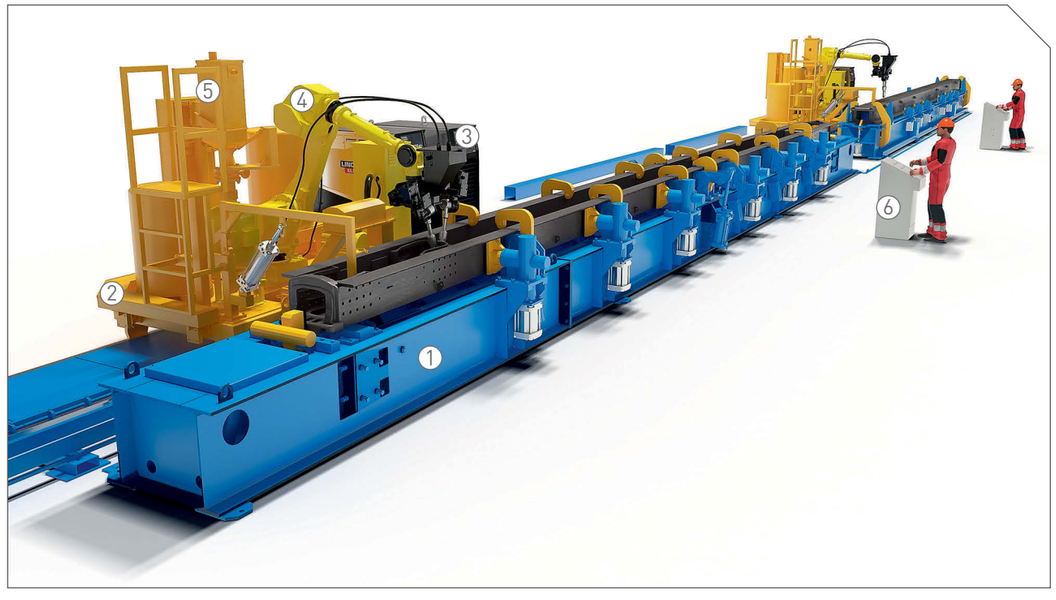
RESEARCH-AND-PRODUCTION ENTERPRISE

# TECHVAGONMASH

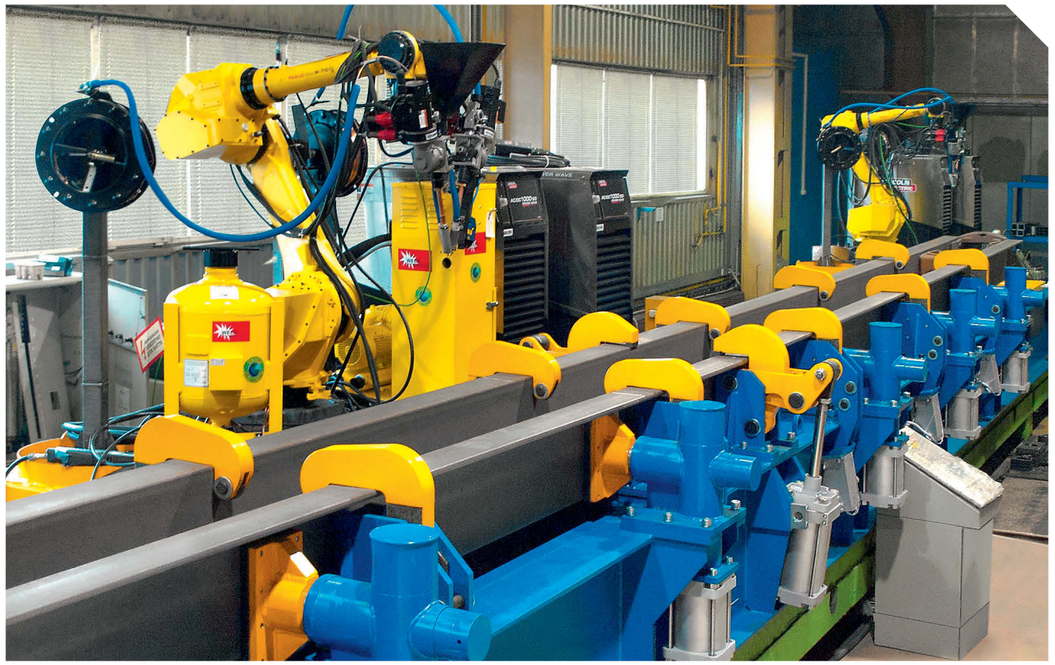

## Automation, robotization of welding production – implementation experience

# ROBOTIC SYSTEM FOR CENTER SILLS WELDING

The equipment is designed and manufactured under Tikhvin Freight Car Building Plant order.
It is a unique , one-of-a-kind system for robotic submerged arc welding of longitudinal seams of all freight car center sill models.
The system allows to perform welding of workpieces in "normal" position as well as in "reverse" position ensuring reverse deflection during welding in order to prevent welding deformations.
Robots application allows to perform fast and flexible changeover to different items. In this case the robot is programmed for welding start and ending, overcoming of obstacles during the process of welding when the item has inner population of reinforcement elements.
One of the equipment peculiarities is the ability to weld on v-shaped gap from 0 to 12 mm by means of META laser welding seam tracking system (UK). The tracking system traces the size of the gap in the butt joint and transfers data to the robot controller.
