



February 2010

JSC “Nizhniy Tagil Iron and Steel Works”



JSC "NTMK" is a part of steel and mining company "EvrazHolding".

NTMK is situated in 140 km to the north of Yekaterinburg. Autoroads and railroads in Nizhniy Tagil give access to any seaport of Russia or the CIS.

Tagilo-Kushvinskaya and the Kachkanarskoye iron-ores deposits (150 km off Nizhniy Tagil) are the main sources of raw materials for the NTMK.



Ore extraction on Kachkanarsky mining and dressing complex (KGOK) is done from open quarries. The special feature of Kachkanarskiy's titaniferous magnetites is presence of 0,45 – 0,60% vanadium pentoxide, which allows for natural steel microalloying. Besides they contain significant quantity of titan dioxide (2,5 – 3,4%) that defines specific difficulties in operations of blast furnaces with this raw material.

Chemistry of KGOK's raw material

KGOK's performance, thousand tons per year	2009	2015
Extraction of raw materials	57 200	63 000
Production of iron ore ,		
total	9 870	10 878
sinter	3 360	3 988
pellets	6 210	6 890

Materials	Chemistry, mass %						
	Fe general	FeO	Fe ₂ O ₃	S	P	V ₂ O ₅	TiO ₂
Sinter	54,09	8,86	60,34	0,015	0,006	0,50	2,06
Pellets	60,99	3,48	74,98	0,006	0,005	0,56	2,25

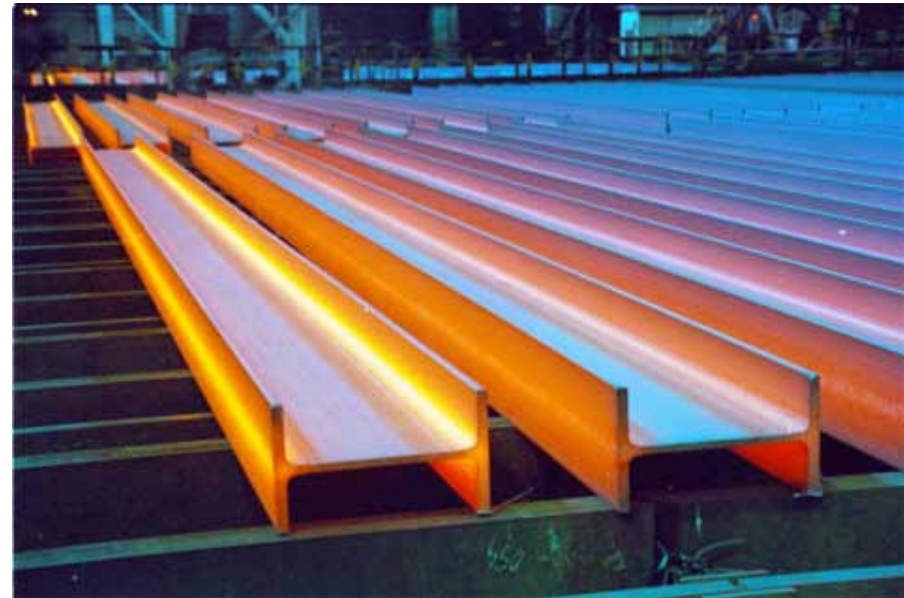


JSC “NTMK” has the following production lines:

- NTMK is one the biggest companies that produce rolled metal products for railway transport (rails, wheels, tyres, different shapes for rail car building);
- NTMK is the only manufacturer of column-formed parallel flange beams in Russia;
- NTMK is the main enterprise in Russia that process vanadium enriched titaniferous ores with succeeding vanadium recovery.

Rolled structurals, tubular billets, rings for mechanical engineering, milling balls, total about 800 profiles sizes from 150 steel grades are also produced here.

Chemical products, building materials from metallurgical slag, air separation products (oxygen, argon, krypton and xenon mix) are produced as commodities



