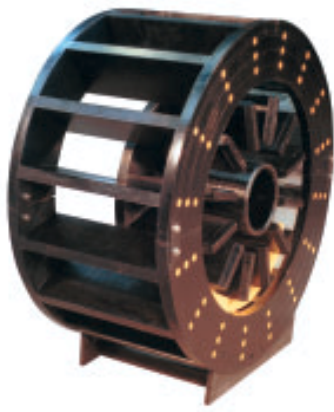




# **FLOTATION MACHINES FOR THE MINING INDUSTRY**



## FLOTATION MACHINES FOR THE MINING INDUSTRY

Flotation machines constitute the basic equipment for useful minerals recovery from non-ferrous ores and other raw materials by flotation. In the years 1963 – 1976, the Institute of Non-Ferrous Metals developed a series of pneumo-mechanical flotation machines, which were marked by letters IZ. They were multi-cell, sluice-type machines of the individual cell volume ranging between 1 m<sup>3</sup> and 30 m<sup>3</sup> — IZ-1, IZ-3, IZ-5, IZ-12, IZ-30. They were widely used in the copper, zinc-lead and coal mining industries. The IZ-12 type still remains the basic coal flotation machine used in Poland. They also were widely exported, mainly to Brazil and China.

At the end of the 90s, in the Institute of Non-Ferrous Metals a new generation of flotation machines was developed, marked with letters IF.

The design philosophy has changed: the series machines have been replaced by flotation machines designed and manufactured according to the specific requirements of customers.

The sluice-type machines have been replaced by one-cell flotation machines which can be linked to form a multi-cell flotation machine. They can operate also as individual flotation cells.

Flash flotation machines IF-9S and IF-19S were constructed, which are used in a grinding cycle for flotation of pulp with high concentration of solids, up to 800 g/dm<sup>3</sup>, with a high thick grains fraction and for conducting flotation process in a short time. The usefulness of the machines can be mainly observed in flotation of ores which, besides the basic mineral, contain also noble metals, such as gold and silver.

The flotation machines are used as a single cell, equipped with all components for automatic control of flotation process conditions.

For the main flotation of non-ferrous ores flotation machines IF-30R and IF-57R were designed. They can be used in a pulp flotation process in a wide



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range of solid parts concentration as well as for enrichment of minerals of high specific gravity. Thanks to the structure of those flotation machines it is possible to construct a multi-cell flotation machine where individual cells are set in line or can be set in a broken line arrangement. The multi-cell flotation machine consists of a series of flotation sections. Individual sections are located at different levels and one section can comprise up to 3 cells

For flotation of crude concentrates flotation machines IF-20RC and IF-30RC were designed. The characteristic feature of the machines is vertical pulp flow through the flotation cell. Those machines have to be used as single flotation cells. When there is a need to use multiple flotation cells it is recommended to use them in a parallel layout, and the material should be fed through a charge distributor.

For flotation of coal, graphite or sulphur, the IZ-45W flotation machine was designed. The machine is adapted for flotation of minerals with a high content of usable components and large output of a froth product.

The main feature of the IF flotation machines is introduction of a new type of the aerator, which allows for the machines operation within a wide range of pulp aeration at low peripheral speed of a rotor, which in turn results in the increase of useful component content in concentrate, low energy consumption and reduced wear of the rotor.

The solution was appreciated and received gold medal at 50<sup>th</sup> World Exhibition of Innovation, Research and New Technology BRUSSELS EUREKA 2001, medal at Fair for Economic and Scientific Innovation INTARG 2002 in Katowice and Diploma of Merit awarded by the State Committee of Scientific Research.

All the IF-type flotation machines are equipped with automatic systems for control of the air supplied to the aerator and with automatic pulp level control system. The systems can be controlled locally or can be integrated with a supervising system for control of the flotation process. We offer also systems for stabilisation of parameters of the fed material, especially for flotation in grinding cycle.

The table below presents listing of IF type flotation machines supplied by Institute of Non-ferrous metals to copper ore enrichment plants of KGHM Polska Miedź S.A. in Lublin.



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<b>Flotation machine</b>	<b>Date of launching</b>	<b>Number of machines</b>	<b>Installation place</b>
IF-30R	2001	11	Main flotation; ZWR Lubin
IF-9S	2002	3	Flash flotation in grinding cycle ZWR Lubin
IF-19S	2002	5	Flash flotation in grinding cycle ZWR Rudna
IF-20RC	2002	1	Cleaning flotation ZWR Rudna
IF-30RC	2002	1	Cleaning flotation ZWR Rudna
IF-57R	2003	7	Main flotation of sandstone ZWR Rudna
IF-19S	2003	4	Flash flotation in grinding cycle ZWR Rudna
IF-20RC	2003	2	Cleaning flotation ZWR Rudna

There were also flotation machine IF-45W installed in the Coal Mine in Pszów, for flotation of coke coal.