After analyzing the received information the robot controller gives a command to the power sources and feeding mechanizms to change parameters of welding without interruption of welding process.
Flux recirculation system allows to feed the flux to the welding zone and to collect unused flux and slag crust after welding without operator in automatic mode.




1 – clamping stand
2 – traveling platform
3 – welding equipment Lincoln Power Wave AC/DC 1000 SD
4 – robot Fanuc M-710iC/50
5 – flux recirculation system
6 – control panel



Robotic system for lingitudinal seams welding

Laser seam tracking system META


Lincoln welding equipment

# STAND FOR AUTOMATIC WELDING OF A CENTER SILL WITH I-BEAM

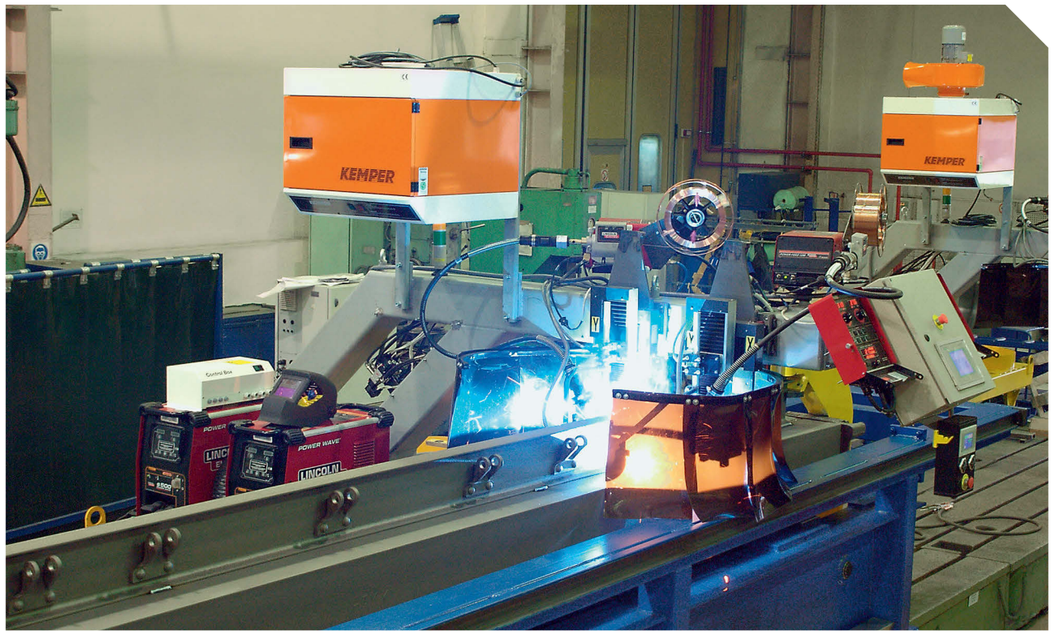
The stand is designed and manufactured under Tikhvin Freight Car Building Plant order.

The stand of automatic welding has original design and technology concepts which do not have analogues in railroad car building. It fully operates in automatic mode on assembly and automatic welding of the workpiece.