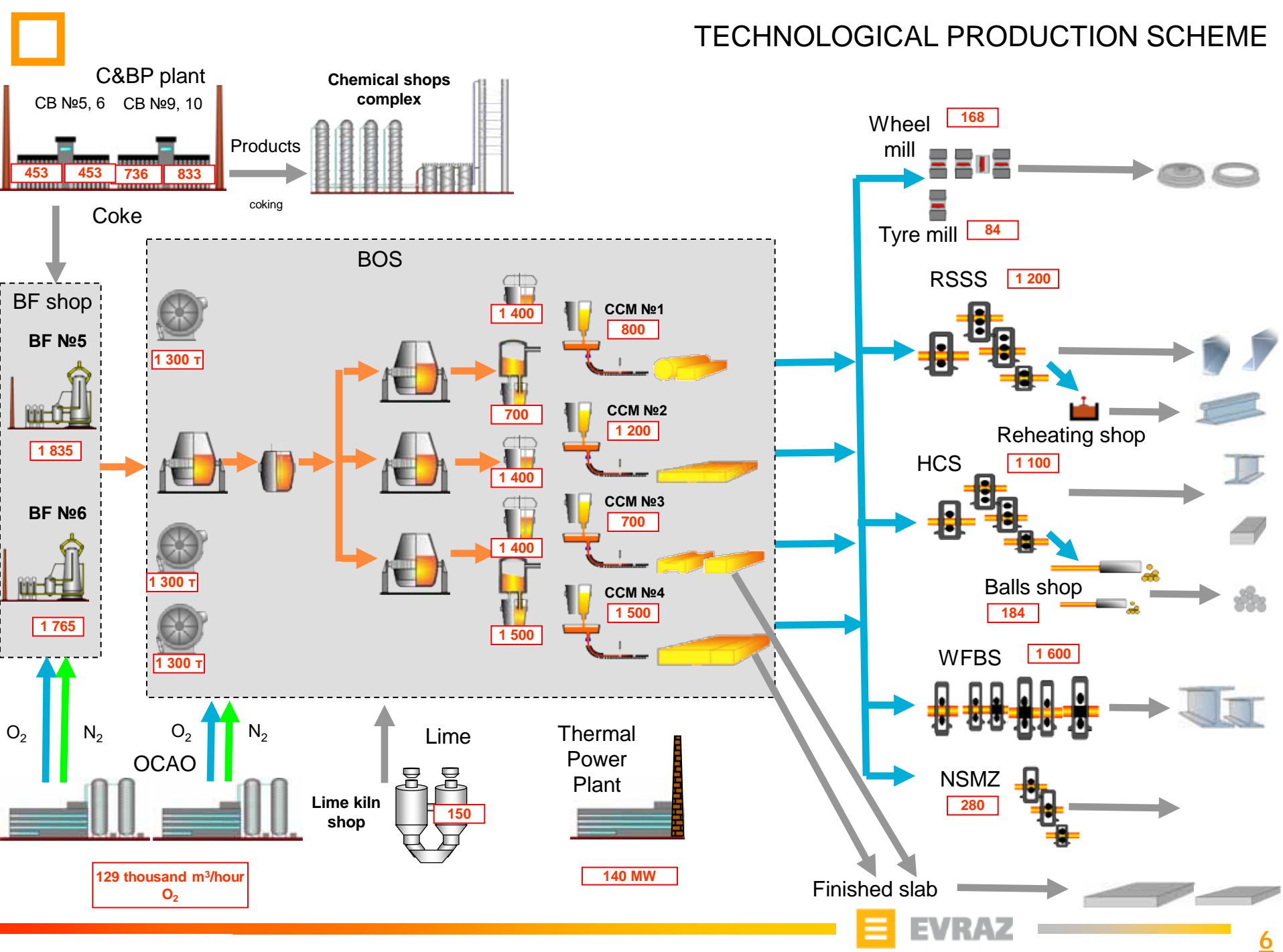


JSC "NTMK" is an industrial complex with full metallurgical cycle that includes coke and by-product operation, blast furnace operation, steelmaking and rolling operations as well as by-products recycling, repair, power supply, transport departments.

Company is certified and works in accordance with the requirements of International Standards ISO-9000. Main strategic objective of the NTMK is to produce high quality competitive products and to ensure company's steady profits.



TECHNOLOGICAL PRODUCTION SCHEME



COKE AND BY PRODUCTS OPERATION

Coke and by products (C&BP) plant produces iron-making coke for blast-furnace shop, performs coke oven gas treatment, derivable chemical products recycling having commodities as an output, deliver refined coke oven gas to the thermal generating units of the enterprise. C&BP plant consists of:



COAL-PREPARATION SHOP

executes receiving, storing of coking coal, preparation of charge coal and its transportation to the coking plants for coking process.

COKING PLANTS # 2, 3

execute charge coal coking, coke fractions sizing, coke transportation to the blast furnace shop and other consumers.

Shops, units	Start-up year	Planned capacity, thousand tons per year	Type of coke quenching
Coking plant # 2			
Coke oven battery #5	2006	453	Dry
Coke oven battery # 6	2002	453	Wet
Coking plant # 3			
Coke oven battery # 9	1986	736	Dry
Coke oven battery # 10	1989	833	Dry

COKE AND BY PRODUCTS OPERATION



BY PRODUCTS RECOVERY PLANTS #2, 3

Coke oven gas treatment from coal-tar pitch, ammonia, benzene carbohydrates, light pyridine compounds.

Ammonia sulphate commodities shipment.

Derivable chemical products transportation to the recycling plants.

Delivery of refined coke oven gas to the thermal generating units of the enterprise.

RECYCLING PLANTS (pitch distillation plant, coke pitch plant, pyridine bases plant)

Recycling of chemical products derived from coke oven gas and commodity goods output.

BLAST FURNACE OPERATION

Only two blast furnaces (BF 5 and 6) out of six operates at the moment.



Blast furnaces specification:

Figures	BF-5	BF-6
Putting into operation after reconstruction (year)	2006	2004
Payload volume, m ³	2 200	2 200
Planned capacity, thousand tons per year	1 835	1 765
Number of casting yards	2	2

Blast furnace shop also includes the following areas:

- ore yard of 30 thousand m² (receiving of raw materials, flux, coke, making seasonal and technological supplies);
- belt-conveyor trestle (raw materials and coke feeding equipment for blast furnaces);
- casting yards (equipment for casting pig iron and slag into ladles);
- stoves' area;
- casting machines area;
- ladle car treatment and repair depot.

STEELMAKING

Steelmaking is done in the Blast Oxygen Shop - converter department. Steelmaking is a two-stage V iron smelting process.



BOS production capacity is 4,2 mln. tons per year. It consists of:

- converter department (four 160 ton oxygen converters, iron desulfurization plant);
- continuous casting machines (CCM) department and secondary refinement area (four CCMs, three ladle furnace plants, two RH vacuum degassers);
- mixer department;
- scrap stockyard;
- slag partition.

Equipment specification of secondary metallurgy department and CCM department of BOS

Units	Start-up year	Manufacturer	Planned capacity, thousand tons per year
CCM #1	1995	VAI	800
CCM #2	1996	Uralmash	1 200
CCM #3	2001	VAI	700
CCM # 4	2004	VAI	1 500
Desulfurization plant	2003	Crupp-Pollizius	1 500
Ladle furnace #1	1995	VAI	1 400
Ladle furnace #2	1997	VAI	1 400
Ladle furnace #3	2004	VAI	1 400
Vacuum degasser #1	1996	VAI	700
Vacuum degasser #2	2006	Mevak	1 500





CC billets assortment

	Billets section, mm.
CCM #1	Ø430; 300x360
CCM #2	240x310 ÷ 575; 240x1 250 ÷ 1 515
CCM #3	BB4; 200x525 ÷ 550; 300x380 (after reconstruction)
CCM #4	200 ÷ 300x1 050 ÷ 1 280; 200 ÷ 300x1 500 ÷ 2 700



Beside CC billets the production of BOS include commercial vanadium slag received on the first stage of two-stage V iron smelting process. Shop's productivity is 250 thousand tons of slag per year. After crushing and separation of metal inclusions vanadium slag is shipped to the customers in 200mm screen sizes.