In the production of aerators and control components protective coatings are used to guarantee their long lasting proper operation. The flotation machines can be delivered with abrasion-resisting coating or prepared for application of a coating made during assembly. The supplied machines have high quality anticorrosion coatings made from renowned lacquer products.

The systems for stabilisation of flotation process conditions consists of an automatic system controlling flow of the air supplied to individual aerators and of automatic systems controlling the volume of the air pumped to a single cell or to a cascade of the multi-cell flotation machine. The control system is equipped with an ETHERNET modem for communication with a supervisory system. For control of a single flotation machine it is recommended to equip it with a microprocessor controller. In that case any changes into set values are introduced from a panel in the controller. When there are several flotation machines installed, it is advised to use PLC controller type GE Fanuc 90-30. Changes into set values for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

The Institute of Non-ferrous Metals has extensive experience in the selection of flotation machines for specific conditions. We have well equipped laboratories and experienced expert personnel. Our experts can provide you with any information and answer all questions related to the use and application of our flotation machines for specific technological requirements.

# FLOTATION MACHINES

## FOR THE MINING INDUSTRY



**FLOTATION MACHINE IF-30R**



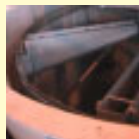
**FLOTATION MACHINE IF-57R**



**FLOTATION MACHINE IF-9S**



**FLOTATION MACHINE IF-19S**



**FLOTATION MACHINE IF-20RC**

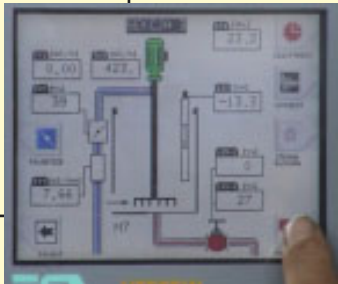
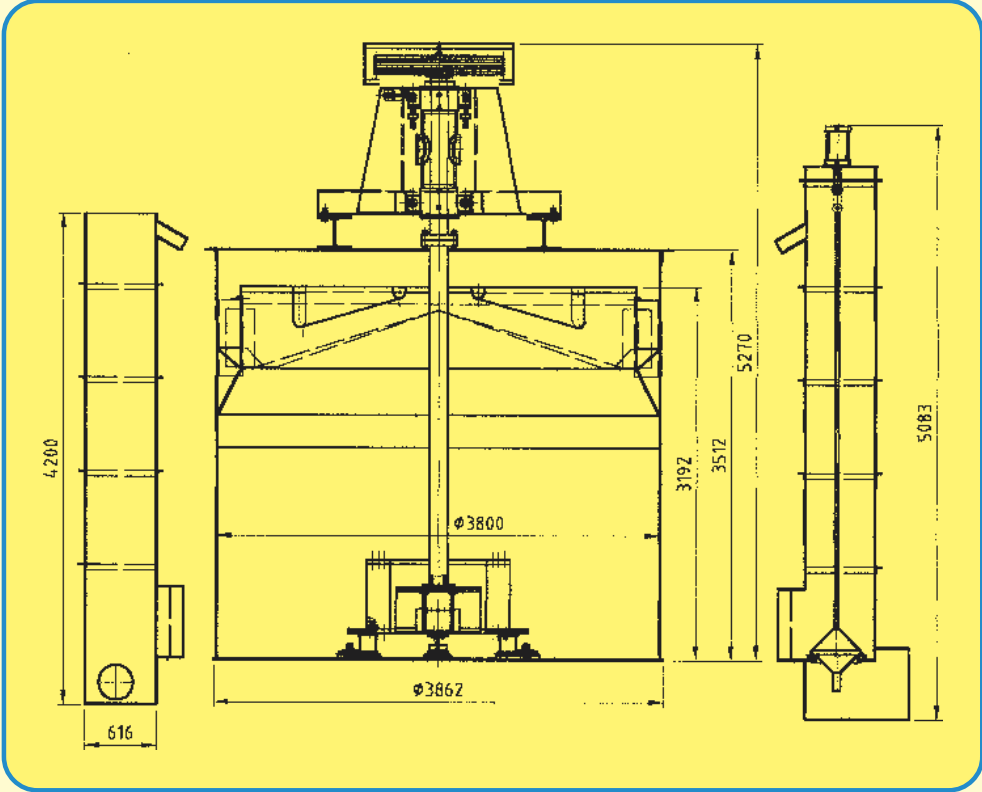


