PROBLEM WITH SELECTION OF MACHINING ALLOWANCES OF WELDED CONSTRUCTIONS - SELECTED CASES

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PRESENTATION PLAN

- Introduction
- Rules for minimizing welding distortion
- Cost analysis
- Case study
- Summary
- Bibliography

INTRODUCTION

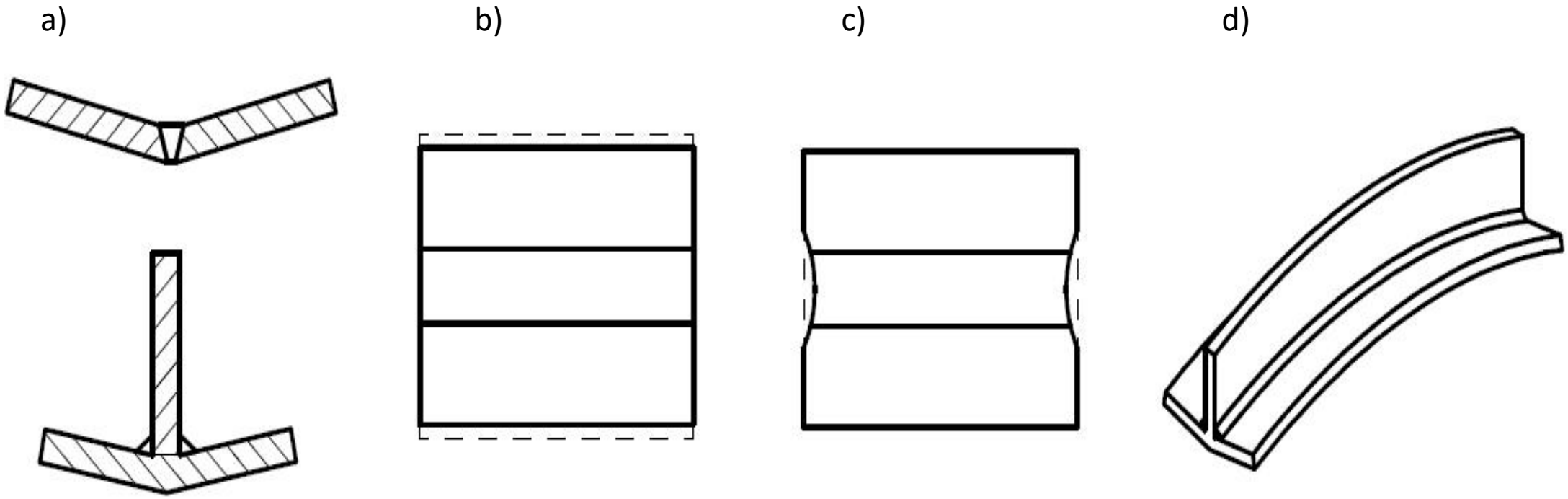

Fig. 1. Types of possible weld distortion: angular distortion (a), transverse shrinkage (b), longitudinal shrinkage (c), longitudinal distortion (d) [Mich2011]

