

Looseness-free Nut "YURUMANAITTO"*

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1 Introduction

A large number of bolts and nuts, of all sizes are used in tightening in steelmaking plants, which are operated under a great vibration. As much as approximately 15% of equipment troubles is caused by looseness of bolts and nuts. Many efforts have been made in order to prevent from loosening bolts and nuts. As one of their fruits, a novel type of looseness-free nut, "YURUMANAITTO" has been successfully developed and commercialized. "YURUMANAITTO" possesses superior features, such as excellent workability and sound for looseness prevention.

2 Structure of YURUMANAITTO

YURUMANAITTO comprises a mother nut and an inner nut, as shown in Fig. 1. The appearance of an M20 nut is shown in Photo 1. Structural features of these nuts are as follows: (1) A washer is united the bottom surface of the mother nut in order to prevent from forming face caves; (2) a looseness prevention function is imparted by giving an eccentricity δ to the inner nut; (3) the upper part of the mother nut is caulked to prevent separation of

the inner nut; and (4) the upper part of the inner nut is provided with a small clearance in order to ensure smooth tightening from the mother nut to the inner nut during bolt tightening.

3 Features of YURUMANAITTO

- (1) The reliability of the looseness prevention function is high.
- (2) One-step tightening is possible, offering good workability (prevailing-torque value satisfies the value specified in JIS B1056.)
- (3) The nut can be reused (prevailing-torque value after the nut is used five times satisfies the value specified in JIS B1056.)
- (4) Eight strength classes are adopted as standard (material: S45C-H).
- (5) Because the nut is provided with a washer, no hard washer is required, leading to good workability.
- (6) The looseness prevention effect can be maintained even if the caulked upper position becomes corroded and separates.

4 Nut Sizes and Prevailing-Torque Value

The available size range of YURUMANAITTO and corresponding prevailing-torque values for each nut size are shown in Table 1.

5 Results of Looseness Evaluation Test of YURUMANAITTO

Figure 2 shows the results of a high-frequency vibra-

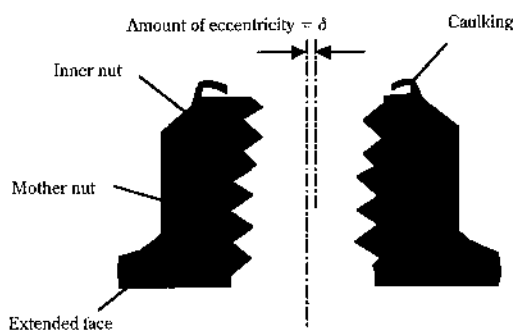


Fig. 1 Section of YURUMANAITTO

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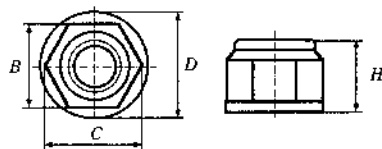
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Photo 1 Appearance of YURUMANAITTO (M20)

Table 1 Nut size and prevailing-torque

Size	H	B	C	D	Weight (g)	Prevailing-torque (N-m)
M12	16	22	25	25	50	10~20
M16	19	27	31	31	100	11~23
M20	22	32	37	37	130	14~28
M24	27	41	47	47	210	17~35
M30	33	50	57	57	430	20~40



Tightening torque = Axial tension torque + Prevailing torque
(Axial tension torque = 40 N-m)

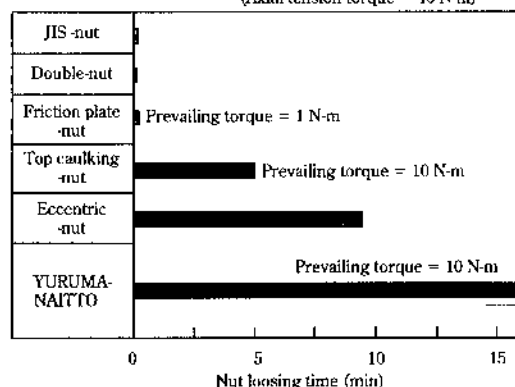


Fig. 2 Results of the nut loosening test

tion test of various types of nuts conducted by the Kansai Testing Center of the Japan Quality Assurance Organization. It is apparent that YURUMANAITTO has a high looseness prevention effect compared with a JIS nut, double nut, others looseness-free nut available in the market. The appearance of the vibration test apparatus used and details of the vibration portion of the apparatus are shown in **Photo 2**, and **Fig. 3**, respectively. The specifications of the vibration test apparatus and the bolt and nut specifications are described below.

