JFE TECHNICAL REPORT
No. 24 (Mar. 2019)

High Productivity Process of Large Diameter Pipes by NEO Press

1. Introduction

With the recent increase in energy demand, new energy sources from the deep sea environment or others are being developed, and the transportation of such resources over long distances (more than 1 000 km) is increasing. To transport large volumes of resources efficiently over long distances, operational pressures becomes higher, and the demand for high strength, heavy wall thickness steel pipes that can withstand high pressure is increasing. Moreover, in order to shorten the transportation distance, pipelines are laid in deep waters at depths exceeding 2 000 m, such as the Mediterranean Sea and Black Sea, and the application of heavy-walled pipes to prevent collapse by water pressure is increasing.

Therefore, JFE Steel developed a high productivity press bending method and achieved mass production of heavy-walled, high strength steel pipes by installing a NEO Press. This article introduces the high productivity production process for steel pipes by the NEO Press process[1)].

2. High Productivity Process for Press Bending Pipes

2.1 Features of High Productivity Press Bending Method

Figure 1 shows the high productivity steel pipe production process by the press bending method. In this method, a steel plate is formed into a circular shape by repeated bending and feeding the plate to change the position of the bend. In the first half of this method, the plate is bent into a semicircular shape from the width edge toward the width center in a 5-stage pressing. In the second half, the opposite side of the plate is bent into a semicircular shape in 5 stages in the same manner, and finally, press forming is completed by bending the plate at the width center. Conventionally, pressing was performed several tens of times in order to form a smooth arc, but in this method, the production efficiency of the pressing process is improved by reducing the number of press stages to 11. However, by decreasing the number of press stages, the convex shape at the pressed parts increases in size, and the unevenness of the pressed pipe becomes larger.

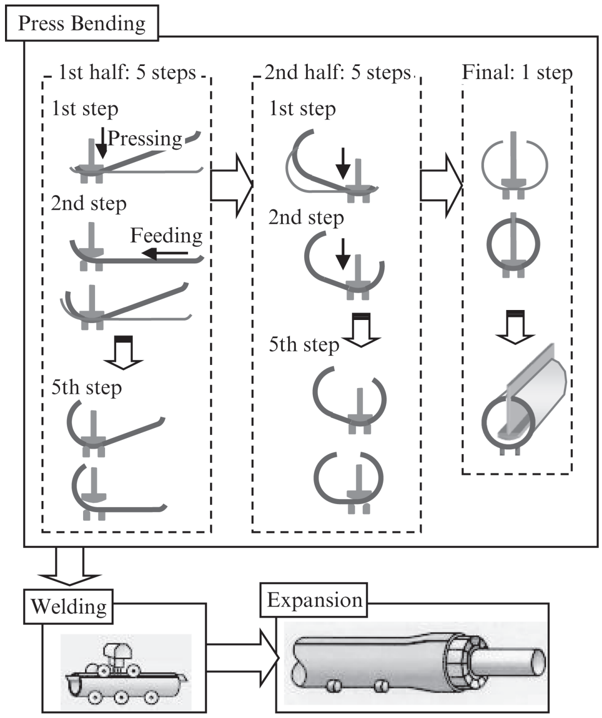

Fig. 1 Schematic illustration of high productivity process of large diameter pipe by high productivity press bending

