

# B-14

(AWS A5.1 E6019)



B-14 is a versatile ilmenite type covered electrode for mild steel, offering unsurpassed usability and weldability in all-position butt and fillet welding and in welding sheet metals and mid-thick (up to 20 mm) plates.

## A History of Ilmenite Type Electrodes

Kobe Steel developed, in 1942, an epoch-making ilmenite type covered electrode: "B-17," which used ilmenite (a composition of iron oxide and titanium oxide) as the raw material for the major part of the coating flux. After a period of years, Kobe Steel developed other ilmenite type covered electrodes, B-10 and B-14, so as to satisfy the requirements of a variety of users.

The consumption of ilmenite type covered electrodes increased sharply, particularly in the shipbuilding industry (Fig. 1) as the construction of ships increased through 1960s and 1970s. The annual production of ilmenite type covered electrodes in Japan increased year

by year up to 132,000 MT in 1973, comprising a major portion of the market for mild steel covered electrodes.

However, starting in 1975, right after the first global oil crisis, ship construction began to dry up, after which the consumption of covered electrodes, including the ilmenite type, rapidly decreased. Since then this trend has accelerated, with covered electrodes being superseded by gas metal arc welding wires in order to save welding costs.

But the consumption ratio of ilmenite type covered electrodes is still high. In 1995, the annual production of ilmenite type covered electrodes was approximately 17,000 MT, which is approximately 30% of all 56,000 MT of mild steel covered electrode produced in Japan.

Ilmenite type covered electrodes classified as D4301 in the JIS standard have been also classified as E6019 (iron oxide, titania potassium type) in the AWS standard since 1991. This standardization per AWS is due to Kobe Steel's active work in the Japan Welding Engineering Society and the American Welding Society. Nowadays, ilmenite type covered electrodes are used for welding general steel structures, pipes, and ships in Japan and overseas. Among these ilmenite type covered electrodes B-14 is one of the leading brands, which is produced by Kobe Steel and overseas subsidiary companies: TKW, KWS, and INTIWI.

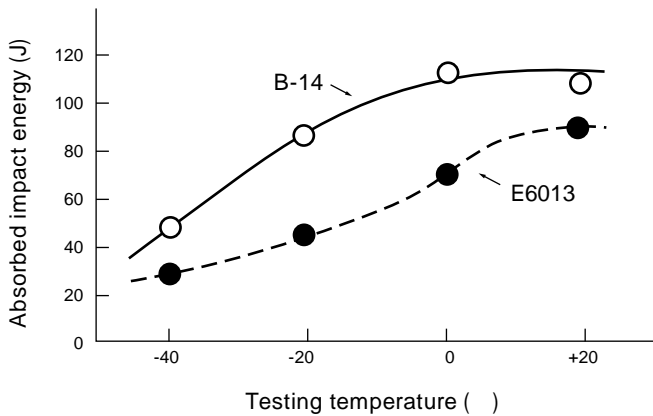
## What Characteristics Highlight B-14

Compared with E6013 electrodes, B-14 features the following characteristics.

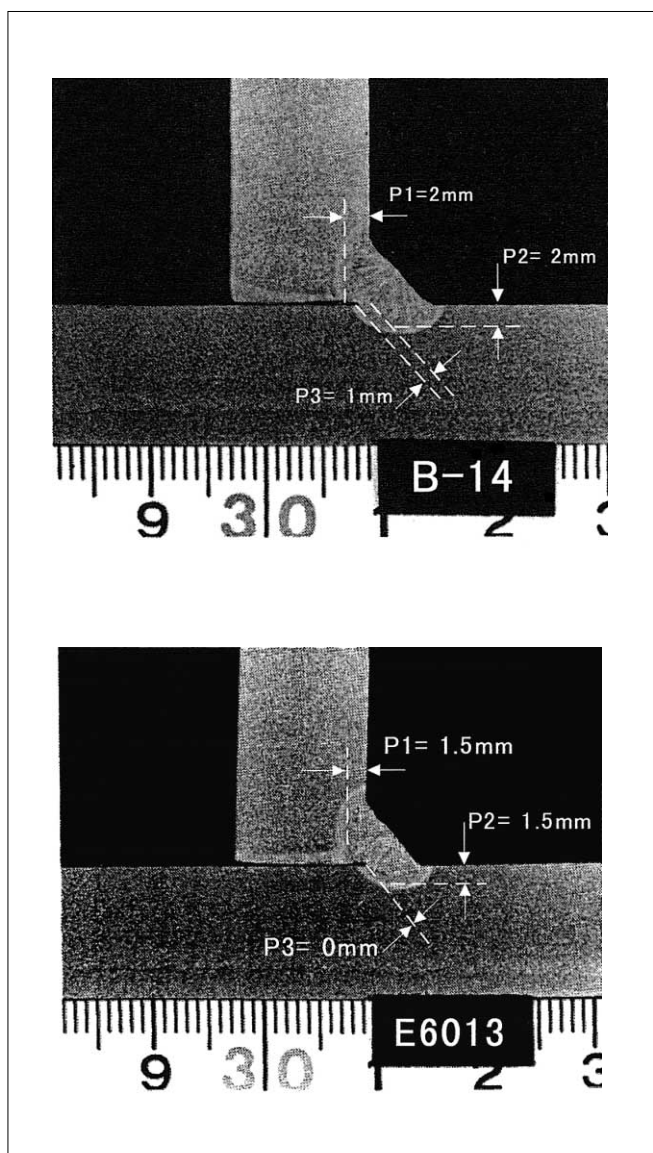
- (1) Suitable for welding heavy-duty structures due to superior X-ray soundness, higher ductility, higher notch toughness (Fig. 2), and deeper penetration (Fig. 3)



Fig. 1 - Ilmenite type electrodes shined in shipbuilding throughout the 1960s and 1970s due to excellent usability and weldability



**Fig. 2 - Charpy impact test results of B-14 and E6013 deposited metals**



**Fig. 3 - A comparison between B-14 and E6013 covered electrodes (4.0 mm , 175A) in fillet weld penetration; P1, P2, and P3 show sizes of penetration**

- (2) Suitable for welding thicker steel plates due to superior hot crack resistance
- (3) Higher welding efficiency due to longer unit electrode length and higher proper currents (Table 1)

**Table 1 - A comparison between B-14 and E6013 covered electrodes on unit length and proper welding current ranges**

Brand	Size (mm )	3.2	4.0	5.0
B - 1 4	Electrode unit length (mm)	400	450	450
	Proper current in flat welding (A)	85-140	130-190	180-260
E6013	Electrode unit length (mm)	350	400	400
	Proper current in flat welding (A)	60- 125	105-170	150-220

**Notes on Usage**

The electrode's performance depends greatly on how it is used. In order to get the best welding results, the following key points should be noted.

- (1) Use B-14 with welding currents within the proper ranges, because excessive welding currents may degrade X-ray soundness, increase spatter, and cause undercut and irregular bead appearance.
- (2) Redry B-14 at 70 - 100 °C for 30 - 60 minutes, if the electrode picked up excessive moisture. This is because excessive moisture in the coating may degrade electrode's usability and cause the occurrence of pits in the weld metal.
- (3) Avoid excessively high temperatures and long time in redrying B-14, because the excessive redrying may damage the coating, causing less penetration, poor X-ray soundness, and electrode burn.