Bolting of High Pressure Urea Equipment

Part 3

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Introduction

This paper is a continuation of Part 1 & Part 2 of the bolting paper.
In Part 1 we have learned that bolting HP Equipment is a delicate process and that many things can go wrong, with large consequences.
In Part 2 background information was given about relaxation and faulty bolt tensioning

In this part we elaborate how to avoid transmission losses when tightening

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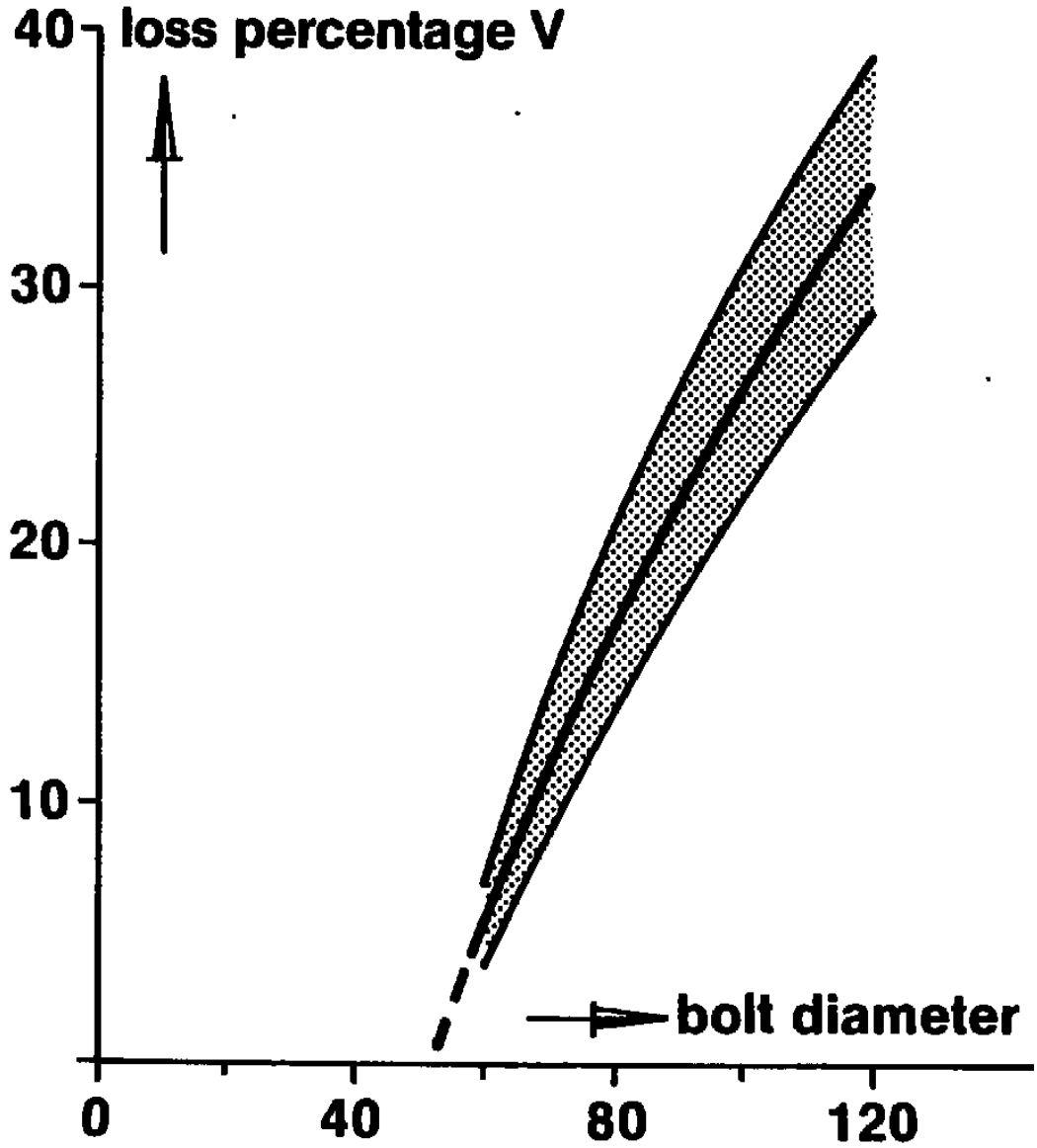
Transmission losses

This diagram shows the transmission losses versus bolt diameter.



