New Cold End Sizing Process for Ensuring Dimensional Precision on Both Ends of Line Pipes

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ABSTRACT

It is a recent trend that narrow range of tolerance in the inside diameter on both ends of a line pipe is specified by customers. High dimensional precision helps smooth and speedy welding field operation for connecting both ends of adjacent pipes. Mismatch in the inside diameter between adjacent pipes leads to lack of stiffness and strength of the welded portion, and it is highly recommended to ensure high dimensional precision of parent pipes. Because as-hot-rolled line pipes manufactured by the Mannesmann process have eccentricity and the inside surface of pipe is not always round, cold end-sizing operation is sometimes necessary when the dimensional precision of as-hot-rolled line pipes does not fall within the range of specified range of tolerance.

Cold-expansion process has been developed for ensuring dimensional precision of inside geometry on the end portions of line pipe. For expanding the inside diameter of line pipe, a plug insertion method by cold press in the axial direction from the end side was finally adopted. As the nature of end sizing operation, only very small amount of cold plastic strain is applicable by cold expansion, and in order to realize the high dimensional precision of end portion a special geometry of the plug had to be designed. If a single-taper plug is adopted the expanded portion tends to overshoot and the inside diameter of expanded portion is larger than the plug diameter. The new plug design allows smooth contact of the inside surface expanded by the inlet portion of the plug on the bearing portion of the plug and no overshooting phenomenon occurs. One of the simplest designs of this type of plug for practical use is a double-taper plug, and finite element method was carried out in order to determine the practical range of the plug geometry referring to the deep insight on the mechanism of expansion process.