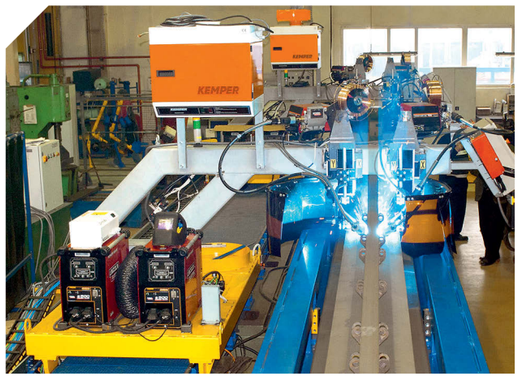
Approved configuration of the stand for automatic welding of center sill to I-beam is typical for all the railroad car building plants, but this stand has distinctive features:

- I-beam centering about a center sill axis and its tack weld are performed in automatic mode;
- the stand for automatic welding of I-beam to center sill is equipped with a tactile tracking system which allows not to involve operator;
- depending on the production program welding can be performed with one or two gantry two-torch plants which allows to vary cycle time from 20 to 40 min.;
- the stand structure provides for devices for beam centering irrespective of rolling tolerance and ensuring reverse deflection during welding in order to compensate welding deformations.


1 – stand
2 – assembly vehicle
3 – reverse deflection device
4 – welding gantry
5 – welding equipment
6 – ventilation equipment
7–




Welding gantry for moving of welding equipment

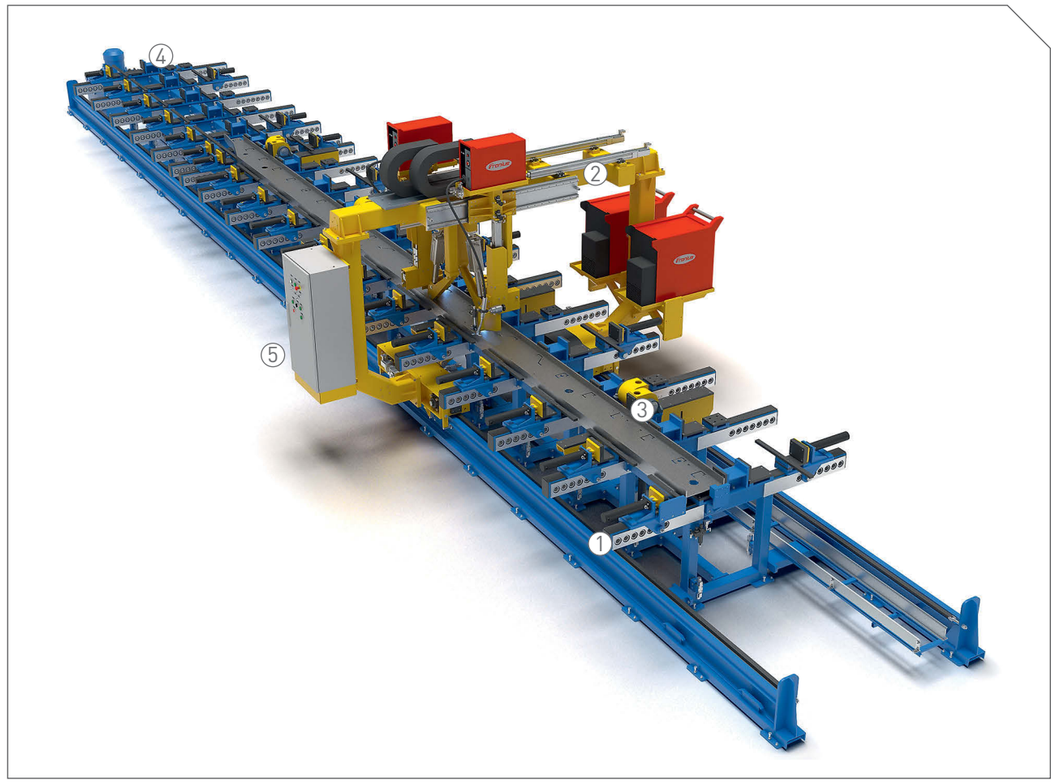



Simultaneous welding with two torches


Assembly vehicle

# MULTIPURPOSE LINE FOR ASSEMBLY AND AUTOMATIC WELDING OF GIRDERS

The line is a multipurpose equipment allowing to manufacture 380 - 700 mm high girders of semitrailers. The first position involves girders assembly and their automatic welding from the front, then the item is turned over $180^0$ with a built-in rotator, and after that welding from the reverse side takes place.
Automatic welding is performed by means of traveling gantry plant. Actuation of the gantry and the torches is performed by means of servodrives which ensures travel and positioning accuracy.
Hydraulic clamps are used to provide necessary clamping force.