Rolling operations include seven hot rolling mills:

- rail and structural steel mill "800" with rails thermal quenching section;
- heavy section mill "650";
- universal beam mill "1300";
- wheel mill;
- tyre mill;
- ball mills 80+120

In general rolling production technique includes the following stages: billets heating, metal rolling in rolling mills to gain the required sizes, rolls exact length cutting using saws and shears, shapes finishing, quality control, shipment.

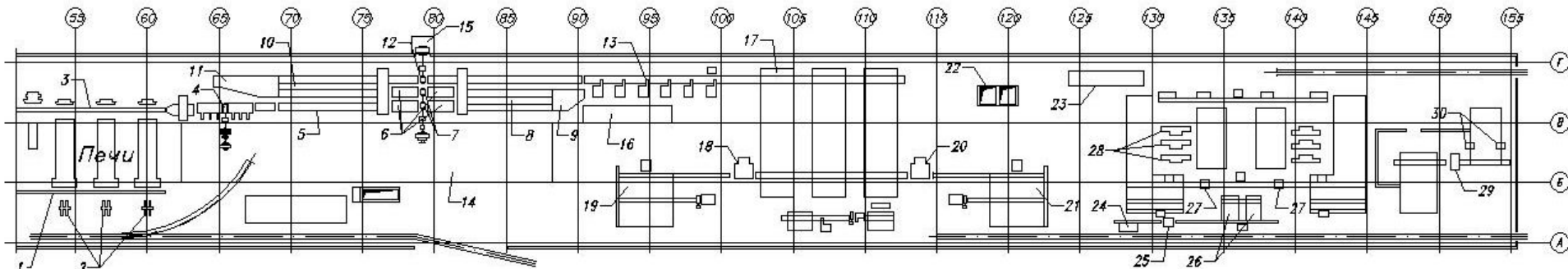
Rolling mills specification

Mills and areas	Start-up year	Planned capacity, thousand tons per year
Rail and structural steel mill "800"	1947	1 200
Thermal section	1966	700
Heavy section mill "650";	1959	1 100
Universal beam mill "1300"	1977	1 600
Wheel mill	2005	168
Tyre mill	1937	84
Ball mills	1965	184



Mill type 650 – linear (two lines).
 Start-up year – 1959.
 Specialty – production of heavy section rolling.
 Input material – rolled and conicast rectangular and square bars.

Lay-out plan of HSS's main equipment



- | | |
|---|---------------------------------------|
| 1. – feed roll-table; | 18, 20. – roller leveller ; |
| 3. – discharge roll-table; | 19, 21. – finishing floors; |
| 4. – breakdown mill «850»; | 22. – thermal bays; |
| 7. – “650” mill’s three-high rolling stand; | 25. – cross roll straightener; |
| 12. – “650” mill’s “duo” finishing stands; | 27. – grinding machines; |
| 13. – high speed saws; | 28. – horizontal milling machines; |
| 14, 15 – turbine buildings; | 29. – vertical straightening machine; |
| 17. – cooling bed; | 30. – boring mills. |



Production capacity is 1100 thousand tons per year.

Mill type– universal beam mill of continuous in-line stand arrangement

Start-up years:

1st stage - 1977;

2nd stage - 1982.

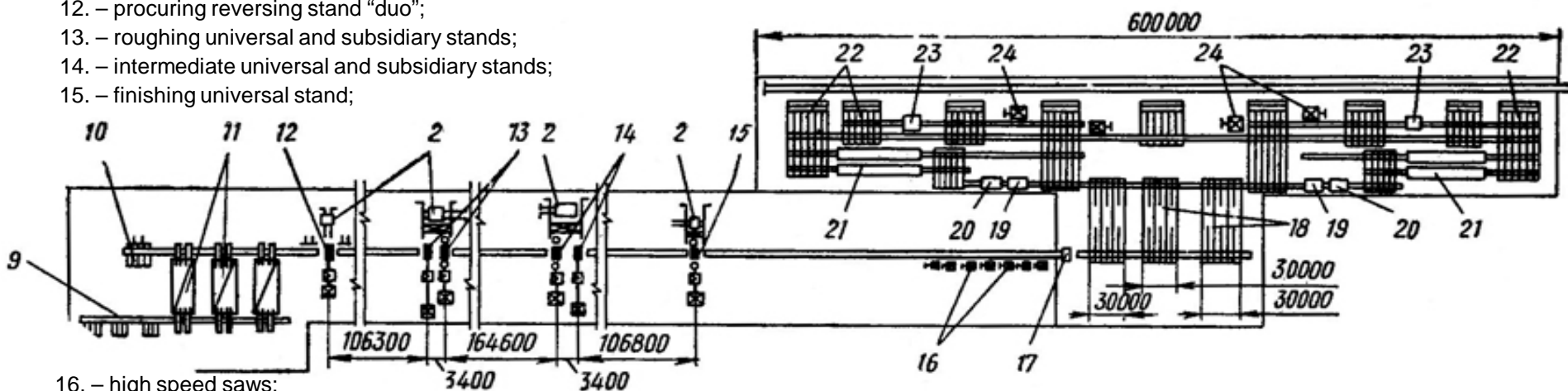
Specialty – manufacturing of I-beams with parallel flanges in depth from 150 through 610 mm and in flange width from 100 through 400 mm including the welded types.

Today it also manufactures U-type sheet piles L5-UM, tubular bars of 120, 150, 210, 220 mm and square bars of 100 through 200 mm.

