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### Address of Editorial Board

E.O. Paton Electric Welding Institute, 11 Kazymyr Malevych Str. (former Bozhenko), 03150, Kyiv, Ukraine  
Tel./Fax: (38044) 205 23 90, E-mail: [journal@paton.kiev.ua](mailto:journal@paton.kiev.ua)  
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China-Ukraine Institute of Welding, Guangdong Academy of Sciences  
Address: Room 210, No. 363 Changxing Road, Tianhe, Guangzhou, 510650, China.  
Zhang Yupeng, Tel: +86-20-61086791, E-mail: [patonjournal@gwi.gd.cn](mailto:patonjournal@gwi.gd.cn)

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- Electrometallurgy Today (<https://patonpublishinghouse.com/eng/journals/sem>).

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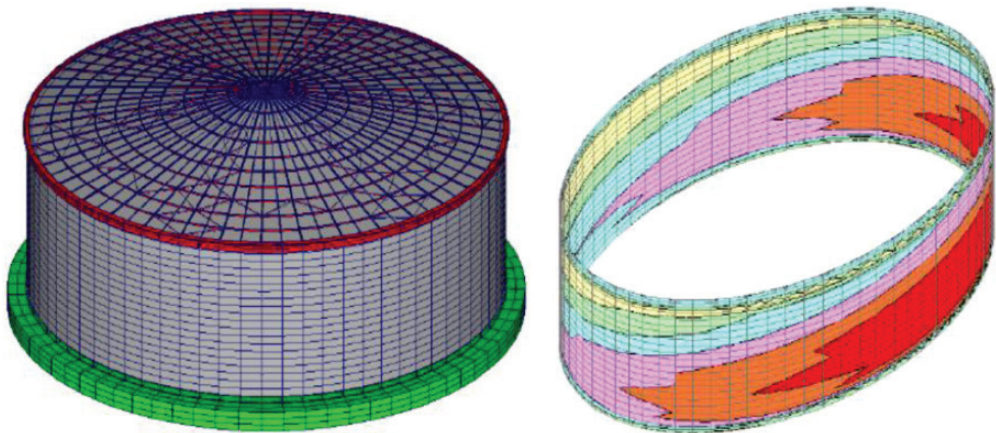
\*Translated Article(s) from «Automatic Welding», No. 8, 2022.  
\*\*Translated Article(s) from «Electrometallurgy Today», No. 3, 2022.  
\*\*\*Translated Article(s) from «Technical Diagnostics & Nondestructive Testing», No. 3, 2022.

# Design and repair of vertical cylindrical above ground welded steel tanks

The E.O. Paton Electric Welding Institute of the NAS of Ukraine has worked for more than 74 years in the field of development of the technology of plant fabrication, erection and improvement of the design of vertical cylindrical steel tanks and renders the following services:

- development of design tanks documentation for storage of all kinds of fluids (crude oil, petroleum products, sunflower oil, sugar syrup, bagasse, etc.) in keeping with the requirements of EN 14015, API 650 standards;

## Development of design documentation



Design of two cylindrical tanks with a conical roof in UBC-97.4 seismic zone, location class *D*, with volume  $V = 10000\text{ m}^3$ ,  $D = 36.6\text{ m}$ ,  $H = 12.0\text{ m}$  in keeping with API-650 requirements



Tank with volume  $V = 50000\text{ m}^3$  ( $D = 60.7\text{ m}$ ,  $H = 18.0\text{ m}$ ), replacement of the bottom and single deck of floating roof



Tank with volume  $V = 10000\text{ m}^3$  ( $D = 34.2\text{ m}$ ,  $H = 12.0\text{ m}$ ) for oil storage after repair