1 – stand for girder assembly
2 – welding gantry
3 – rotator
4 – hydraulic unit
5 – control cabinet

Multipurpose line for assembly and automatic welding of girders

Welding gantry

Rotator

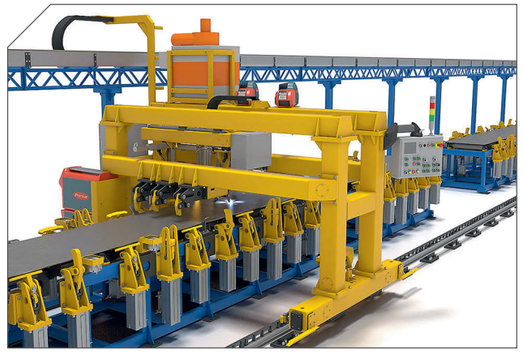
# LINE FOR ASSEMBLY AND WELDING OF ELECTRIC LOCOMOTIVES SIDE-FRAMES

The equipment is manufactured for Novocherkassk Electric Locomotives Plant. This line is multipurpose one - it ensures assembly and welding of side-frames of all produced models of the electric locomotives.

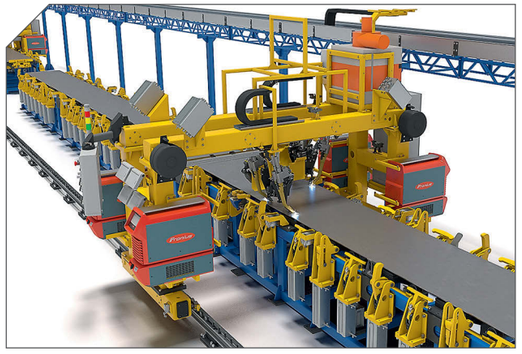
The line involves CMT Twin (Fronius, Austria) welding technique. It allowed to reduce occupied area, increase efficiency, minimize deformations after welding.


1 – stand for assembly and automatic welding of strips
2 – gantry for welding of transverse seams and strips
3 – gantry for automatic tack welding of channel bars
4 – gantry for automatic welding of longitudinal seams
5 – stand for channel bars mounting, side-frames automatic tack welding and welding -


Gantry for welding of strips transverse seams



Gantry for automatic tack welding of channel bars



Gantry for automatic welding of longitudinal seams

# LINE FOR VESSELS ASSEMBLY AND AUTOMATIC WELDING

This center is multipurpose one and it allows to to localize vessel production on a small area. It ensures output of a wide range of vessels with different diameters with a slight realignment on one plant.

The line is equipped with an external clamp which automatically provides sections edges overlapping for welding which significantly decreases assembly labour intensity and ensures quality assembly for automatic welding.

Assembled vessel elements are welded automatically with plants for welding of internal and external seam which are mounted on the welding columns. The parts of the vessel and the entire vessel are moved to assembly and welding positions by means of transportation system controlled from the operator's panel. Welding of a problem closing joint is performed by the welding device (ESAB company) completely in the automatic mode without welder's presence inside the vessel. Welding process tracking is shown on the control panel display.

High level of mechanization and automation allows to guarantee high quality at high efficiency, ensures high production culture.