Input material - rolled or cast square bars or beams blanks for large profiles.

Lay-out plan of universal beam mill's main equipment

- 9. – feed devices;
- 11. – walking hearth furnace;
- 12. – procuring reversing stand "duo";
- 13. – roughing universal and subsidiary stands;
- 14. – intermediate universal and subsidiary stands;
- 15. – finishing universal stand;



- 16. – high speed saws;
- 17. – marking machine;
- 18. – walking beam cooling bed;
- 19. – horizontal roller leveller ;
- 20. – vertical roller leveller ;
- 22. – sorting racks;
- 23. –levelling hydraulic press;
- 24. – cold saws. .



Production capacity is 1600 thousand tons per year.

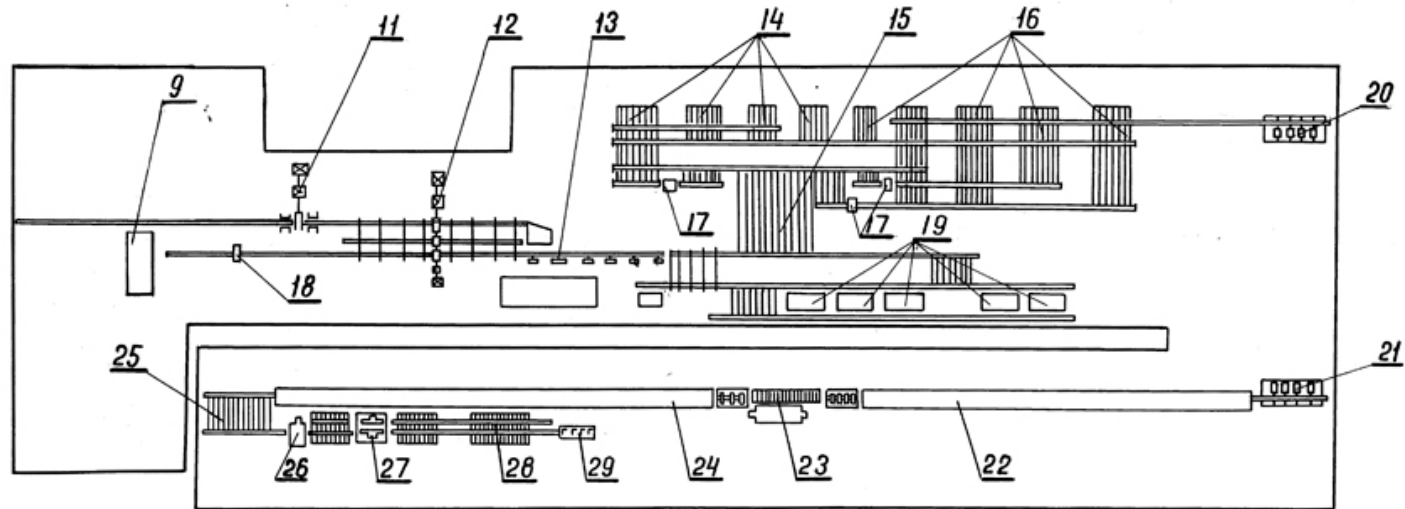
RAIL AND STRUCTURAL STEEL SHOP

Mill type 800 – linear (two lines).

Start-up year – 1949.

Specialty – manufacturing of product for transport needs – rails, shaped sections for carriage engineering, axle billet, and section forms for tractor industry etc.

Input material – rolled and conicast rectangular billets.

