



STRAIGHT GRATE INDURATION MACHINES



The “Uralmashplant” JSC, is a key equipment supplier for basic industry sectors: mining, metallurgical, and oil-and-gas industries.

In 2013 the “Uralmashplant” marked its 80s anniversary.

The main shareholder of the “Uralmashplant” is the “Gazprombank” JSC, one of the three largest Russian banks.

Today, the “Uralmashplant” JSC is a company providing the state-of-the-art engineering, welding, metal-working, mechanical assembly, and tool production works.

Main product assortment includes:

■ Mining equipment

- walking and track-type draglines,
- track-type open-mine excavators,
- cone and jaw crushers for all crushing stages,
- ball and rod grinding mills, semiautogenous and autogenous grinding mills,
- concrete-production equipment.



■ Metallurgical equipment

- sintering equipment,
- indurating equipment,
- blast furnace equipment,
- continuous casting machines,
- rolling equipment,
- press-forging equipment,
- rolling mill rolls

■ Oil-and-gas drilling equipment

- complete movable, stationary, and cluster drilling rigs with loading capacity from 160 to 600 tons,
- drilling equipment packages.

■ Handling equipment

- heavy cranes for metallurgical works,
- handling equipment for nuclear plants,
- general purpose special and bridge cranes.

■ Power equipment and nonstandard equipment

- hydraulic turbine units,
- transfer and homogenizing equipment units.



A company development strategy is aimed at creating a world-class machine-building company able to fully fulfill customers' needs for modern equipment.

STRAIGHT GRATE INDURATION MACHINES

History

Uralmashplant has begun to manufacture the pelletizing equipment since 1964, when the first domestic straight grate induration machine OK-2-108 was put in service at Sokolovsko-Sorbaisky ore mining and processing enterprise. In seven years, already 12 such machines were in operation at Sokolovsko-Sorbaisky ore mining and processing enterprise. All these machines were manufactured by Uralmashplant.

Uralmashplant supplied straight grate induration machines to many ore mining and processing enterprises of the USSR, including Lebedinsky GOK, Kachkanarsky GOK, Kostomukhsky GOK, Mikhailovsky GOK, Northern GOK, Central GOK and Pechenganikel works.

To eighties, 80% iron-ore pellets in the USSR were produced at the equipment issued by Uralmashplant.

In all, for the period from 1964, Uralmashplant built about 50 straight grate induration machines of conveyor type for the ore mining and processing enterprises of Russia, Ukraine and Kazakhstan at which 90% iron-ore pellets in these countries were produced. These machines allow heat treatment of pellets from iron-ore and chromic concentrates, phosphorous ores to be carried out, oil shale and ash residues of the electric power stations to be processed and cement clinker to be produced.

At present time, Uralmashplant is the single in Russia designer and supplier of the induration machines of conveyor type with the working area of 108 – 700m² and completing equipment to them.

Today, the equipment of Uralmashplant for production of iron-ore pellets for blast furnaces or subsequent metal deposition competes, successfully, with the products of the leading world manufacturers.