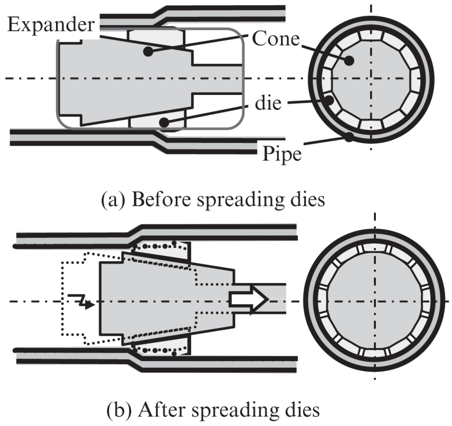

Fig. 2 Expander and pipe expansion method

† Originally published in *JFE GIHO* No. 42 (Aug. 2018), p. 100−101

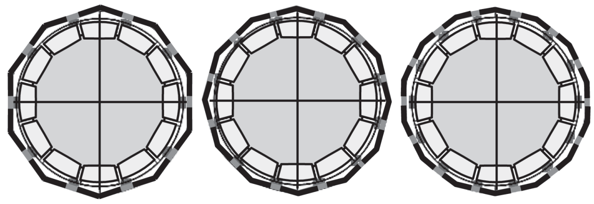

Fig. 3 Schematic illustration of different step expansion of press bending pipe

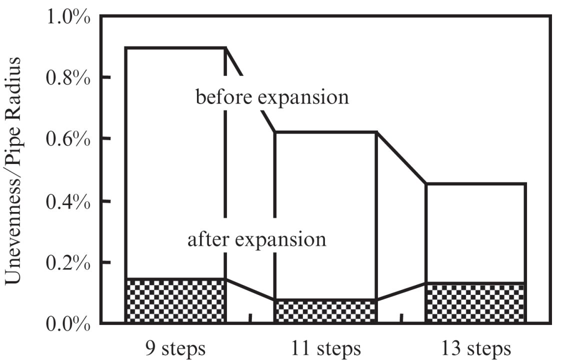

Fig. 4 Influence of press steps on pipe unevenness before and after expansion

Therefore, after welding, the pipe is formed into a circular shape by an expander like that used in UOE pipe production. **Figure 2** shows the expander and the pipe expansion method. The expander is equipped with 12 expanding dies on the outer side of a 12-sided cone, and the dies are spread to the outside in a radial direction by pulling the tapered cone. By inserting this expander into the pipe and pulling the cone, the diameter of the steel pipe is expanded.

Figure 3 is the schematic illustration when the expander is inserted into pipes with different numbers of press stages. If the number of press stages is 11, all of the concave and convex parts are in contact with the dies in the same way. The results of the calculation of the amount of pipe unevenness before and after expansion by the finite element method are shown in **Fig. 4**[2]. There is less unevenness of the pipe after expansion in the case of 11 press stages. Therefore, the pipe shape with 11 press stages of bending is the most suitable shape to produce a circular pipe with expansion.

2.2 Production of Steel Pipes by NEO Press

The NEO press machine that utilizes the high productivity press bending process was installed alongside the U-ing press and O-ing press at JFE Steel's West Japan Works, Fukuyama District. The appearance of the NEO Press is shown in **Fig. 5**. It has a pressing force of 100 MN, and the available steel pipes are those with outer diameters of 20 to 56 inches and a length of 12 m.

Fig. 5 Press for high productivity press bending (NEO press)

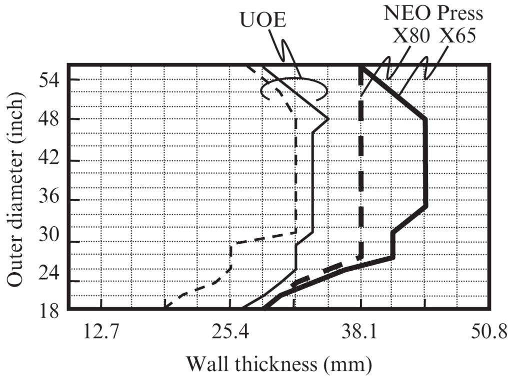

Fig. 6 Available size range of SAWL pipe

Fig. 7 Appearance of pipes made by NEO press

By reducing the number of press stages, the productivity of the press bending method by NEO Press is approximately 3 times higher than that by a conventional press machine, and the productivity is the same as the UOE process. In addition, its pressing force is 1/7 that of the press machine of the UOE method.

The available size range of SAWL (longitudinal submerged arc welding) pipes at JFE Steel is shown in **Fig. 6**. The maximum wall thickness was increased by 1.2 times. Although the available outer diameter was limited to 2-inch stages with UOE pipes, it is now possible to produce steel pipes with any required outer diameter. **Figure 7** shows an example of the pipes produced by the NEO Press. The pipes are without unevenness in the pipe diameter, and dimensional accuracy is equal to that of the UOE pipes.

3. Conclusion

JFE Steel developed a high productivity press bending method and achieved a mass production of high quality, heavy-walled, high strength steel pipes by installing a NEO Press. The pipes produced by this process are used in major projects in the oil industry. JFE Steel will make efforts to further increase the available size range so as to respond to the requirements of customers.

References

1) 13th Shin-Kikai-Shinko-Sho Jushousha Gyouseki Gaiyou. 2016, p. 13.
2) Horie, M.; Tamura, Y.; Miwa, T.; Kiyoto, Y. Proc. 67th Jpn. Jt. Conf. Technol. Plast. 2016, p. 3.

For Further Information, Please Contact(Oct.2021-):

Plate Business Planning Dept., JFE Steel
Phone: (81)3-3597-3183 Fax: (81)3-3597-4567
http://www.jfe-steel.co.jp/en/products/plate/index.html
Email:t-atsuitasec@jfe-steel.co.jp