



# NEW SHACKLE TO LOCK THE BLAST FURNACE TUYERE STOCK<sup>1</sup>

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## Abstract

New design of the shackle to lock the tuyere stock using a bolt to fasten the set. The new shackle plate replaces the cotters used in the old design that needs hammer to fasten the set. ArcelorMittal Tubarão prohibits the use of hammer aims improve worker safety and the quality of work. The new shackle plate is a unique design that brings greater precision tightness and more facility to assembly the tuyere stock. The design is in process to patent registration to ArcelorMittal.

**Key words:** Shackle; Blast furnace; Tuyere stock.

## NOVA ALÇA DE FIXAÇÃO PARA MONTAGEM DO CONJUNTO DE INSUFLAÇÃO DE AR DO ALTO FORNO

## Resumo

Nova alça de fixação para montagem do conjunto de insuflação de ar do Alto-Forno usando parafuso para fixação do conjunto. A nova alça substitui a utilização de cunhas e marreta para fixação do conjunto. O uso de marreta na ArcelorMittal Tubarão é proibido objetivando a segurança e a qualidade do trabalho. A nova alça de fixação é um projeto único que proporciona grande precisão de aperto e maior facilidade de montagem do conjunto de insuflação de ar. O projeto está em processo de registro de patente pela ArcelorMittal.

**Palavras-chave:** Alça; Conjunto de insuflação; Alto-forno.

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## 1 INTRODUCTION

A new design of shackle plate to assembly the tuyere stock using a bolt to fasten the set. The new shackle plate replaces the cotters used in the old design that needs hammer to fasten the set.

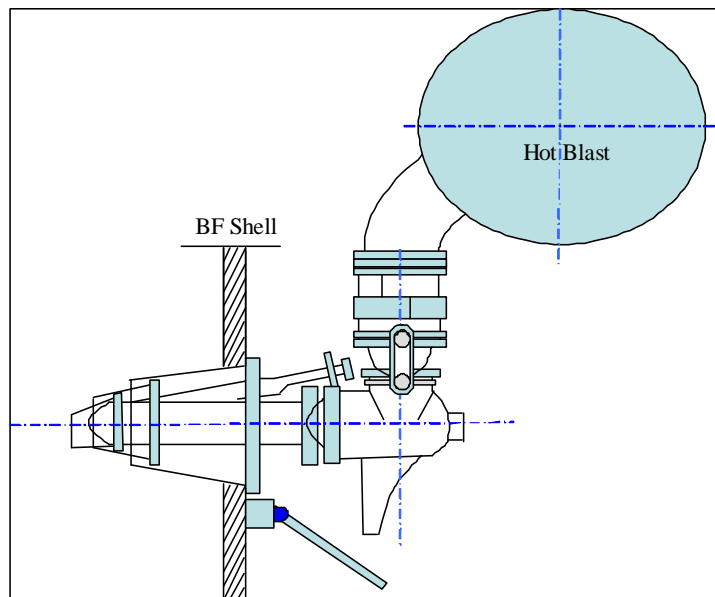


**Figure 1** – Old shackle plate.

The Tuyere Stock is an important device in the Blast Furnace responsible for inject the hot air. The hot air conditional in each 38 tuyere stock is:

- Normal Pressure: 4.2 bar
- Maximum Pressure: 6 bar
- Temperature: 1250°C
- Flow: 6300Nm<sup>3</sup>/min.

The shackle plate must guaranty the seal of the assembly. The smallest leak can cause a major accident.



**Figure 2** – Tuyere stock assembly.

## 2 METHODOLOGIES – NEW SHACKLE PLATE

The new shackle plate was developed to put out the use of hammer to assembly the tuyere stock in blast distribution system in Blast Furnace. ArcelorMittal Tubarão prohibits the use of hammer aims improve worker safety and the quality of work.<sup>(1)</sup>



Figure 3 – New Shackle plate assembly.

The new shackle plate uses a bolt to fasten the tuyere stock. A pneumatic gun bolt is used to tighten the bolt with 850N.m of control torque.<sup>(2)</sup>