**FLOTATION MACHINE IF-30RC**



**FLOTATION MACHINE IF-45W**

# FLOTATION MACHINE IF-30R



## FLOTATION MACHINE IF-30R

The flotation machine IF-30R was designed for mineral processing by flotation. The flotation machine can be used in a pulp flotation process in a wide range of solid parts concentration as well as for enrichment of minerals of high specific gravity. Thanks to the structure of the IF-30R flotation machine it is possible to construct a multi-cell machine where individual cells are set in line or can be set in a broken line arrangement. The multi-cell flotation machine consists of a series of sections located at different levels. A minimum distance between the levels of individual sections is 300 mm. One section can comprise up to 3 cells. The material comes to the flotation cell through a feed cell. Individual sections are linked by an intermediate cell. The waste goes out of the machine through a waste cell. Working components (mushroom valves and pneumatic piston servomotors) of an automatic system controlling pulp level in the individual cells of a section are located in the intermediary and waste cells. The operation of the multi-cell flotation machine IF-30R is controlled by the automatic system controlling the pulp level in the cells of each section and by individual automatic systems controlling the volume of the air pumped to each cell.

### Flotation cell

The flotation cell is constructed in a form of a cylindrical tank with a flat bottom. The upper part of the cell contains froth product runners in a radial arrangement connected to an inner cumulative runner. In the cases when large volume of the froth products needs to be carried away, it is recommended to equip the IF-30R flotation machine with an outer cumulative runner. The cell and its components having contact with pulp are protected against corrosion by thick epoxy – acrylic coating. To ensure a long-life of the flotation machine, side surfaces are covered with polymeric or ceramic coating, and the bottom as well as control boxes with ceramic lining. The feed, intermediary and waste cells are connected to the flotation cell by bolts.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. Components of the aerator are protected against erosion by high quality abrasion-resisting coating, which ensures three to five year correct operation. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts.

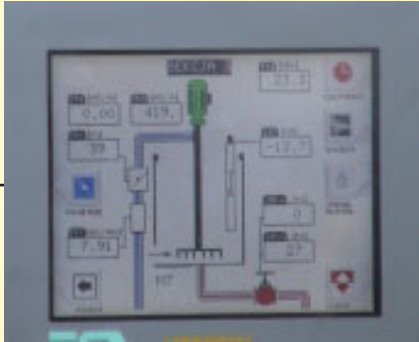
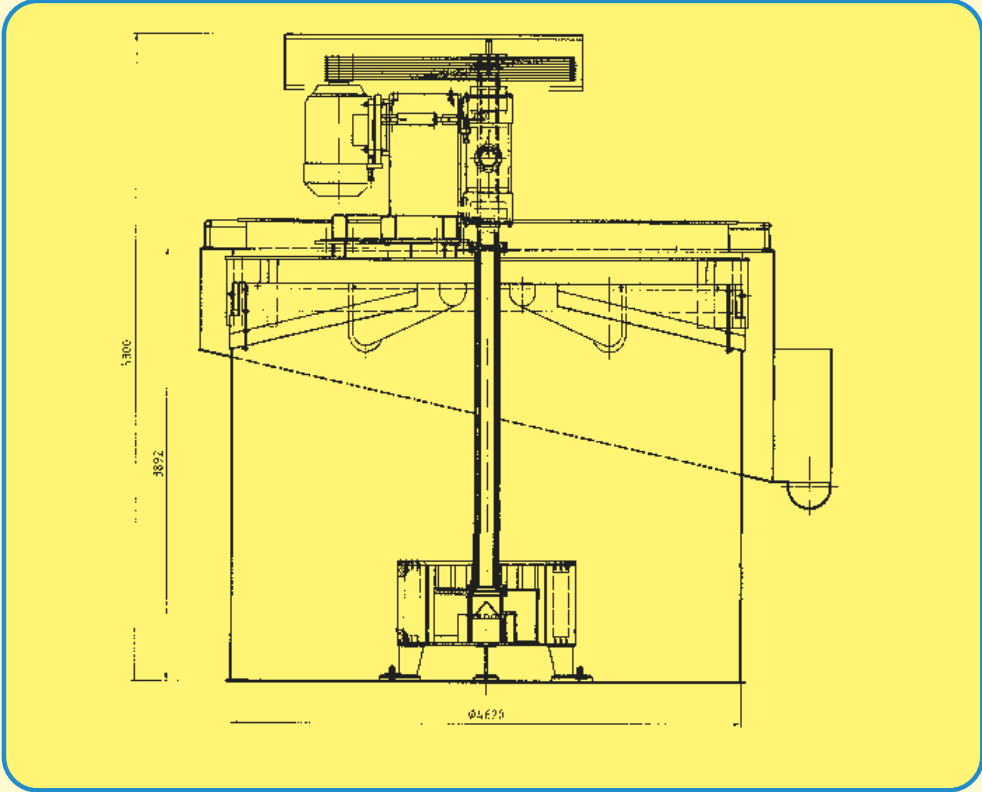
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The air flow control system gives possibility for individual control of air flow intensity in each aerator. The system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system controls cells in the sections of the multi-cell flotation machine. One pulp level control system controls one section (maximum 3 flotation cells). The system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with electro-pneumatic positioner, connected to a mushroom valve in the intermediary and waste cells. The automatic control system of the machine is built with the use of PLC controller type GE Fanuc 90-30 and has a distributed structure. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHERNET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every section, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	36m <sup>3</sup>
- Working space	34m <sup>3</sup>
- Maximum pulp flow	1200m <sup>3</sup> /h
- Maximum air flow	< 780Nm <sup>3</sup> /h
- Supplied air pressure	0.05MPa
- Air pressure in a control system	0.30 — 0.60 MPa
- Electric motor rated power	30kW
- Cell weight	10,35 Mg