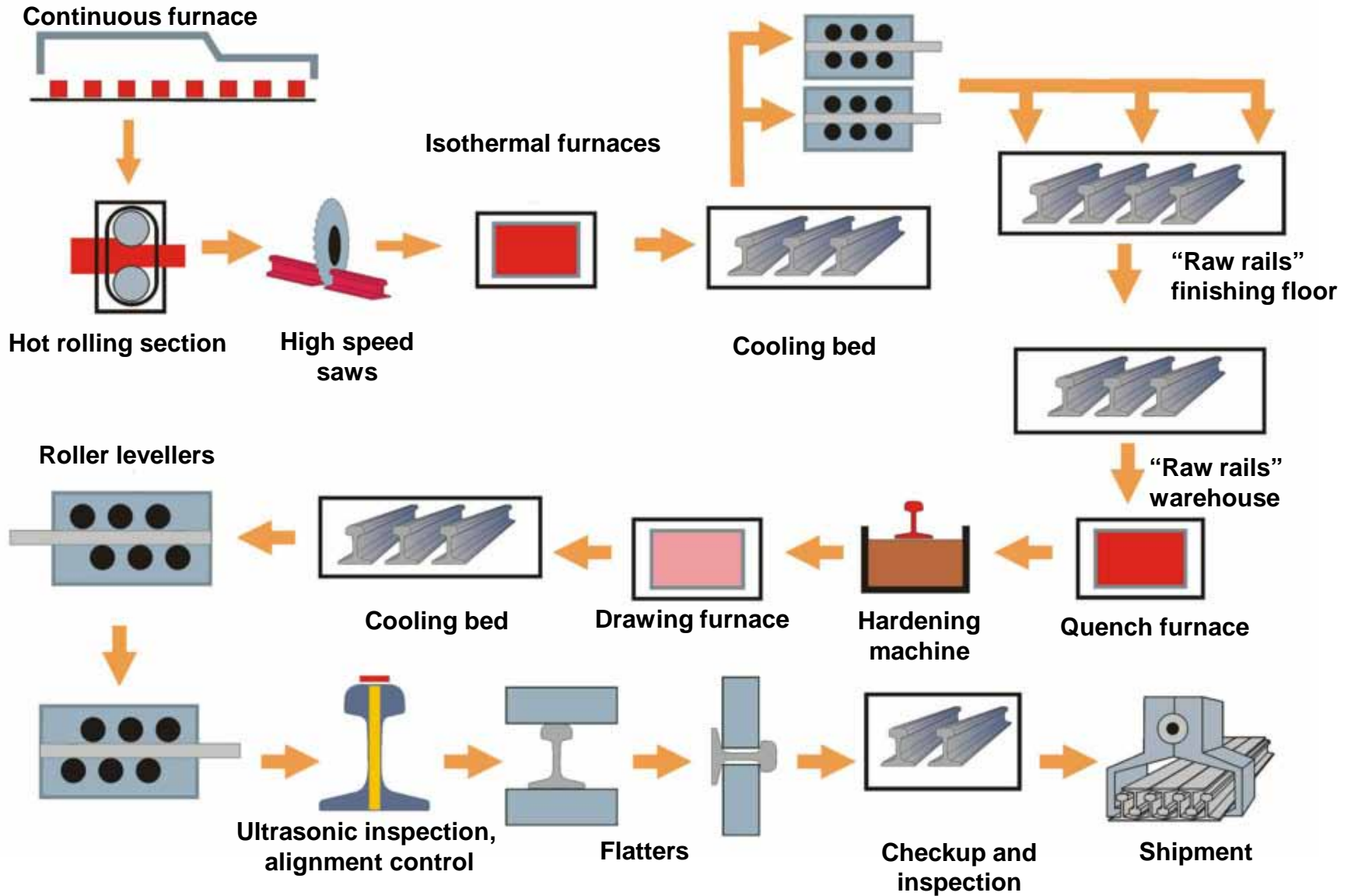


- | | |
|-------------------------------|-----------------------------|
| 9. – continuous furnace; | 18. – backflow shears; |
| 11. – break-down stand «950»; | 19. – isothermal furnace; |
| 12. – finishing stand «800»; | 21. – charging rack; |
| 13. – high speed saws; | 22. – quench furnace; |
| 14. – beam finishing floor; | 23. –hardening machine; |
| 15, 25. – cooling bed; | 24. – rail drawing furnace; |
| 16. – rail finishing floor; | 27. – flatters; |
| 17, 26. – roller leveller; | 29. – piler. |



Production capacity of rail and structural steel mill is 1200 thousand tons per year.

TECHNOLOGICAL SCHEME OF RAILROAD RAILS PRODUCTION



WHEEL MILL, WHEEL PRODUCTION SCHEME

Specialty – manufacturing of wheels and wheel blanks for rolling stock equipment and crane construction.
Исходная заготовка - круглая непрерывно-литая заготовка диаметром 430 мм.

Thermal treatment

Pressing and rolling section

Drawing furnaces

Hardening units

Heating furnaces
For hardening

Rolling mill

Heating furnace
for working

Cold saws

5000 m 9000 m 5000 m

Machining process train #1

Final checking line #1

Machining process train #2

Final checking line #2

Products shipment

Measuring

Shot-blasting
machine

Ultrasonic
inspection

Hardness
metering

Shot
blaster

Покраска

Measuring

Ultrasonic
inspection

Changeable
pressure
method

Hardness
metering

Shot
blaster

Painting

Production capacity - 172 thousand tons per year



Start-up year – 1937.

Specialty – manufacturing of tyres for rolling stock and blank rings of various shares for machine building.

Input material – round conticast billets of 430 mm.

EQUIPMENT CINFIGATION:

Furnace section includes continuous and two chamber reheating furnaces.

Pressing and rolling section includes:

- 3200-t press for preforming and piercing; a roughing mill for preforming of billets;
- finishing mill for preforming of tyres and rings to the required sizes and shapes; a 400-t press for stamping and marking;



A slow cooling section for flake prevention in tyres and rings from flake susceptible steels.

A heat treatment section of 16 chamber type furnaces for reheating for quenching and tempering of special quenching tanks.

An automated tyres final checking line LKB-1d (start-up year - 2007).

Production capacity - 148 thousand tons per year.

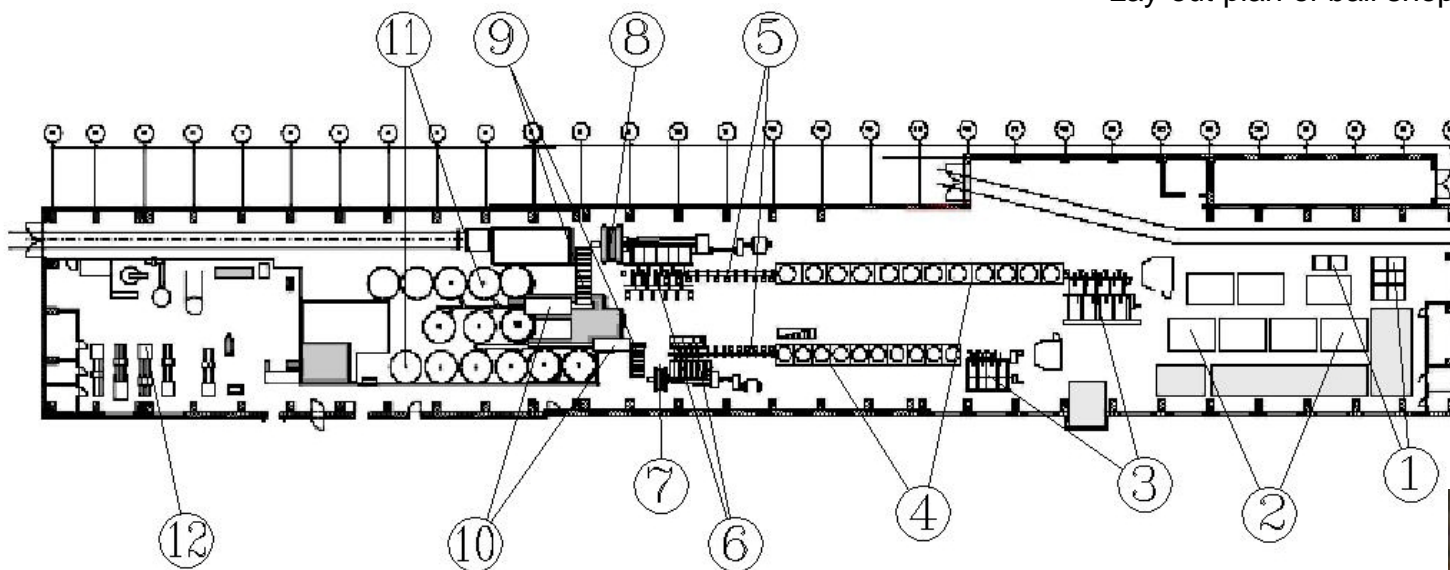
Start-up year – 1965.