Specifications of straight grate induration machines of conveyor type

| Type of straight grate induration machine | OK-108 | OK-306 | OK-315Л | OK-324/336 | OK-520 | OK-520/536 |
|---|-----------------|----------------|---------------|----------------|----------------|----------------|
| Capacity, t/h | 90...110 | 280 | 304 | 259.2 | 391 | 360 |
| Working width/length, m | 2/54 | 3/102 | 3/105 | 4/84 | 4/130 | 4/134 |
| Working area, m ² | 108 | 306 | 315 | 336 | 520 | 536 |
| Pellet layer height, mm | 320 | 450 | 480 | 500 | 400 | 400 |
| Number of gas-air chambers, pc | 27 | 34 | 35 | 27 | 32.5 | 33 |
| Dimension of gas-air chamber, m×m | 2x2 | 3x3 | 3x3 | 4x3 | 4x4 | 4x4 |
| Number of pallets, pc | 136 | 189 | 171 | 142 | 204 | 210 |
| Pallet size, m×m | 2x1 | 3x1.35 | 3x1.5 | 4x1.5 | 4x1.5 | 4x1.5 |
| Weight of pallet, t | 3.225 | 6.8 | 8.21 | 9.48 | 9.05 | 10.5 |
| Pallet speed, m/min | 0.5...3.0 | 0.63...3.8 | 1.5...3.5 | 0.72...2.5 | 1.8...5.6 | 1.8...3.12 |
| Fuel heat rate, MJ/t (thd Cal/t) | 1260 (301.0) | 502 (120.0) | 200 (47.6) | 648 (155.0) | 540 (129.0) | 586 (140.0) |
| Maximum temperature above pellet layer in roasting zone | 1350 | 1350 | 1280 | 1300 | 1300 | 1350 |
| Maximum temperature in gas-air chamber of recuperation zone, °C | 550 | 550 | 550 | 550 | 550 | 600 |
| Pellet temperature at outlet from machine, °C | 300 | 150 | 120 | 130 | 130 | 130 |
| Machine drive motor power, kW | 20 | 47 | 22 | 22 | 32x2 | 32x2 |
| Weight of machine | 1230 | 3500 | 2950 | 2610 | 4064 | 4580 |



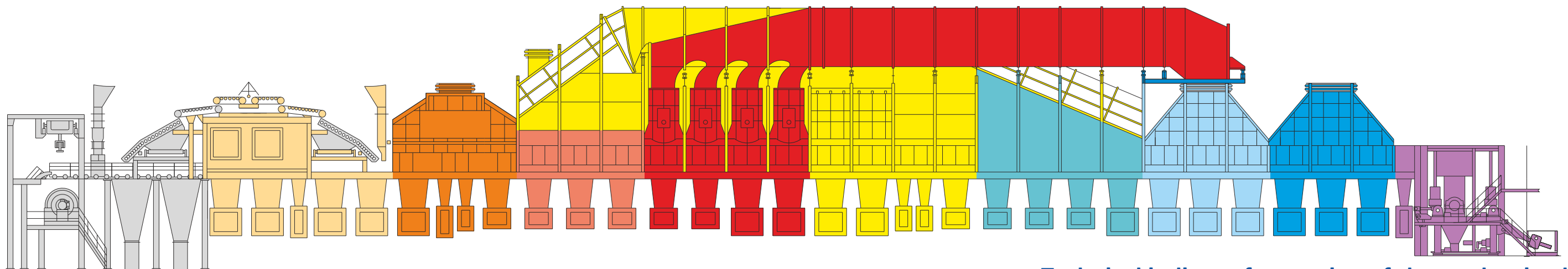
Use of straight grate induration machine of conveyor type

- production of pellets of iron-ore and nickel concentrates, chromic ore, phosphate rock
- production of cement clinker
- non-waste oil shale process
- any processes connected with roasting

Offers from Uralmashplant

- complete supply of the straight grate induration machines of new generation of any area and capacity
- reconstruction of operating balling plants
 - using of modern processes
 - economical gas flow circuits
 - maximum use of the existing production buildings, foundations, service lines
- supply of separate units of roasting equipment and spare parts





Advantages of straight grate induration machines of new generation

- optimal process, developed proceeding from the physical-and-chemical and mineralogical properties of source burden materials, mechanism of the processes in heat treatment of pellets, requirements to quality and metallurgical properties of ready-made product;
- economical heat circuit and parameters of gas-air flows in the machine which are optimal for the specified process;
- designs of furnaces, headers and gas pipelines of the machine, securing the specified heat-engineering parameters and indices of the heat circuit.

First, such approach was used in the process of updating the operating induration machines at Lebedinsky ore mining and processing enterprise in 1998-2001. Implementation of two stages of updating increased the machine capacity by 25% and reduced consumption of natural gas by 32%.