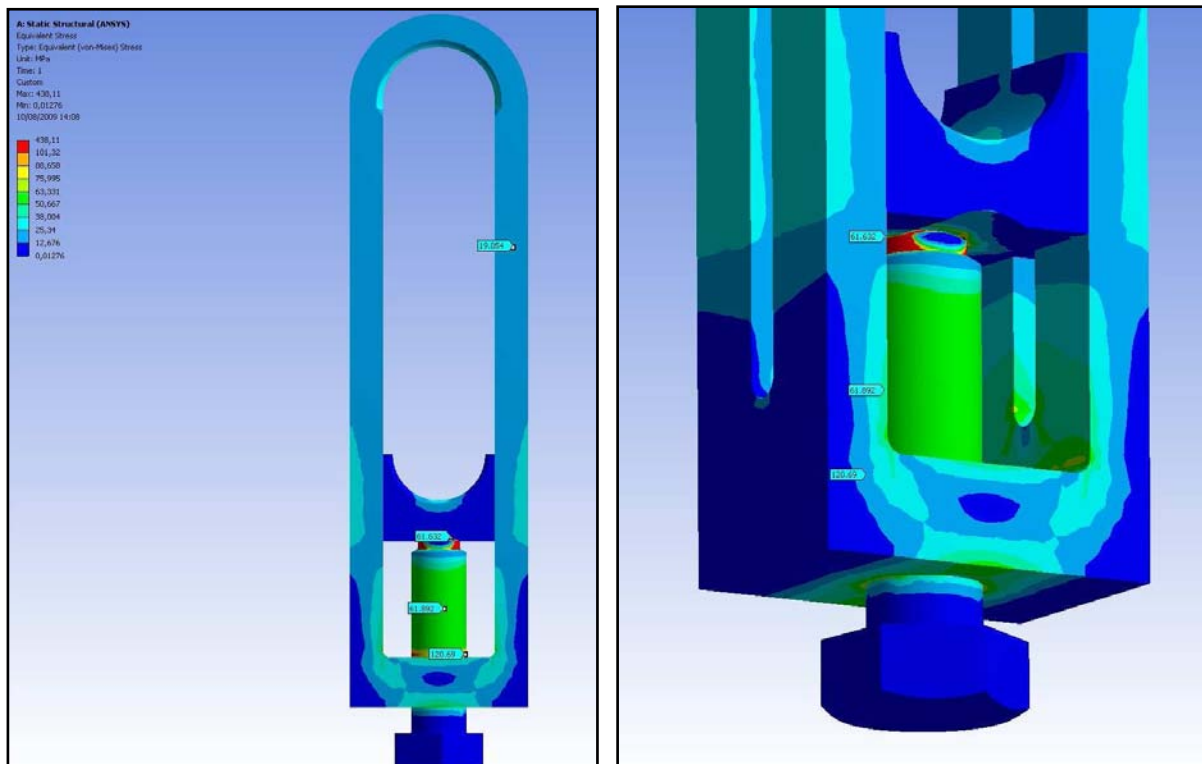


Figure 4 – Stress calculation.

The new shackle plate has being more efficient to avoid leakage and rework to fasten the assembly.

### 3 ADVANTAGES OF NEW SHACKLE PLATE

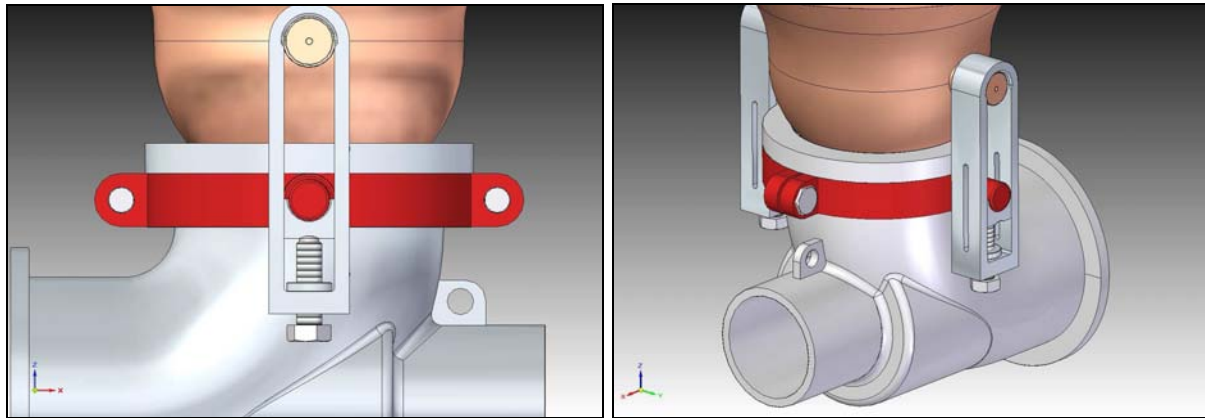


Figure 5 – Basic design.

- a) Eliminated the uses of hammer;
- b) Just 2 workers to assembly the tuyere stock;
- c) Reduction of 15 min to assembly the tuyere stock;
- d) More efficient to avoid leakage;
- e) Does not need rework to fasten the set;
- f) Improves the ergonomics of worker;
- g) Greater precision tightness.

### 4 CONCLUSIONS

ArcelorMittal Tubarão prohibits the use of hammer aims improve worker safety and the quality of work.<sup>(1)</sup> The new shackle plate is a unique design that brings greater precision tightness and more facility to assembly the tuyere stock.<sup>(3)</sup> The design is in process to patent registration to ArcelorMittal.

### Acknowledgments

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### REFERENCES

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