Specialty – manufacturing of grinding balls for mining and cement industry.

Input material – round billets of relevant diameter manufactured in the heavy section shop and the H-beam mill.

Production capacity - 180 thousand tons per year.

Lay-out plan of ball shop's main equipment



1. – box piles breaking unit;

2. – billet stalls;

3. – charging gears;

4. – heating furnaces;

5. – roll-tables;

6. – feed unit;

7. – mill's roll stand «40 – 80»;

8. – mill's roll stand «80 – 120»;

9. – elevators;

10. – drum-type ball quenching machine;

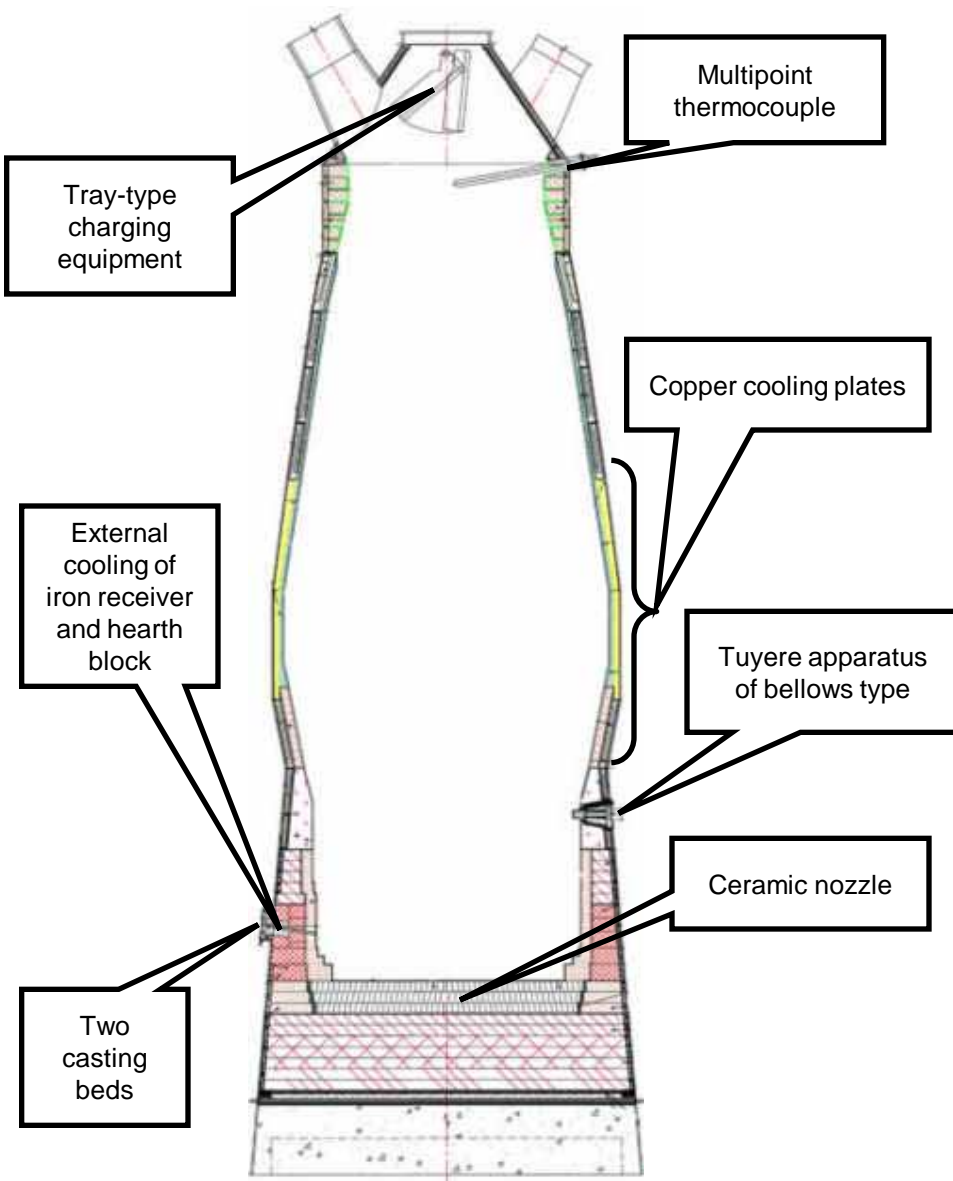
11. – storage hoppers;

12. – interchangeable equipment staging area.



RECONSTRUCTION OF BLAST FURNACE №3

Main engineering solutions



- ∅ Fundamental reconstruction of blast furnace № 3 (with main engineering solutions of blast furnace № 5).
Furnace capacity will be increased up to 2 200 m³, production capacity - 2 000 thnd tpa of pig iron. Feed material for furnace will be KGOK's vanadium raw materials with pulverized coal fuel (PCF).
- ∅ Coke consumption will decrease to 349 kg/t of pig iron (with PCF consumption 200 kg/t of pig iron) after reconstruction. Natural gas will be absolutely excluded from the blast process.
- ∅ BF #3 reconstruction project will be implemented in case of further development of NTMK steel processing, which ensures full V-iron processing (6,0 mln. tpa).