# FLOTATION MACHINE IF-57R





## FLOTATION MACHINE IF-57R

The flotation machine IF-57R was designed for mineral processing by flotation. The flotation machine can be used in a pulp flotation process in a wide range of solid parts concentration as well as for enrichment of minerals of high specific gravity. Thanks to the structure of the IF-57R flotation machine it is possible to construct a multi-cell machine where individual cells are set in line or can be set in a broken line arrangement. The multi-cell flotation machine consists of a series of sections located at different levels. A minimum distance between the levels of individual sections is 500 mm. One section can comprise up to 3 cells. The material comes to the flotation cell through a feed cell. Individual sections are linked by an intermediate channel with a valve system. The waste goes out of the machine through a waste cell. Working components (mushroom valves and pneumatic piston servomotors) of an automatic system controlling pulp level in the individual cells of a section are located in the intermediary and waste cells. The operation of the multi-cell flotation machine IF-57R is controlled by the automatic system controlling the pulp level in the cells of each section and by individual automatic systems controlling the volume of the air pumped to each cell.

### Flotation cell

The flotation cell is constructed in a form of a cylindrical tank with a flat bottom. The upper part of the cell contains froth product runners in a radial arrangement connected to an outer cumulative runner. The cell and its components having contact with pulp are protected against corrosion by thick epoxy – acrylic coating. To ensure a long-life of the flotation machine, side surfaces are covered with polymeric or ceramic coating, and the bottom as well as control boxes with ceramic lining. The feed and waste cells are connected to the flotation cell by welding. Control of the level in individual cascades is performed by the valve system, located on the edge of the last cell in the cascade. The last cell in the whole flotation flow is equipped with a waste box with the same valve system as is used for the control of level in the individual cascades.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. Components of the aerator are protected against erosion by high quality abrasion-resisting coating, which ensures three to five year correct operation. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts.

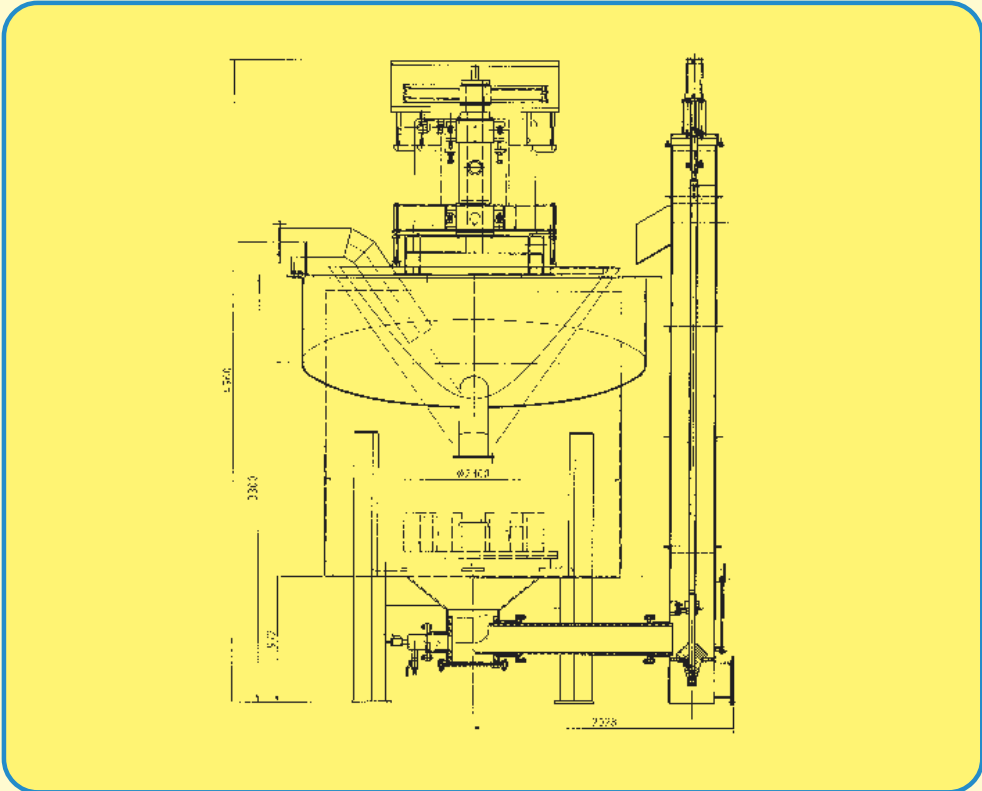
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The air flow control system gives possibility for individual control of air flow intensity in each aerator. The system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system controls cells in the sections of the multi-cell flotation machine. One pulp level control system controls one section (maximum 3 flotation cells). The system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with electro-pneumatic positioner, connected to a mushroom valve in the intermediary and waste cells. The automatic control system of the machine is built with the use of PLC controller type GE Fanuc 90-30 and has a distributed structure. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHERNET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every section, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	60m <sup>3</sup>
- Working space	57m <sup>3</sup>
- Maximum pulp flow	2400m <sup>3</sup> /h
- Maximum air flow	< 1200m <sup>3</sup> /h
- Supplied air pressure	0.05MPa
- Air pressure in a control system	0.30 — 0.60 MPa
- Electric motor rated power	55kW
- Cell weight	16,54 Mg