1 – longitudinal travel roll supports
2 – rotation roll supports
3 – clamp
4 – plants for internal seam welding
5 – plants for external seam welding
6 – mechanized carriage
7 – control panel

Line for assembly nad automatic welding of vessels

Transportation system of the line

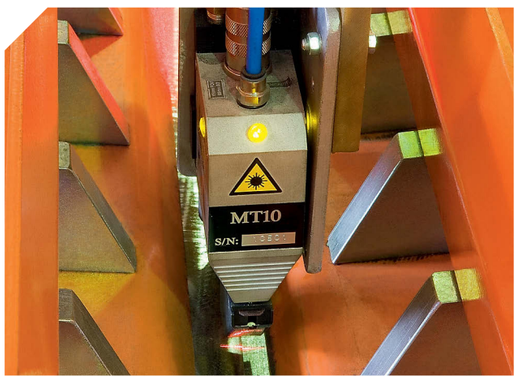
Internal seam welding

# PASSENGER CAR ROOF SHEATHING WELDING

The equipment is manufactured for Tver Railroad Car Building Works. The stand is unique one and does not have analogues.
Welding on this stand is performed in automatic mode without operator's participation, applying laser seam tracking system over the whole length of the workpiece.
The stand is multipurpose and flexible one.

The plant provides for ability to automatically readjust for output of eight types of roof sheathing rapidly
If there is a need then it is possible to add more sheathing models.

Multipurpose stand for assembly and welding of passenger cars roof sheathing



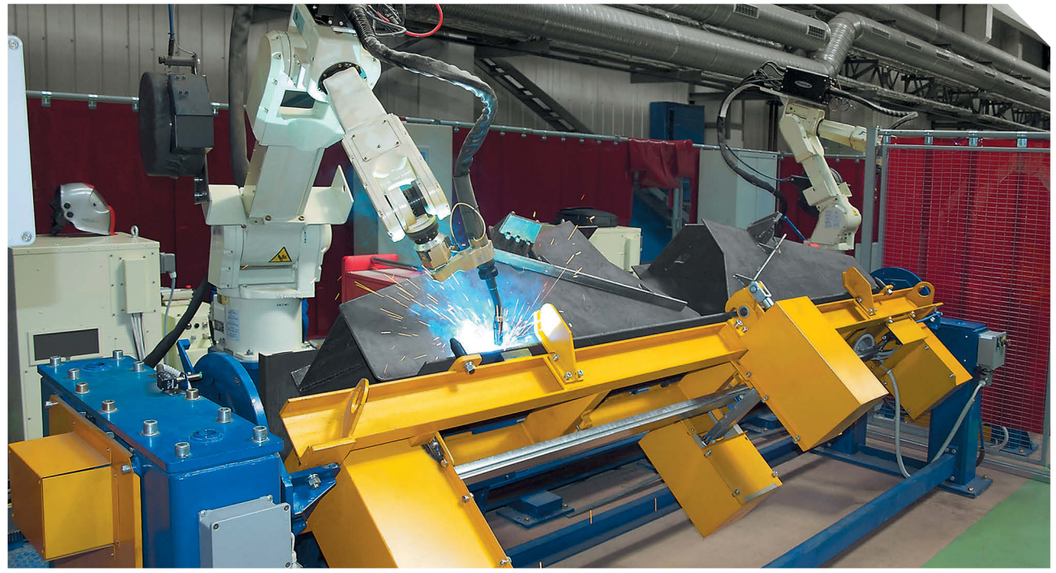

Laser seam tracking system


Clamps and rammers system

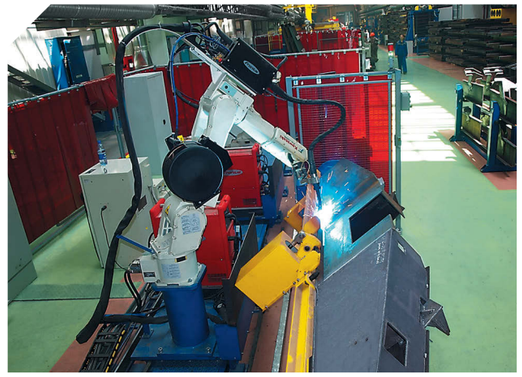




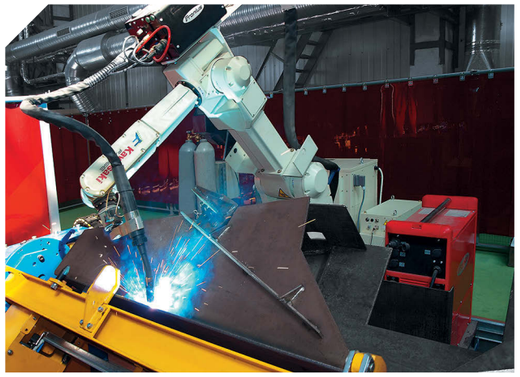
# ROBOTIC CENTER FOR WELDING OF FREIGHT CARS CROSS BEARERS