Repair of riveted tank with volume  $V = 5000\text{ m}^3$  built in 1895 year

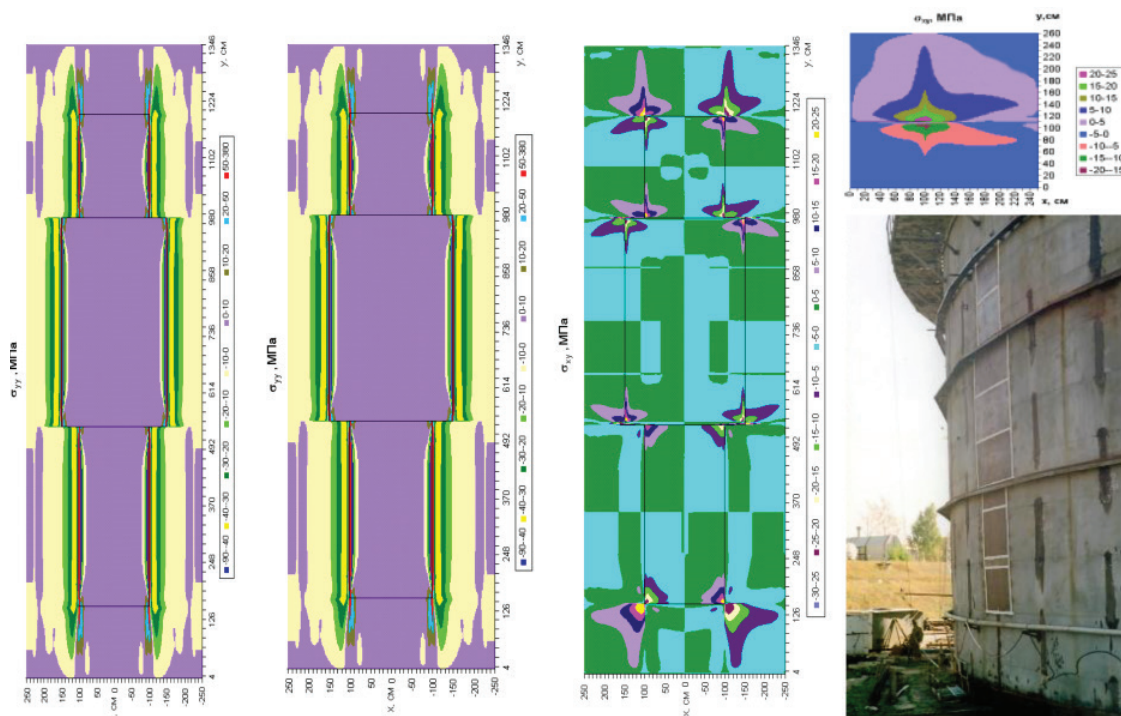




Tank with volume  $V = 50000 \text{ m}^3$  ( $D = 60.7 \text{ m}$ ,  $H = 20.0 \text{ m}$ ) with double shell: erection the double deck steel floating roof

**Calculation of residual stress fields after welding individual sheets in the rigid contour**

During welding-in of individual sheets the cylindrical shell lost its stability. Based on computer calculations a new technology of repair welding taking into account rigid contour at replacement of extended sections of the shell was developed to prevent the loss of its stability.



Tank with floating roof with volume  $V = 50000 \text{ m}^3$ ,  $D = 60.7 \text{ m}$ ,  $H = 18.0 \text{ m}$  for crude oil storage: calculation of residual welding stresses in the presence a rigid contour for the shell at replacement of a section to the entire height of the tank at its repair.

- development of design documentation for tanks repair in keeping with the requirements of API 653 or national standards;
  - determination of the causes for failures and accidents of tanks;
  - welding engineering and supervision on site/fabrication.
- Starting from 1994, inspection of more than 273 tanks from 1000 up to 50000 m<sup>3</sup> volume has

been performed; 66 tanks of 5000 to 50000 m<sup>3</sup> volume have been successfully repaired, based on the results of documentation development and author's supervision. During the last six years PWI experts designed six tanks of 50000 m<sup>3</sup> volume with a double shell, double-bottom and doubledeck floating cover. The Institute has successful experience of tank design in regions with up to 0.4 g seismic activity.

Tank Design, Inspection & Repair  
E-mail: tanksweld@gmail.com  
Phone: +38(067) 502-75 54