# FLOTATION MACHINE IF-9S



## FLOTATION MACHINE IF-9S

The flotation machine IF-9S is a one-cell machine designed for mineral processing by flotation. It is mainly used in a grinding cycle for flotation of pulp with a high concentration of solid parts, up to 800 g/dm<sup>3</sup>, with a high thick grains fraction and for conducting flotation process in a short time. The usefulness of the machine can be mainly observed in flotation of ores which, besides the basic mineral, contain also noble metals, such as gold and silver. The flotation machine is used as a single cell, equipped with all components for automatic control of flotation process conditions.

### Flotation cell

The cell is constructed in a form of a cylindrical tank with a flat bottom passing in its middle part into a cone terminated by a waste cell, which is connected to a waste box. In the waste box working components of a system for pulp level control and connection of a waste pipe are located. To the side surface a circumferential froth product runner is mounted. In the upper part of the cell there is a froth product guide, in a form of inverted cone. Thanks to the mounting way of the froth product guide it is possible to adjust its immersion in the cell, which gives a possibility of changing the surface of froth product in a range between 0.11 – 0.54 m<sup>2</sup>. The material is introduced into the flotation cell by a rubber connection, and the feeding is performed centrally, through the inner space of the froth product guide. Waste is collected centrally, from under the aerator. The cell is placed on four supporting arms welded to the side surface. The flotation cell and supporting structure of aerator drive are protected against corrosion by thick epoxy – acrylic coating. The waste box, in the area where erosion may occur, is made of abrasion resistant steel. The inner surfaces of the cell can be protected with a steel, polymeric or ceramic lining, while the bottom of the cell with abrasion-resisting ceramic lining.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts. The components of the aerator, which operate in very hard conditions, are protected against erosion by abrasion-resisting coating, which ensures their proper operation for 10 to 12 months.