Robotic center for welding of freight cars cross bearers



Robotic welding of cross bearers



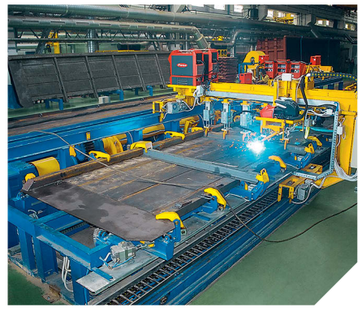
Robotic welding of cross bearers

Robotic welding center is equipped with a system of path correction during welding which allows to make the system less sensitive to welded workpieces grooving shifts. Besides there is no need to perform deseaming as a smooth arc ignition function is integrated into a robot movement dynamic model which considerably reduces spattering during welding startup.
The stand is equipped with a safety system which prevents trespassing of people into working area.

# AUTOMATED CENTER FOR WELDING OF GONDOLA CAR SIDE WALLS

Automated center for welding of gondola car side walls

Built-in book-type rotator



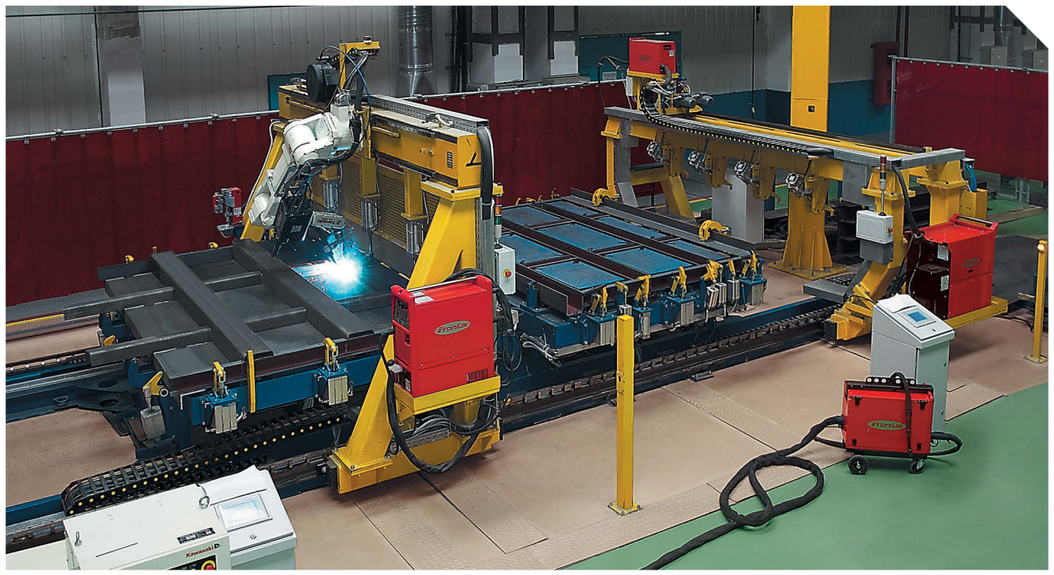
Air clamps system

Automatic welding of items on this equipment is performed simultaneously by means of three welding machines. The side wall is rotated by $180^0$ with a built-in rotator after welding, and after that its automatic welding from the reverse side is performed.