PULVERIZED COAL FUEL (PCF) BLASTING

Unit is designed for coal raw materials receiving, crushing to required size, drying and transportation of finished PCF to all BF tuyeres, PCF distribution and regulation.

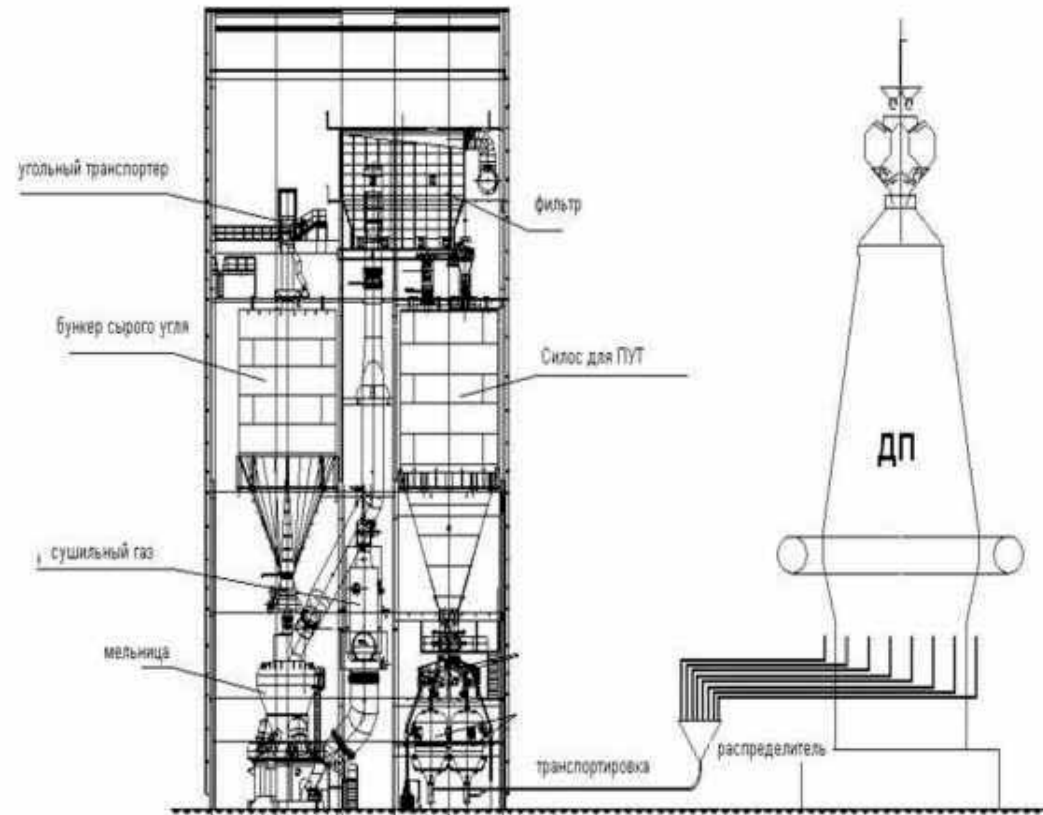
Coal receiving and storage section is located in the Coke and by products shop area, where the existing coal receiving facilities are located, and in the new subsidiary feeding sections and additional coal stocking silos.

PCF preparation and blasting sections are located in one building with the space between blasting complex and blasting furnaces less than 600 m., that satisfies the requirement for transportation distance of PCF in dense phase.

Blasting complex includes:

Crushing line that consists of: raw coal storage hopper, jar roller, PCF drying unit, gas flues, PCF recovery unit, blower, PCF collecting hopper;

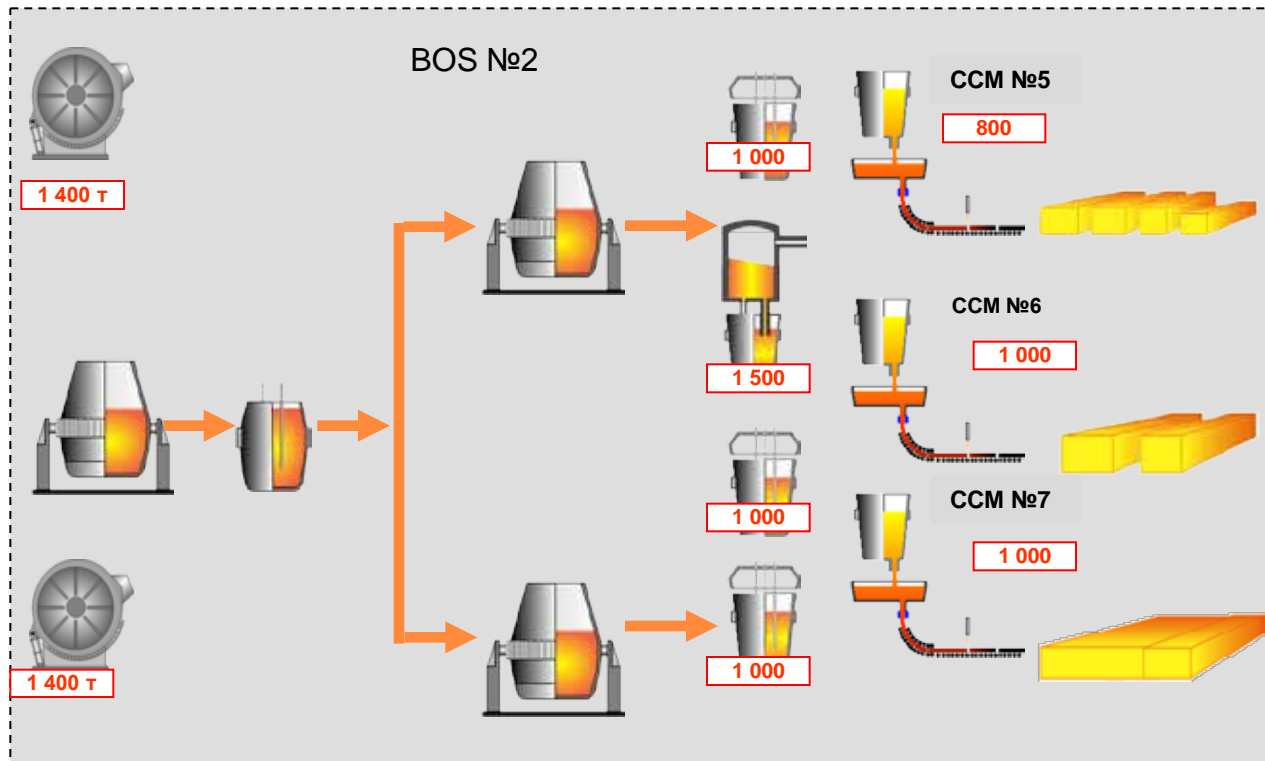
Blasting unit that consists of: injection reservoirs, nitrogen feeding system to reservoirs and transport pipelines, common PCF transport pipeline towards blast furnaces, PCF flow divider, transport pipelines from divider to BF tuyeres.