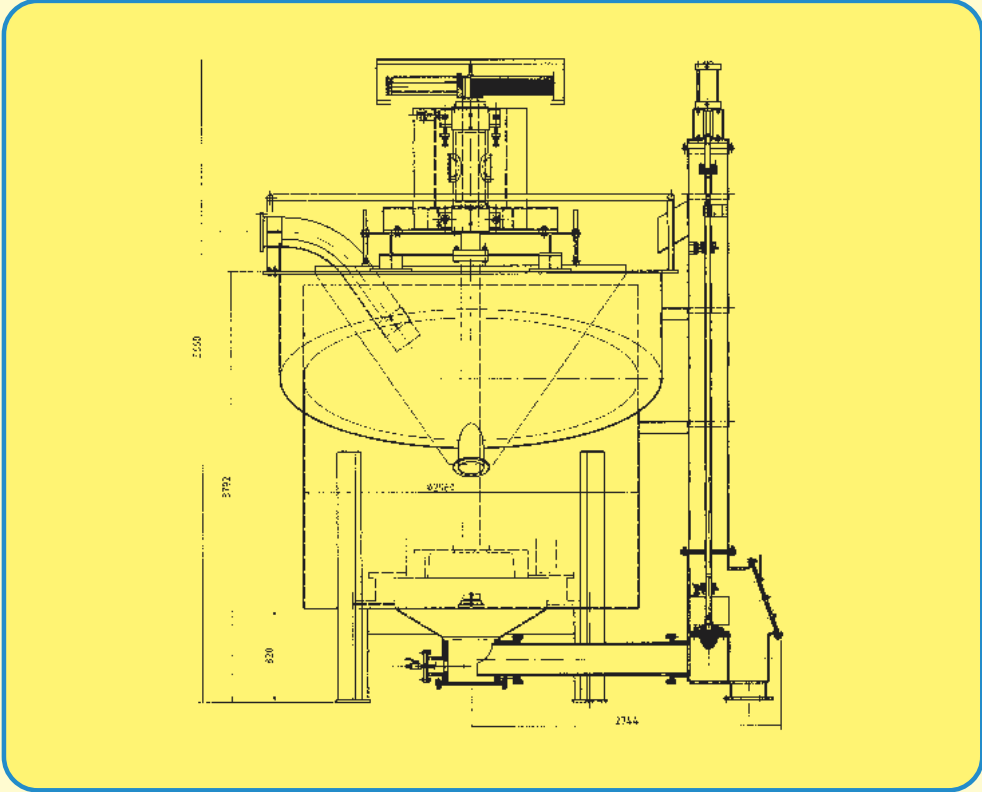
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The automatic air flow control system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with a positioner, connected to a plug valve. For a single flotation machine installation, a two-channel microprocessor controller is used. Changes into set values (of level and of air flow) for control systems are introduced from a panel in the controller. When there are several flotation machines IF-9S installed, the control system uses PLC controller type GE Fanuc 90-30. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHER-NET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	9.2 m <sup>3</sup>
- Working space	5.8 m <sup>3</sup>
- Maximum pulp flow	300 m <sup>3</sup> /h
- Maximum air flow	< 90Nm <sup>3</sup> /h
- Supplied air pressure	0.06 MPa
- Air pressure in a control system	0.30 — 0.60 MPa
- Electric motor rated power	15 kW
- Cell weight	6.2 Mg

# FLOTATION MACHINE IF-19S



## FLOTATION MACHINE IF-19S

The flotation machine IF-19S is a one-cell machine designed for mineral processing by flotation. It is mainly used in a grinding cycle for flotation of pulp with a high concentration of solid parts, up to 800 g/dm<sup>3</sup>, with a high thick grains fraction and for conducting flotation process in a short time. The usefulness of the machine can be mainly observed in flotation of ores which, besides the basic mineral, contain also noble metals, such as gold and silver. The flotation machine is used as a single cell, equipped with all components for automatic control of flotation process conditions.

### Flotation cell

The cell is constructed in a form of a cylindrical tank with a flat bottom passing in its middle part into a cone terminated by a waste cell, which is connected to a waste box. In the waste box working components of a system for pulp level control and connection of a waste pipe are located. To the side surface a circumferential froth product runner is mounted. In the upper part of the cell there is a froth product guide, in a form of inverted cone. Thanks to the mounting way of the froth product guide it is possible to adjust its immersion in the cell, which gives a possibility of changing the surface of froth product in a range between 0.18 – 0.9 m<sup>2</sup>. The material is introduced into the flotation cell by a rubber connection, and the feeding is performed centrally, through the inner space of the froth product guide. Waste is collected centrally, from under the aerator. The cell is placed on four supporting arms welded to the side surface. The flotation cell and supporting structure of aerator drive are protected against corrosion by thick epoxy – acrylic coating. The waste box, in the area where erosion may occur, is made of abrasion resistant steel. The inner surfaces of the cell can be protected with a steel, polymeric or ceramic lining, while the bottom of the cell with abrasion-resisting ceramic lining.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration.

The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts. The components of the aerator, which operate in very hard conditions, are protected against erosion by abrasion-resisting coating, which ensures their proper operation for 10 to 12 months.

