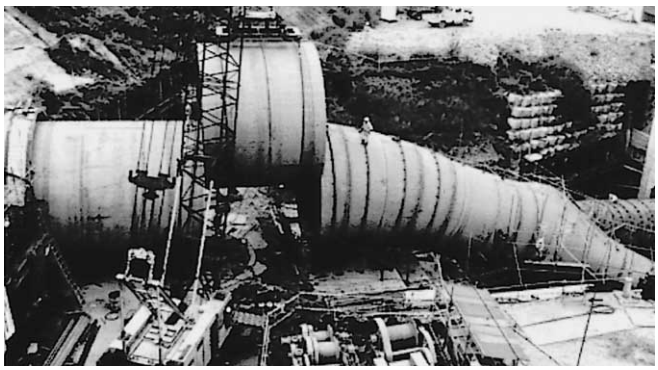


Fig. 3 — The construction of penstocks for hydraulic power generation requires the welding procedures be strictly controlled, because the welding circumstances are very severe in terms of humid welding atmosphere, and confined welding spaces.

The strict requirements in the construction of penstocks include persistent tensile strength and impact value of the welds in the all-position welding of thick-section work. **Figs. 4** and **5** show tensile test results and Charpy impact test results of LB-62 weld metals respectively. The tensile test results show stable tensile strength and 0.2% proof strength being affected little by postweld heat treatment over a range of temper parameters. The impact test results show stable absorbed energies with little scattering over a range of testing temperatures both in as-welded and postweld heat treated conditions.

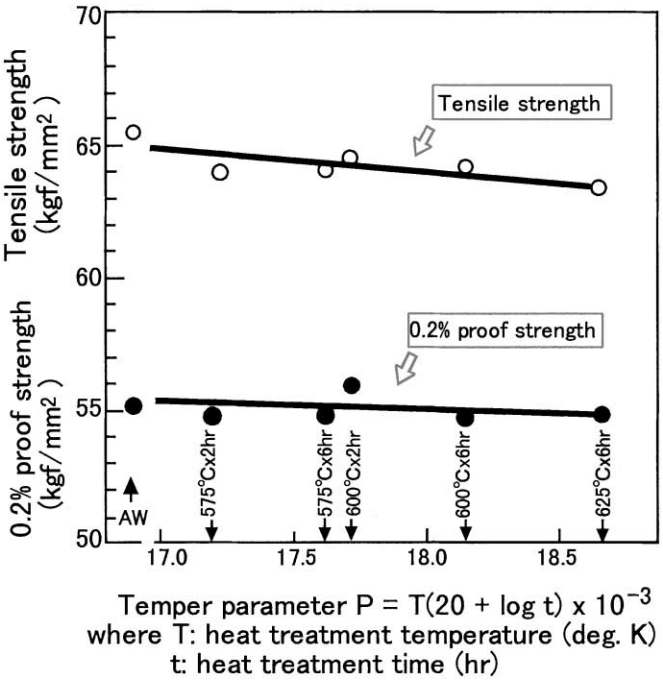


Fig. 4 — Stable tensile properties of LB-62 deposited metals being affected little by postweld heat treatment over a range of temper parameters

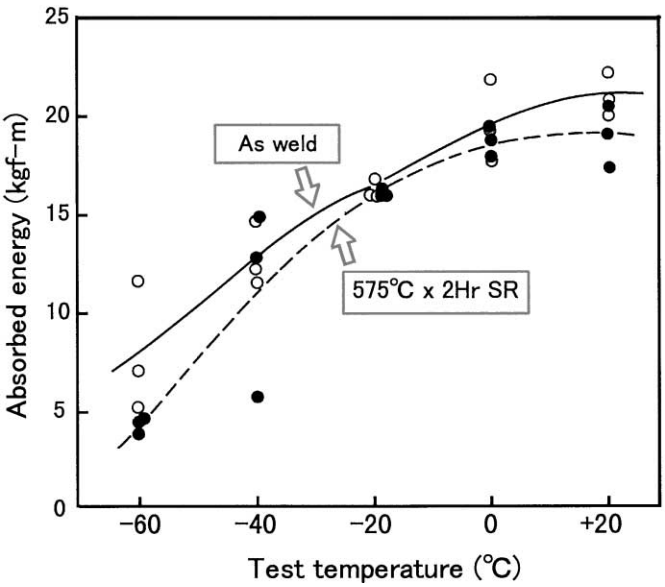


Fig. 5 — Stable impact properties of LB-62 deposited metals with little scattering over a range of testing temperatures both in as-welded and postweld heat treated (SR) conditions