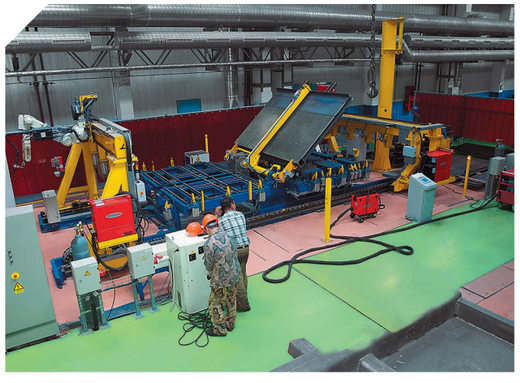
# ROBOTIC CENTER FOR WELDING OF GONDOLA CARS END WALLS

All the operations of clamping and welding of the item are performed automatically, operator just needs to control the welding process and provide loading/unloading of the workpieces. Applying of Festo intellectual pneumatic automation allows to control workpiece assembly accuracy, to inform the worker about deviations, minimizes human factor. After welding from the reverse side the end wall is rotated by $180^0$ with a built-in rotator and laid on the stand for welding in normal position, then it is fixed and welded with a welding robot.



Stand for welding of gondola car end walls

Robotic welding of the end wall posts



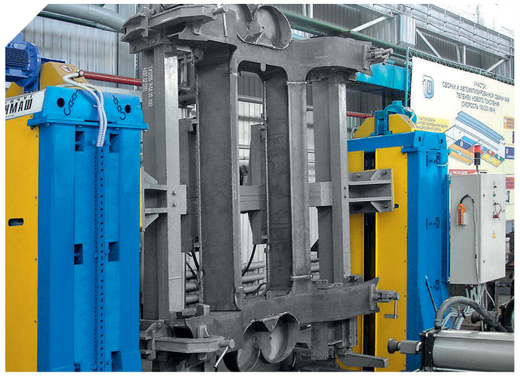
Built-in book-type rotator

# ROTATORS

Model range and rotators' load capacity respectively is comprehensive and can vary from several hundreds of kilos to tens of tons.
The rotators are equipped with light and audio alarms. Control system ensures synchronization of lift, swing and motion drives.

Rotator with lifting supports, load capacity -15 t

Body rotator



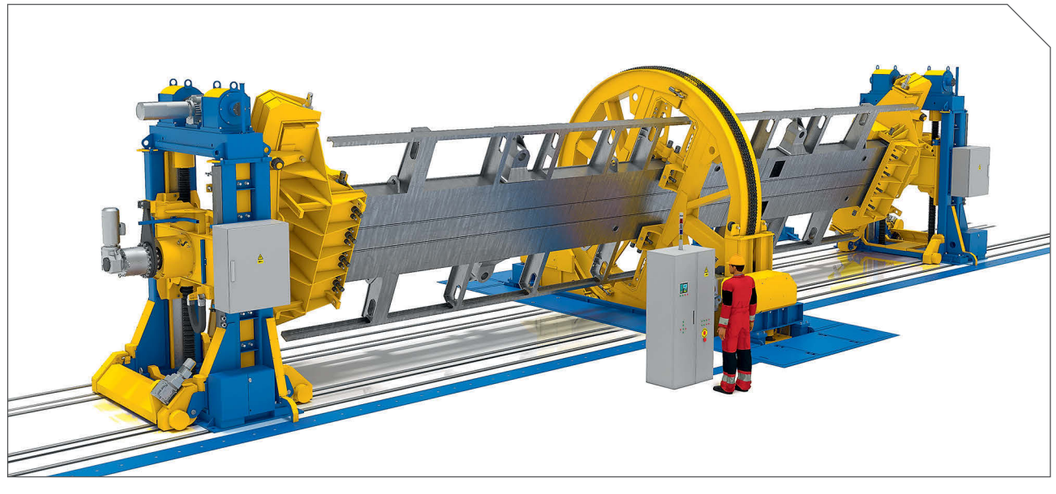
Rotator with lifting supports, load capacity 4 - t

Rotator stand

Chain rotator

Overhead rotator

Rotator for car roof sheathing welding



Rotator with lifting supports, load capacity - 40 t

# ASSEMBLY EQUIPMENT

The company is one of the main manufacturers of assembly equipment for different types of heavy engineering factories products. We offer solutions for one type production as well as multipurpose stands allowing to assemble several product models.

We stick to the following concept of assembly equipment construction in our developments:

- equipment has to be multipurpose one ;
- minimum dependence on human factor has to be ensured;
- equipment must not allow to make defective items (equipment informs operator about a defective part or subassembly);
- equipment has to be highly efficient and flexible.