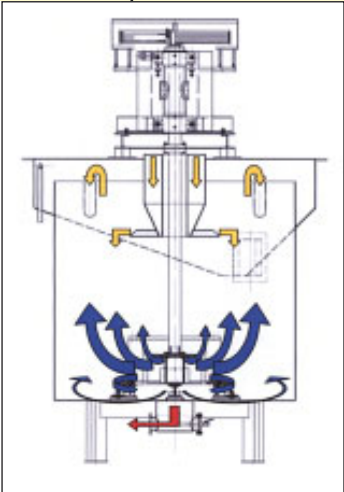
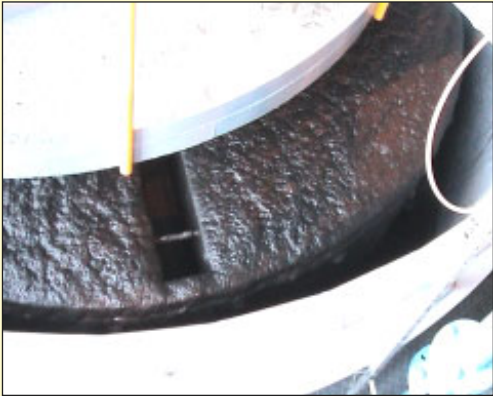
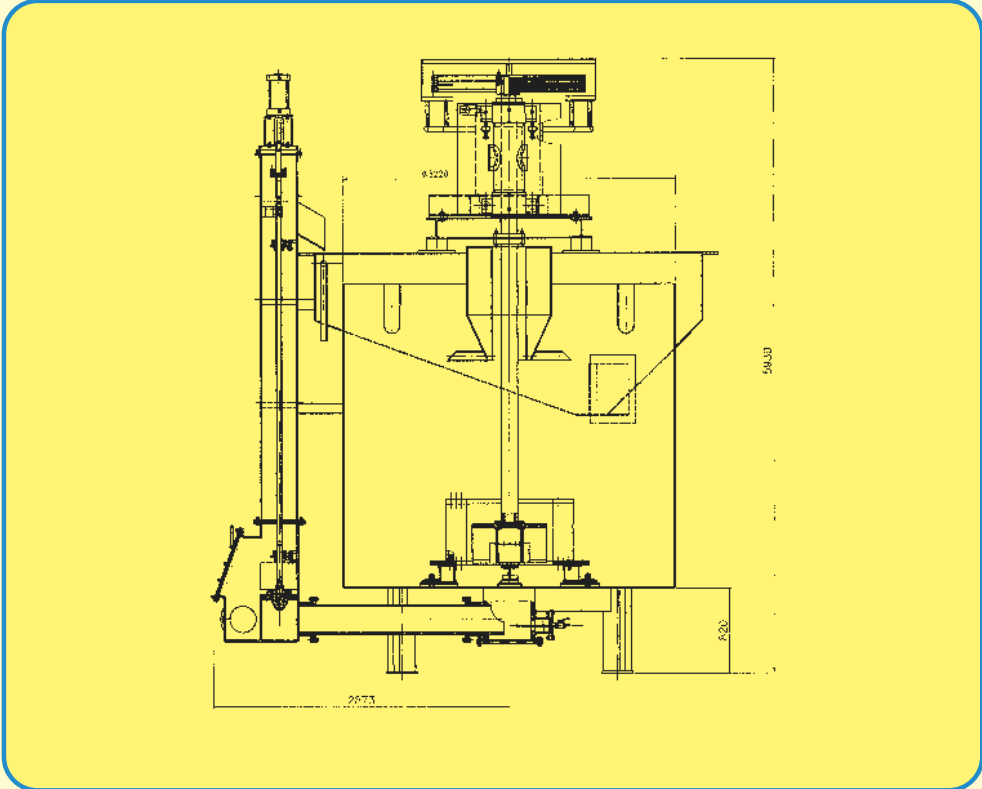
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The automatic air flow control system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with a positioner, connected to a plug valve. For a single flotation machine installation, a two-channel microprocessor controller is used. Changes into set values (of level and of air flow) for control systems are introduced from a panel in the controller. When there are several flotation machines IF-19S installed, the control system uses PLC controller type GE Fanuc 90-30. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHER-NET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	19m <sup>3</sup>
- Working space	13m <sup>3</sup>
- Maximum pulp flow	500m <sup>3</sup> /h
- Maximum air flow	< 90Nm <sup>3</sup> /h
- Supplied air pressure	0.06MPa
- Air pressure in a control system	0.30MPa
- Electric motor rated power	30kW
- Cell weight	10.9 Mg

# FLOTATION MACHINE IF-20RC



## FLOTATION MACHINE IF-20RC

The flotation machine IF-20RC is a one-cell machine designed for mineral processing by flotation. The machine was designed for flotation of suspended matter with a high content of usable components, especially for cleaning crude concentrates in the process of non-ferrous ores enrichment. It is recommended for the flotation machines IF-20RC to be used as a system of single cells operating in a parallel layout, and equipped with individual automatic control systems of air flow and of pulp level.