INTRODUCTION

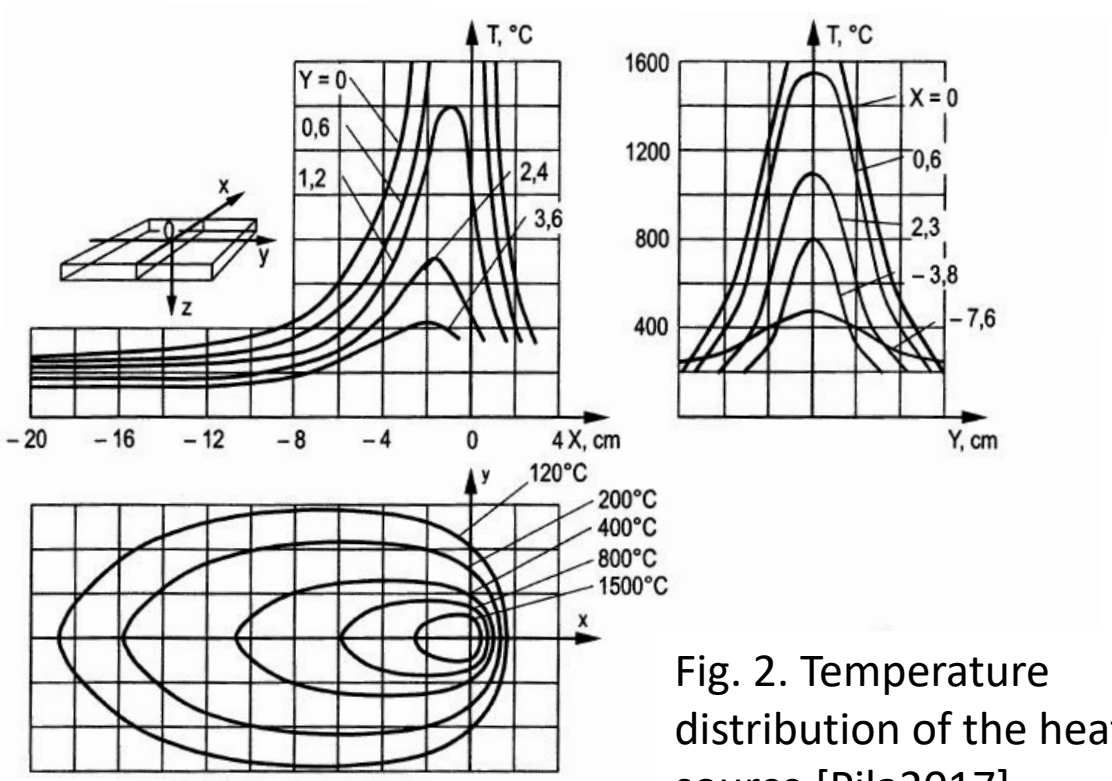

Fig. 2. Temperature distribution of the heat source [Pila2017]

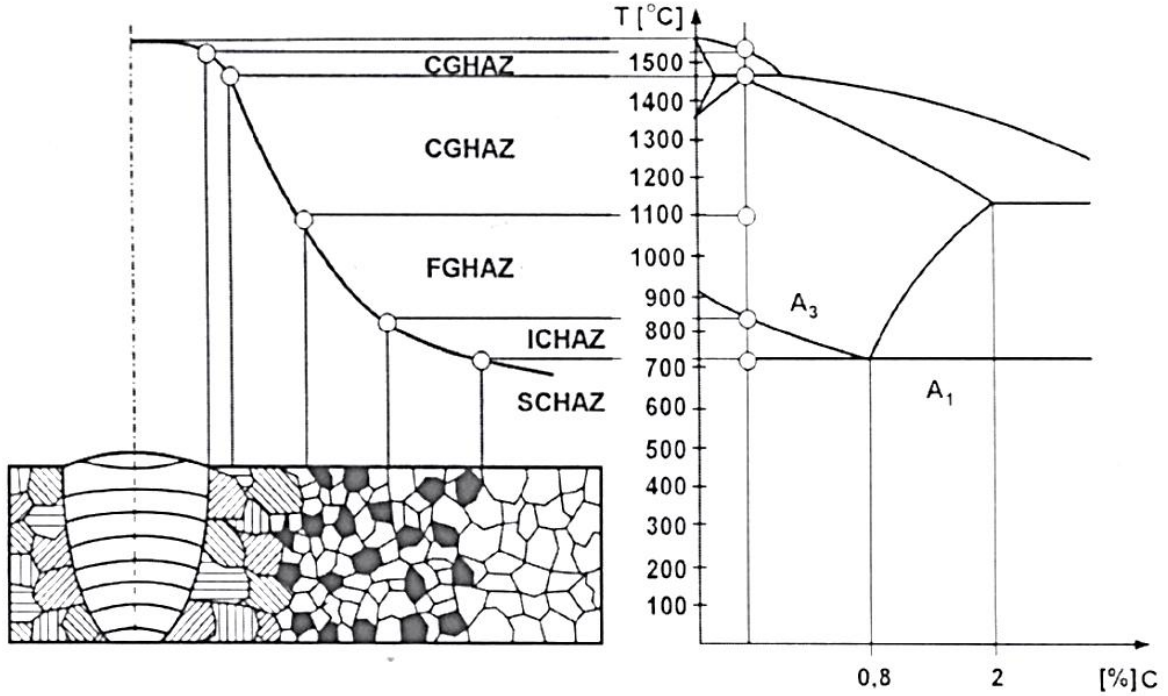

Fig. 3. Distribution of structural areas of HAZ for low alloy steel as a function of temperature, in relation to the iron-carbon phase equilibrium [Ślod2015]