It indicates that the theoretically oil pressure of the hydraulic jack should be multiplied by a correction factor:

100/100-V,

where V is the loss percentage.

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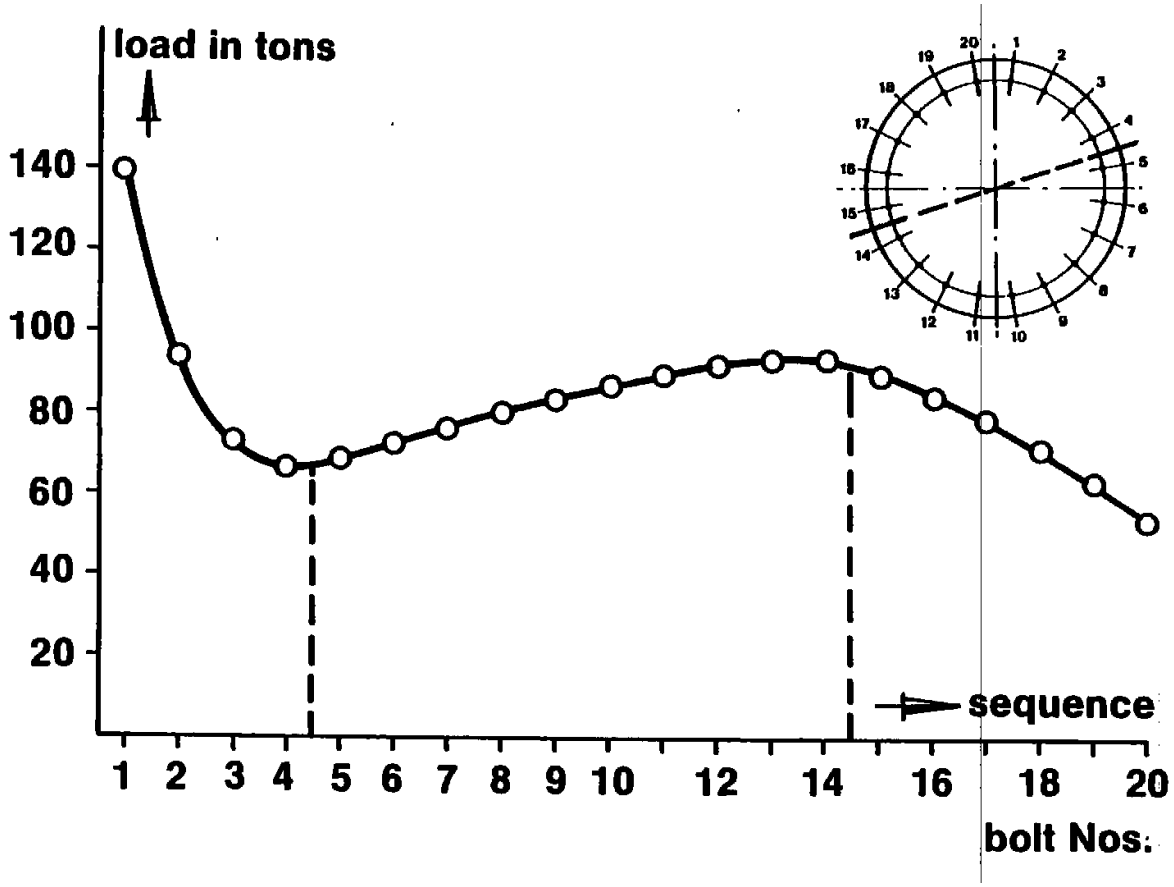
Transmission losses occur due to deformation of components at the flanges.
The load, which remains decreases even more when the adjacent bolts are tightened.

The next figure shows the loss of bolt preload in any one bolt as the other bolts are tensioned one after each other, following in order of bolt numbering.



These transmission losses can be as high as some 40%.
Often these transmission losses are taken into account by the designer. It is strongly advised to inquire if this has been taken into account.