Equipment is based on the intellectual pneumatic automation. Pneumatic clamps have advantages over mechanical ones: quick action, possibility to control several clamps from one point, different position in space, etc. Especially valuable is the fact that pneumatic clamp has considerable resilience which compensates deformations of welded parts.

Assembly of freight cars intermediate bearers

Assembly of freight cars intermediate bearers

Gondola car body assembly stand

Passenger cars side walls assembly

Multipurpose stand for passenger car underframes assembly

Box car roofs assembly stands

# EQUIPMENT FOR VESSELS MANUFACTURE

Research and production enterprise "Techvagonmash" has a rich long-term experience in production of special process equipment for vessels manufacture. We offer comprehensive solutions in vessel production automatization projects: conveying systems for workpieces and fininshed items transfer, automatic lines for sheet parts welding, assembly equipment for head-to-shell welding, line for vessels automatic welding.

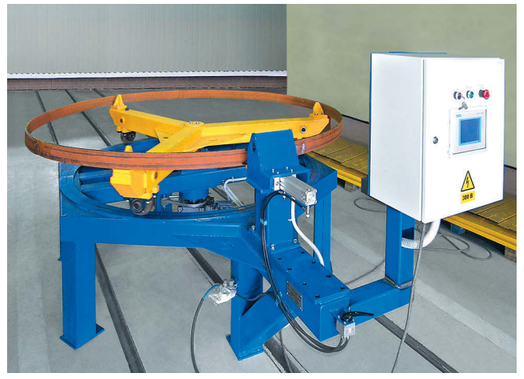
Equipment is designed according to the output production program and customer's production conditions.

Sheets assembly and welding line

Stand for head and shell assembly

Stand for assembly, welding of vessel heads and skirt facing

Vessel assembly and welding line



Stand for heads measurement and selection

Stand for automaic welding of shell with head

# ABOUT ENTERPRISE

Research and production enterprise "Techvagonmash" has a forty-year experience of design and manufacturing of special process equipment for enterprises of transport machine building.

Our company is a legal successor of VNIPTIvagon (All-union scientific research design-technological institute of railway-car building) - head technological organization on design of transport machine building enterprises.

Great experience and technological abilities allow us to implement turnkey projects. Cooperation with our company starts from the development of detail design, manufacturing of nonstandard equipment, supervised installation and commissioning to training of the customer's personnel, elaboration of manufacturing technique of the product sample lot, after-sales service.

As a basis of production establishment we lay down the principles of technology flexibility, ability of fast transfer from one item model to another, minimum influence of human factor, rational use of working area.

ISO 9001:2008 Certified Management System

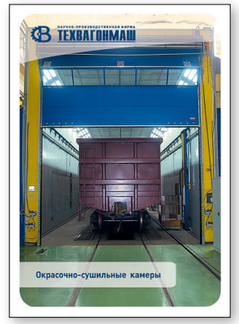
Independent audit, performed by the representatives of TÜV Rheinland (Germany) - a world leader in the sphere of quality management systems certification confirmed the compliance of the Research and Production Enterprise "Techvagonmash" quality management system to the requirements of international standard ISO 9001:2008.



# SPHERES OF OUR ACTIVITY

### SPRAY-AND -DRYING CABINETS

Design and manufacture of spray-and-drying cabinets for painting of rolling stocks, trucks, large-size welded metalworks.




### SHOTBLASTING, SHOT PEENING EQUIPMENT

Equipment for cleaning of sheet and profile metal-roll, pipes, welded metalworks, large-size castings.


### AUTOMATED MACHINING CENTERS

Equipment for efficient coordinate machining of items without preliminary marking and jigs application.
Operations performed: drilling, reaming, core-drilling, thread cutting.


### MECHANIZED STORAGE SYSTEMS FOR METAL-ROLL

Mechanized storage systems for metal-roll is an up-to-date storage solution for storing of wide range of metal-roll, its control and identification.


RESEARCH-AND-PRODUCTION ENTERPRISE
**TECHVAGONMASH**

39627 Ukraine, Poltava Region,
Kremenchug, Poltavsky Pr. 2D,

Tel.: +38 (0536) 70-17-23, 77-69-98;
Fax: +38 (0536) 77-34-87
E-mail: market@tvagonm.com.ua
Web: www.tvagonm.com.ua