INTRODUCTION

I – II – Elastic deformations
II – III – Plastic deformations
III – Cooling
IV – V – Plastic deformations
V – II’ - Stress on reheating

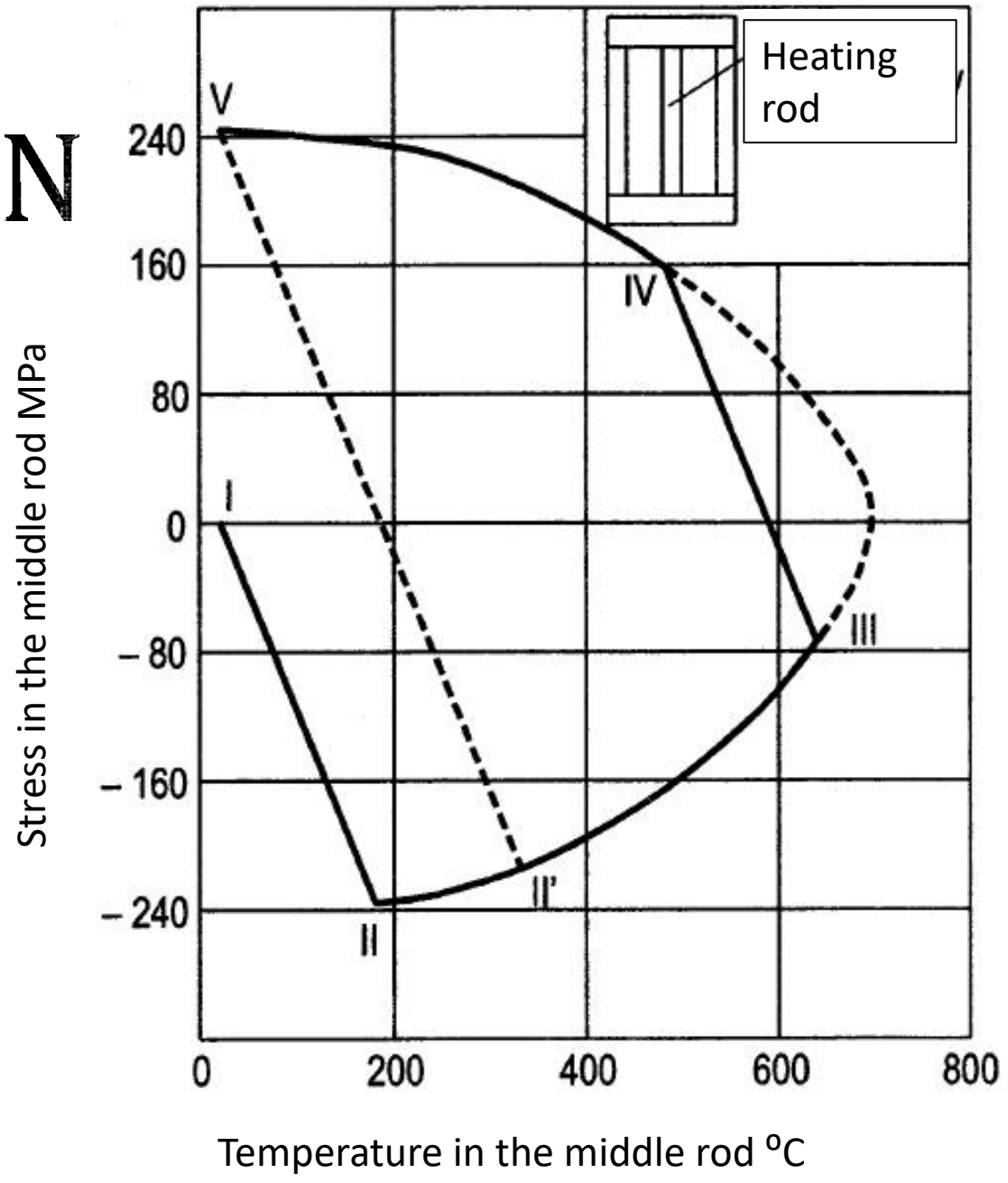

Fig. 4. Stress of the heated rod as a function of temperature [Sęde200]