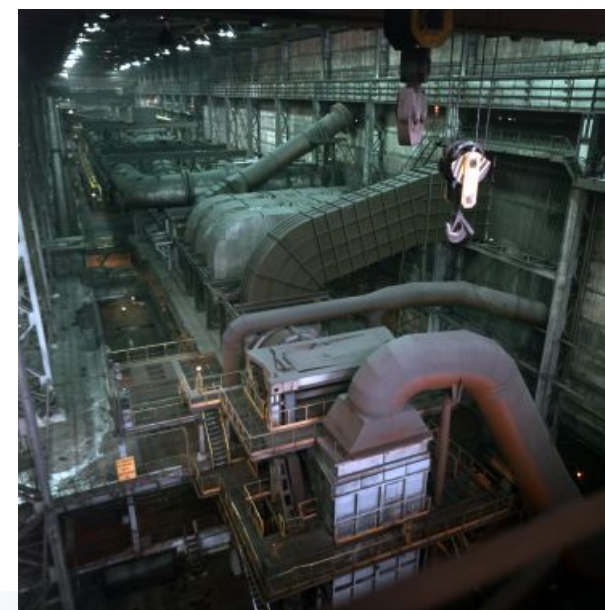
Uralmashplant cooperates closely with TOREKS Scientific and Production Promotional Enterprise Ltd. (NPVP TOREKS) created in 1990 by the leading specialists of VNIIMT and PTP URALENERGOCHERMET who design heat circuits for the straight grate induration machines of Uralmashplant.

These decisions have been used in the process of modernization of the straight grate induration machines at Mikhailovsky GOK. Affordability of the first stage of modernization (2004-2005) at the Mikhailovsky ore mining and processing enterprise made up 1.5 milliard rubles per year.

When comparing the indices (equipment usage factor, specific capacity, heat rate, natural gas rate and electric power rate per a ton of pellets) of operation of the modernized machines at Mikhailovsky GOK with the similar indices of the Lurgi's machines, superiority of the equipment issued by Uralmashplant over the foreign analogs is evident.

Technical indices of operation of the modernized machine No.1 at Mikhailovsky GOK in production of pellets of magnetite concentrate

| Serial No | Indices | Before updating 2002 | Stage I of updating (2005 r.) | | Stage II of updating (2007 r.) | | Indices of Lurgi's machines, 2005 | |
|-----------|---|----------------------|-------------------------------|-------|--------------------------------|-------|-----------------------------------|------|
| | | | Value | ±% | Value | ±% | Average | Max |
| 1 | Equipment usage factor | 0.775 | 0.846 | +9.0 | 0.932 | +20.2 | 0.90 | 0.91 |
| 2 | Specific capacity, t/(m ² /h) | 0.92 | 1.13 | +23.0 | 1.21 | +31.2 | 1.10 | 1.19 |
| 3 | Daily specific capacity, t/(m ² /h) | 22.1 | 27.2 | +23.0 | 29.0 | +31.2 | 26.4 | 28.5 |
| 4 | Heat rate, MJ/t | 585 | 405 | -30.8 | 335 | -42.1 | 390 | 350 |
| 5 | Natural gas rate, Nm ³ /t of pellets | 16.4 | 11.4 | -30.4 | 9.5 | -42.1 | 11.0 | 9.8 |
| 6 | Power rate, kWh/t | 33.1 | 30.2 | -8.8 | 28.5 | -14.0 | 26.5 | 24.5 |