5.1 Specifications of Vibration Test Apparatus

- (1) NS-type high-frequency vibration test apparatus
 - (a) Number of vibrations: 1 780 rpm
 - (b) Stroke of vibration table: 11 mm
 - (c) Impact stroke: 19 mm
 - (d) Direction of vibration: vertical (reciprocating vibration)
 - (e) Acceleration: $\alpha = 19.9 \text{ G}$

5.2 Bolt and Nut Specifications Employed

- (a) Bolt size: M12 \times 55 (coarse screw thread, medium class)
- (b) Bolt material: SS440

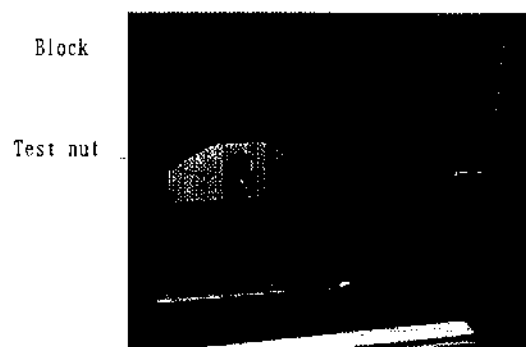


Photo 2 Appearance of vibration test apparatus

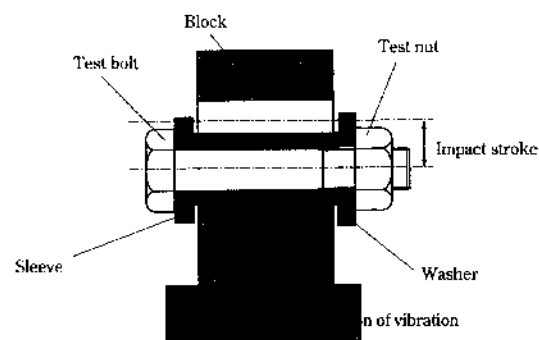


Fig. 3 Details of vibration test apparatus

- (c) Material of nuts of different type: S45C-H
- (d) Nut-tightening torque: Set so that the stress on the effective thread of the bolt is almost equal to the yield point of the material $\times 0.7$.

6 Coated Nuts with Environmental Resistance

A PTFE-coated bolt/nut that is effective against bimetallic corrosion, a dacro-coated nut capable of extending life to two to three times life time of a general electroplated nut, and other types are also available. **Photo 3** to **5** show a chromate-coated nut, a dacro-coated bolt/nut, and a PTFE-coated bolt/nut, respectively.

7 Conclusion

At Kawasaki Steel, the causes of nut looseness were

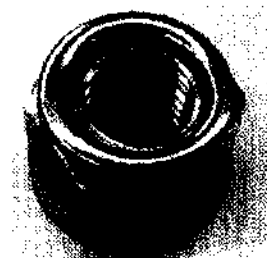


Photo 3 Chromate-coated nut



Photo 4 Dacron-coated bolt and nut



Photo 5 PTFE-coated bolt and nut

analyzed from examples of troubles in bolts and nuts used in steelmaking plants. A new type of looseness-free nut that is remarkably effective in preventing looseness and has good workability, named YURUMANAITTO, was brought to the commercial stage. At present, this type of nuts are used at Mizushima Works, Chiba Works, and Chita Works of Kawasaki Steel and has

reduced trouble ascribed to looseness of bolts and nuts.

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