RULES FOR MINIMIZING WELDING DISTORTION

1. Minimisation of the number of welds.
2. Use of intermittent welds.
3. Use of double-sided welds.
4. Symmetrical arrangement of welds.
5. Avoid crossing of welds.
6. The welds shall be as close as possible to the neutral axis.
7. Use of counter-deformation.
8. Use of specialist clamping tools.

COST ANALYSIS

Chamber faceplate:

- Dimension: 2120x520 mm
- Material: Stainless steel 0H18N9
- Drawing dimension after machining: 25 mm

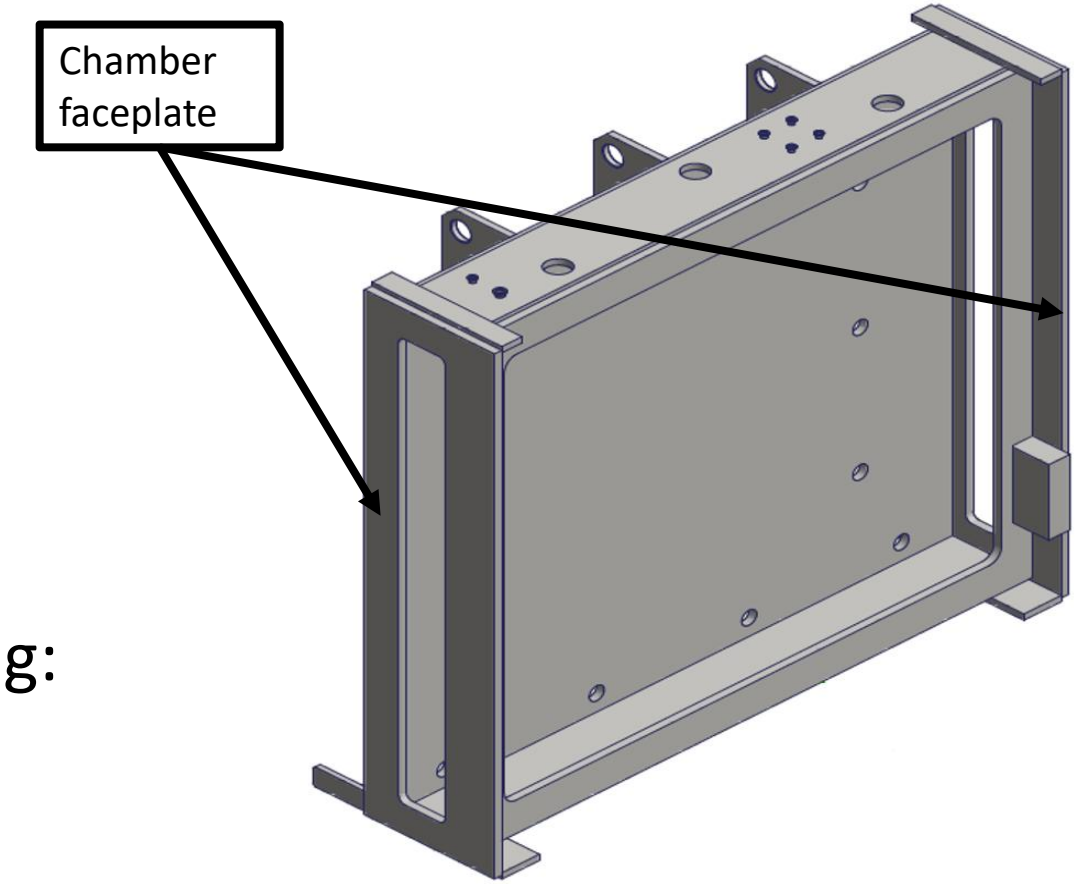

Fig. 5. Computer model of vacuum chamber made of stainless steel 0H18N9

COST ANALYSIS

Tab. 1. Summary of the results of the analysis

Part thickness 30 mm		Part thickness 27 mm	
Cost of material	7938 zł	Cost of material	7144 zł
Cutting costs Water jet/Plasma	2160/582 zł	Cutting costs	1906/464 zł
Summary	10098/8520 zł	Summary	9050/7608 zł
Profit		1048/912 zł	