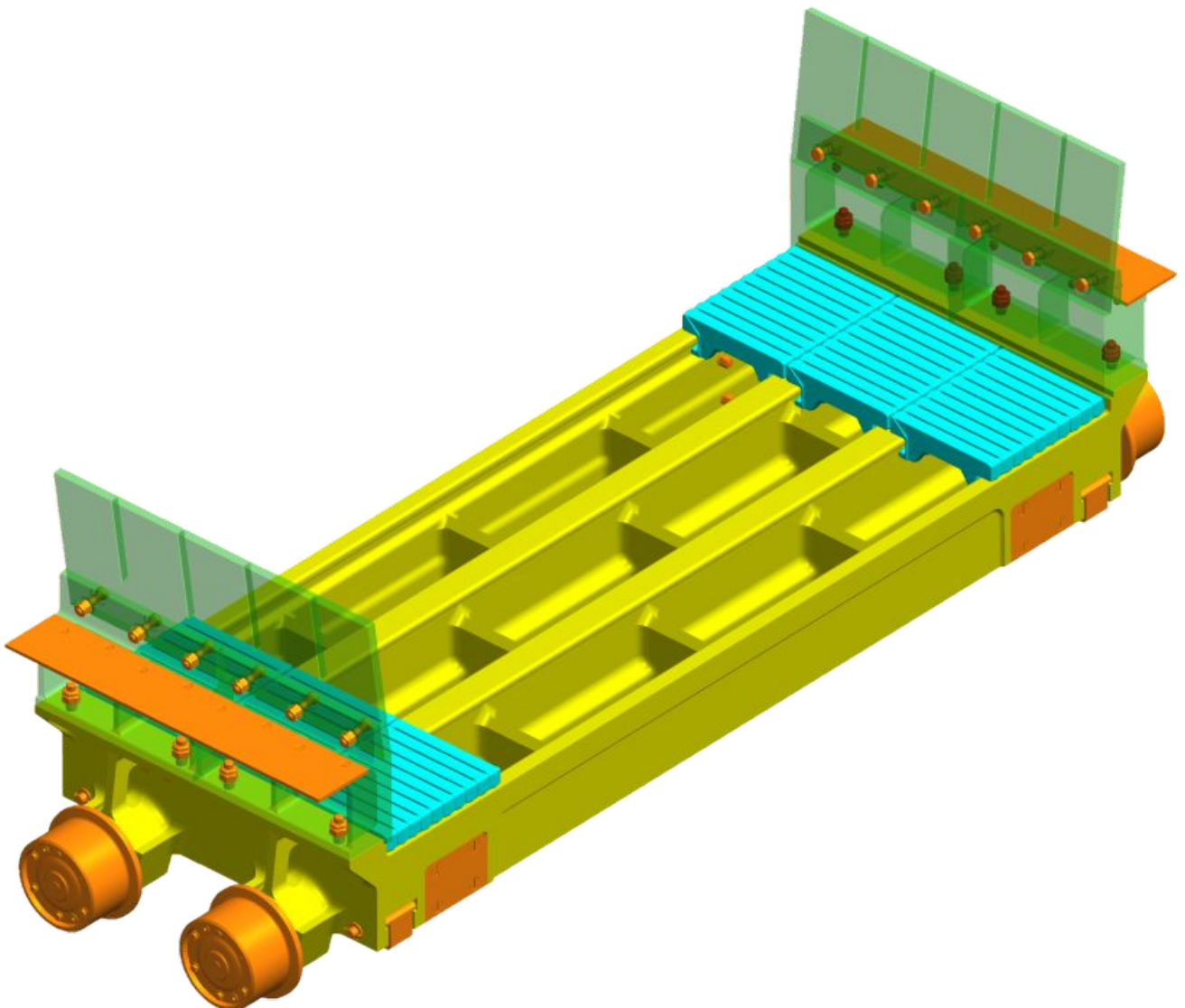
Main technical decisions

- efficient gas-air flow circuit – maximum use of the process gases by means of their circulation over the process zones
- double-layer charging of green pellets in the straight grate induration machine with their subsequent drying in layers – increase pellet quality
- direct run of high-temperature coolant from cooling zones to roasting zones – reduction of electric power consumption
- application of injector torches:
 - a possibility of using oxidizing agent for hot air combustion
 - reduction of fuel consumption
- sealing of increased tightness – reduction of electric power consumption
- drawing of gases via sealing of wind boxes for aspiration of gases blown out through the sealing of delivery chamber – reduction of electric power consumption for aspiration
- economical and efficient electric drives:
 - a possibility of meeting all process requirements
 - high level of electric drive diagnostics and, hence, reduction to the minimum of number and duration of shutdowns
- modern automation system
 - service of high level
 - easy control
 - a possibility of optimization of the process efficiency with the help of the mathematical models