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Extraneous Forces

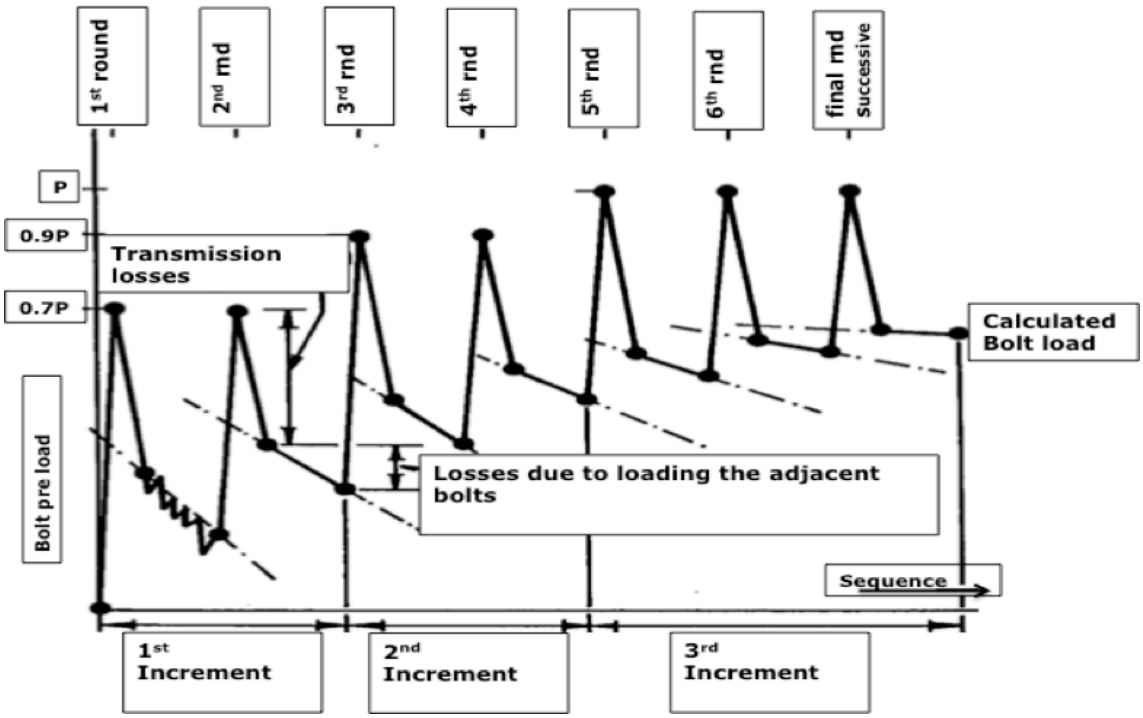
Before the equipment is heated up and the plant is started up, it is very important to provide adequate insulation for the cover but also the bolts should be insulated to avoid large temperature difference between the bolts and the cover.
Large temperature differences here will have an impact on the thermal expansion of the materials and thus the preload.

Tensioning Sequence

When one uses hydraulic bolt tensioning devices, the ideal situation with regard to the uniformity and amount of preload can be achieved if the number of jacks used is at least half the number of bolts present.

If fewer jacks are available and that is normally the case (it is normal to have two or four jacks available), than the bolts should be tightened cross wise. It is also important to tighten the bolts in steps and to optimize the tightening, one should repeat each step at least once.

It is advisable to repeat the final step twice and in the final round tighten successively instead of cross wise. Repetition is very important as one can learn from the figure below.
Do not forget that one should also loose the nuts in increments for similar reasons. It is advisable to loosen in two steps, half the load and then loosen them.



To be continued with Part 4.

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Schoeller-Bleckmann Nitec (SBN) has been active in the fabrication of critical process equipment for ammonia and urea plants for now more than 40 years. In this period, SBN has not only acquired an unmatched level of expertise, but has also been instrumental in the development of materials and fabrication techniques for the various types of equipment geared to support the nitrogen fertilizer industry in its desire for larger capacity and higher efficiency plants coupled with longer plant life time. This has been achieved by closely co-operating with process licensors, engineering contractors, material suppliers and regulatory bodies for the design of pressure vessels and other non-pressure bearing critical components. In addition SBN has developed and implemented new improved fabrication and welding techniques vital for optimum fulfillment of customers' requirements, while focusing on highest possible quality and on-time delivery.

Comprehensive product range

To provide the best possible service to customers, SBN has streamlined its operations and focused on the fabrication of critical equipment for ammonia and urea plants including reactors, heat exchangers etc. designed for high pressures, high temperatures, corrosive process conditions, or a combination of these parameters.

Core competencies

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- International certificates
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