CASE STUDY

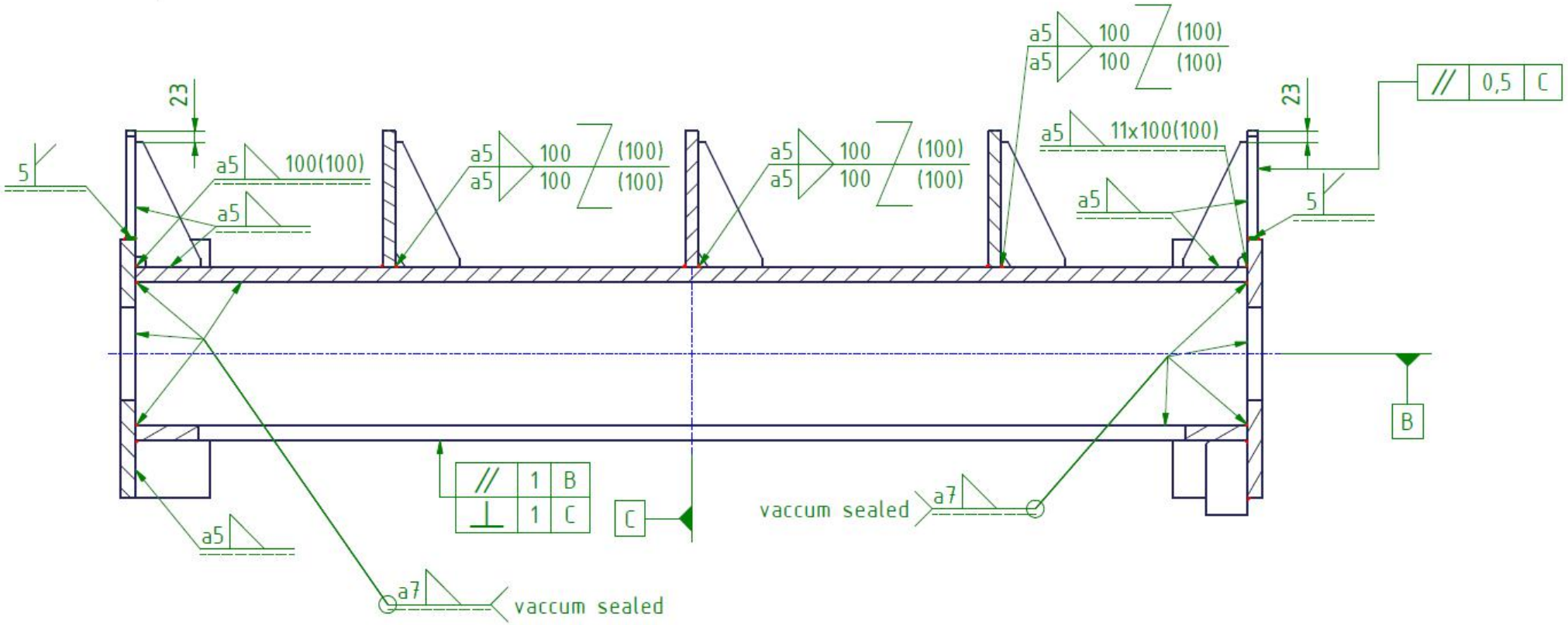

Fig. 6. Drawing of vacuum chamber made of stainless steel 0H18N9

CASE STUDY

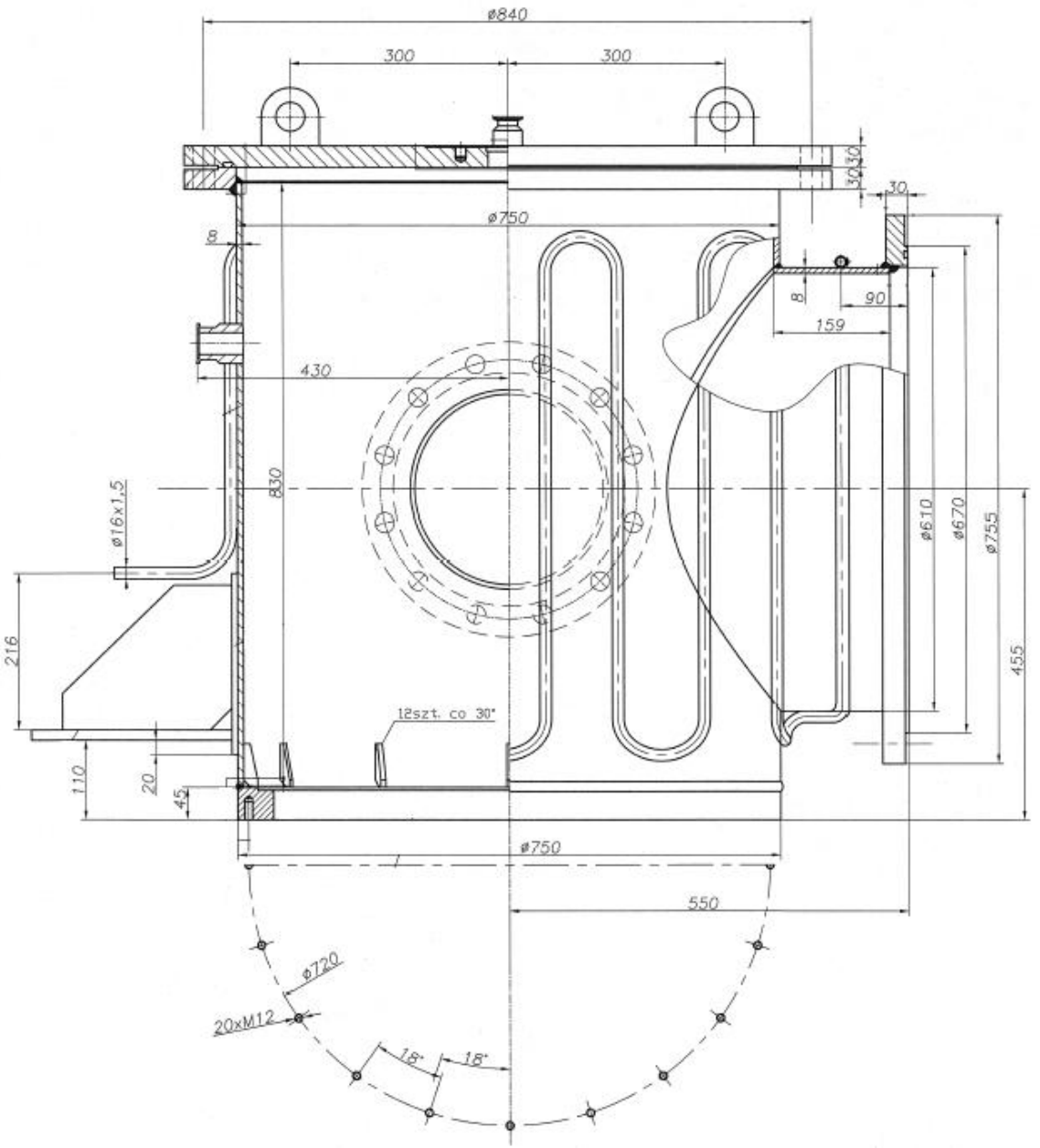

Fig. 7. Drawing of valve made of stainless steel 0H18N9

CASE STUDY

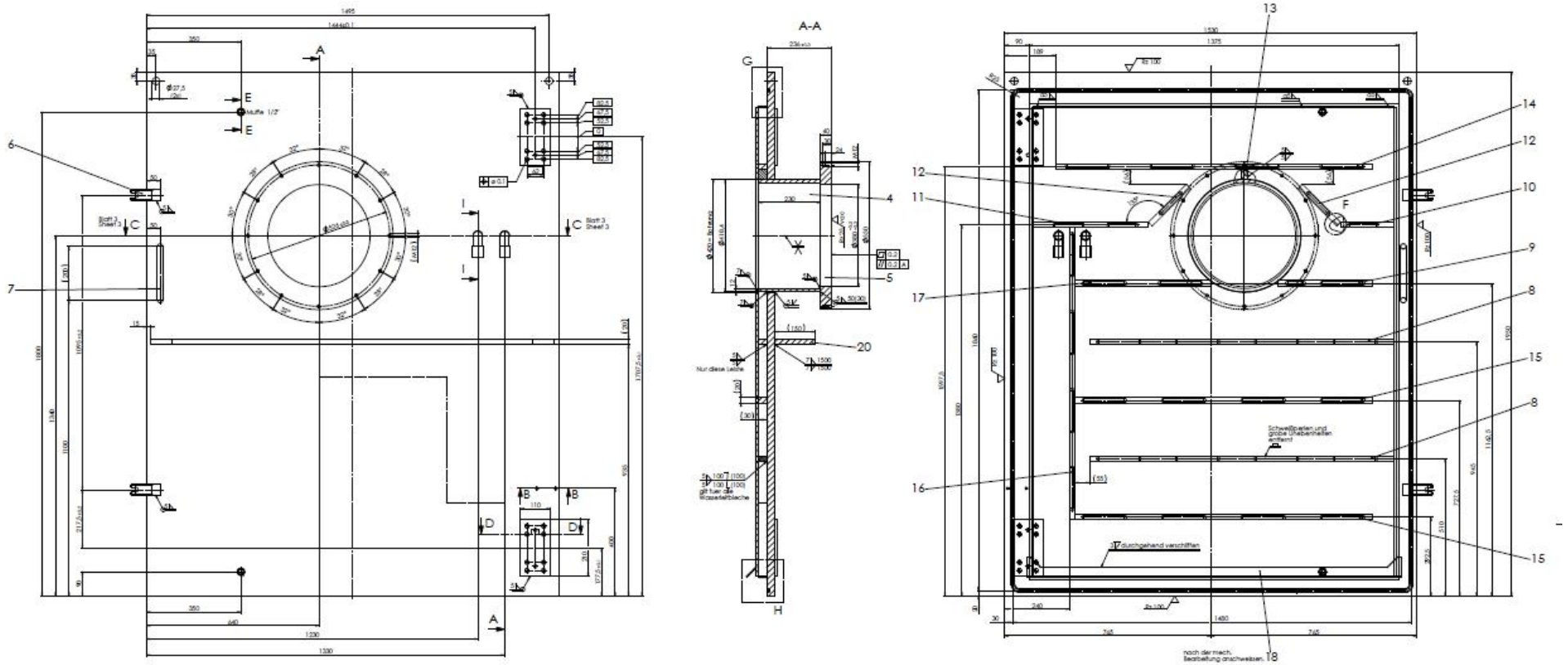

Fig. 8. Drawing of door of vacuum chamber made of carbon steel S355 and stainless steel 0H18N9

SUMMARY

1. The rules for minimising deformation cannot always be applied to a particular case.
2. Literature guidance is not sufficient to correctly predict welding distortion.
3. Predicting the welding distortion will reduce the technological machining allowances.
4. Deformation control will eliminate additional operations i.e. flame straightening.

BIBLIOGRAPHY

- [Pila2017] - J. Pilarczyk, *Poradnik inżyniera. Tom 1. Spawalnictwo, Wydawnictwo Naukowe PWN , 2017.*
- [Ślod2015] - Z. Śloderbach, J. Pająk, *Determination OF ranges OF components of heat affected zone including changes of structure,* Archives of metallurgy and materials, Volume 60, 2015.
- [Mich2011] - P. Michaleris, *Minimization of welding distortion and buckling,* Modelling and Implementation, 2011.
- [Sęde2000] – P. Sędek, *Problemy naprężeń i odkształceń spawalniczych*, Biuro Gamma, 2000.

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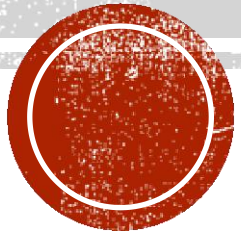

THANK YOU FOR ATTENTION