Design

- a system of pallet condition diagnostics and protection of the equipment in emergency situations
- the pallet component material – heat-resistant steel and alloys
- the grate bars are equipped in its head part with flanges and dents to exclude skewing of the grate bars in the grate
- symmetrical, tilting grate bar frame of pallet simplifies repair
- the propel mechanism of pallet runs on rolling anti-friction bearings
- unloading device with load hold-down – decrease of pellet spill in discharging
- pallet replacement device is equipped with automatic grippers to exclude manual labor and reduce number of shutdowns



Complete delivery set

- straight grate induration machine with high-performance devices for pellet unloading and quick pallet replacement
- drum, rotary, two-shaft and vortex mixers for burden mixing
- drum and bowl type pelletizers to produce green pellets
- roller-type, three-product screens for sorting of green pellets after balling complete with crusher for crushing coarse pellets
- fired pellet screens
- a possibility of delivery set expansion

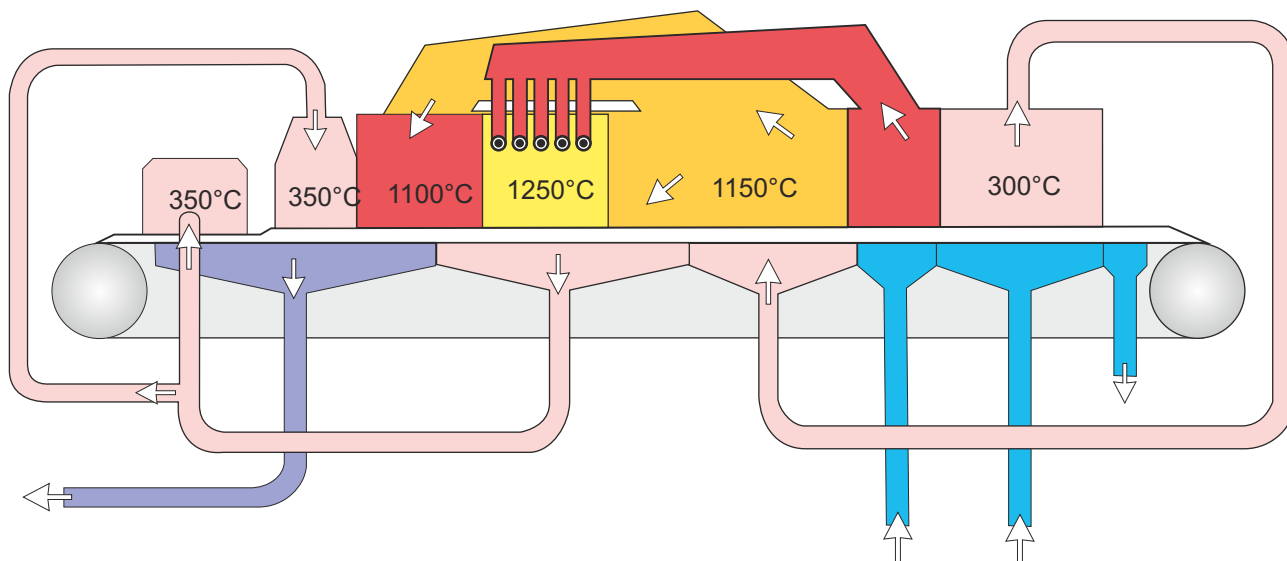
Service

- designer's supervision of the equipment erection, adjustment and putting in service with bringing its operation indices up to the design ones
- technical maintenance, diagnostics in guarantee and post-guarantee periods
- participation in updating of the equipment issued earlier
- a possibility of attracting on the contract basis the specialized organizations for rendering services

Guarantees

Uralmashplant guarantees trouble-free operation of the equipment within one year but not more than within 18 months since the date of shipment, provided that the conditions of transportation, storage, erection, adjustment, tests, putting in service and service are observed.