CONSTRUCTION OF BLAST OXYGEN SHOP (BOS) #2

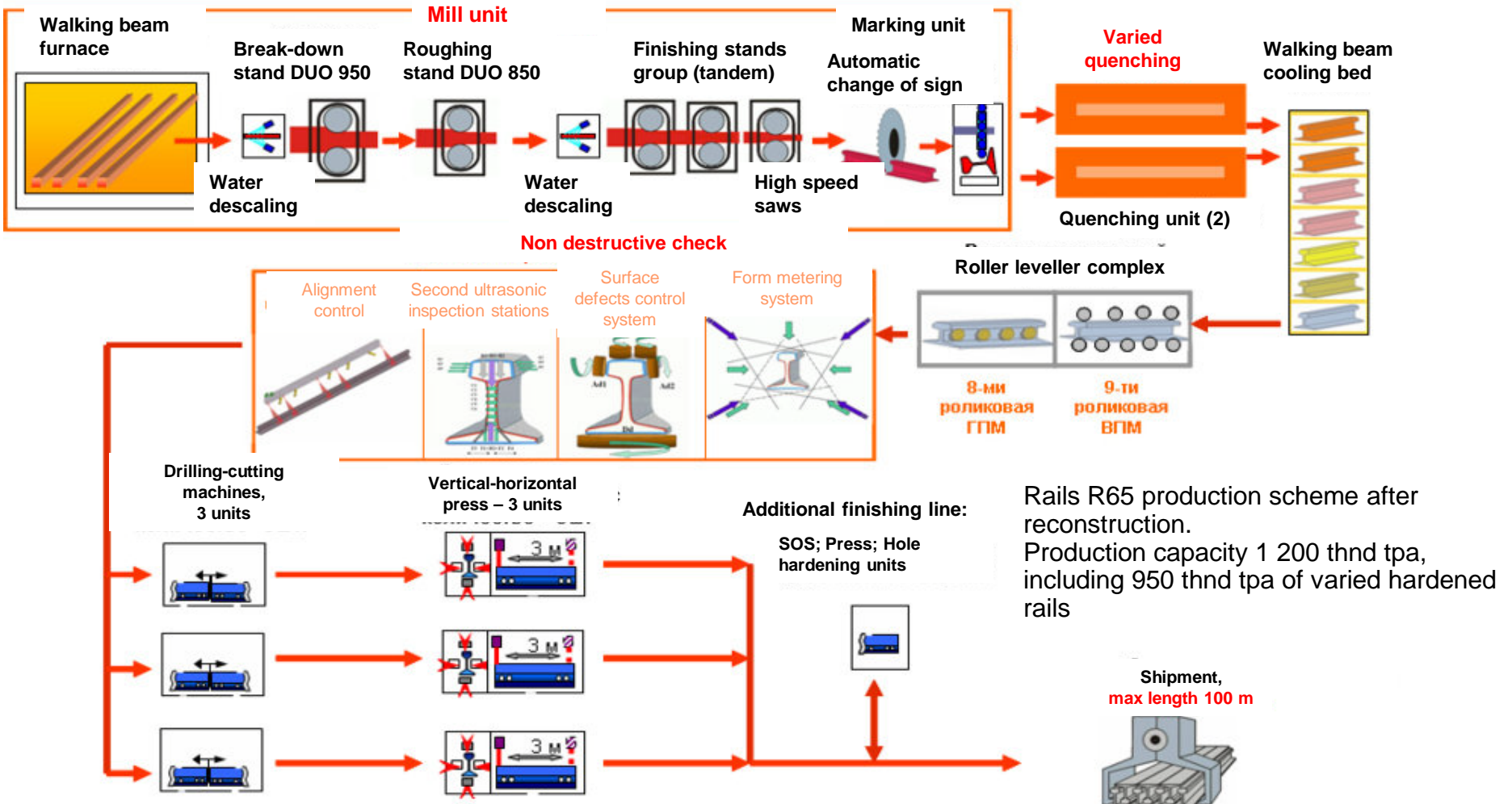
Production capacity of BOS #2 is 2 800 thnd tpa. It will consists of:

- converter department (three 160 ton oxygen converters, iron desulfurization plant);
- continuous casting machines (CCM) department and secondary refinement area (three CCMs, three ladle furnace plants, circulation vacuum vessel);
- mixer department;
- scrap stockyard;
- slag partition.



RECONSTRUCTION OF RAIL AND STRUCTURAL STEEL SHOP

Spade-work for shop's reconstruction is doing currently. It is planned to change fundamentally the outdated technologies of rolling, heat treatment, finishing and products quality control and to produce rails of 100 m.



Rails R65 production scheme after reconstruction.
Production capacity 1 200 thnd tpa, including 950 thnd tpa of varied hardened rails