The guarantee does not cover the rapidly wearing parts.



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Reference list

| Supply year | Customer | Country | Type of equipment | Qty |
|-------------|--|------------|---|-----|
| 2015-2016 | Visakhapatnam Steel Plant | India | Sinter machine-1 (revamping & upgradation) and phase-1 of sinter machine-2 (revamping & upgradation) | 1 |
| 2014 | Ahluwalia Group, Shri Jagannath & Steels Pvt. Ltd. | India | Straight grate induration machine for 100% hematite. Working area – 189 m ² | 1 |
| 2013 | Minera Steel and Power Pvt. Ltd. | India | Straight grate induration machine for 100% hematite. Working area – 108 m ² | 1 |
| 2013 | Crest Steel and Power Limited | India | Straight grate induration machine for 100% hematite. Working area – 189 m ² | 1 |
| 2013 | Mikhailovsky GOK | Russia | Construction of pelletizing plant no.3 with straight grate induration machine "MOK-592M". Working area – 592 m ² | 1 |
| 2012 | Northern GOK | Ukraine | Pallets 4.0x1.5 | 69 |
| 2011 | Northern GOK | Ukraine | Reconstruction of straight grate induration machine Lurgi-278 "B" Working area – 278 m ² | 1 |
| 2011 | Northern GOK | Ukraine | Balling Disk "04-7500" | |
| 2011 | Lebedinsky GOK | Russia | Balling Disk "04-7500" | 1 |
| 2010 | Northern GOK | Ukraine | Reconstruction of straight grate induration machine Lurgi-278 "A" Working area – 278 m ² | 1 |
| 2010 | Kola MMC | Russia | Pallets "TO 1-2x1-Y" | 20 |
| 2009 | Lebedinsky GOK | Russia | Pallets "TO-4x1.5" | 45 |
| 2009 | Northern GOK | Ukraine | Balling Disk "04-6000" | 6 |
| 2007 | Lebedinsky GOK | Russia | Balling Disk "04-7500" | 2 |
| 2007 | Central GOK | Ukraine | Reducing gear | 1 |
| 2007 | Karelsky Okatysh | Russia | Drive component for drum pelletizer "05 – 3.6x10" | 2 |
| 2005 | Mikhailovsky GOK | Russia | Drum pelletizer "05 -3.6x14" | 4 |
| 2005 | Sokolovsko-Sorbaisky GPO | Kazakhstan | Roller distributor "ТПР-2200" | 1 |
| 2005 | Karelsky Okatysh | Russia | Drive component for drum pelletizer "05 – 3.6x10" | 2 |
| 2004 | Mikhailovsky GOK | Russia | Pallets "TO 4x1.5 – Y" | 132 |
| 2004 | Sokolovsko-Sorbaisky GPO | Kazakhstan | Reconstruction (project) of straight grate induration machine. Working area – 120 m ² | 4 |
| 2004 | Aksusky ferroalloy plant | Kazakhstan | Reconstruction (project) of straight grate induration machine. Working area – 34 m ² | 1 |
| 1995 | Central GOK | Ukraine | Straight grate induration machine. Working area – 324/326 m ² | 1 |
| 1995 | Lebedinsky GOK | Russia | Straight grate induration machine (Project). Working area – 315 m ² | 4 |
| 1987-1993 | Kachkanarsky GOK | Russia | Straight grate induration machine. Working area – 228 m ² | 4 |
| 1992 | Donsky works, Hromtau | Kazakhstan | Straight grate induration machine (Project). Working area – 108 m ² | 1 |





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