### Flotation cell

The cell is constructed in a form of a cylindrical tank with a flat bottom. In the central part of the bottom a waste cell is located, connected with a control box, which is equipped with two mushroom-type valves. One valve is controlled by a pneumatic servomotor and the other is controlled manually. The material is introduced to the space above the aerator in the flotation cell through a feed cell, located in the centre of the upper part of the flotation cell, and the waste goes out of the machine through a waste cell, located under the aerator. Thus created vertical pulp flow through the flotation cell ensures multiple flow of grains undergoing flotation through the area of aeration which results in a high degree of froth product enrichment. To the side surface a circumferential froth product runner is mounted, and connected with six radial runners. That system ensures possibility for reception of large volume of froth product. There are two carrying beams at the top of the cell where basis of the aerator of welded construction is mounted. The cell is placed on four supporting arms welded to the side surface. The flotation cell and supporting structure of aerator drive are protected against corrosion by thick epoxy – acrylic coating. The waste cell, in the area where erosion may occur, is made of abrasion resistant steel. The inner surfaces of the cell can be protected with a steel, polymeric or ceramic lining, while the bottom of the cell with abrasion-resisting ceramic lining.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. Components of the aerator are protected against erosion by high quality abrasion-resisting coating, which ensures five year proper operation. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts.

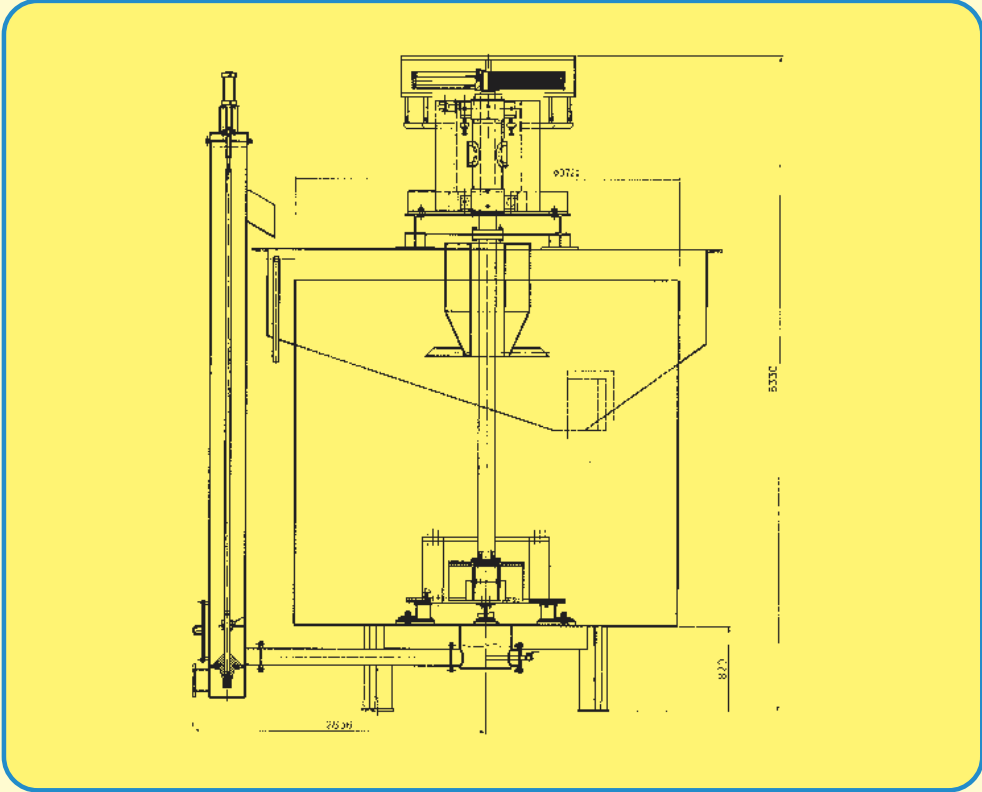
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The automatic air flow control system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with a positioner, connected to a control valve. For a single flotation machine installation, a two-channel microprocessor controller is used. Changes into set values (of level and of air flow) for control systems are introduced from a panel in the controller. When there are several flotation machines IF-20RC installed, the control system uses PLC controller type GE Fanuc 90-30. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHERNET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	23.3 m <sup>3</sup>
- Working space	20 m <sup>3</sup>
- Maximum pulp flow	500 m <sup>3</sup> /h
- Maximum air flow	< 480 Nm <sup>3</sup> /h
- Supplied air pressure	0.05 MPa
- Air pressure in the control system	0.30 – 0,60 MPa
- Electric motor rated power	30 kW
- Cell weight	11.0 Mg

# FLOTATION MACHINE IF-30RC





## FLOTATION MACHINE IF-30RC

The flotation machine IF-30RC is a one-cell machine designed for mineral processing by flotation. The machine was designed for flotation of suspended matter with a high content of usable components, especially for cleaning crude concentrates in the process of non-ferrous ores enrichment. It is recommended for the flotation machines IF-30RC to be used as a system of single cells operating in a parallel layout, and equipped with individual automatic control systems of air flow and of pulp level.

### Flotation cell

The cell is constructed in a form of a cylindrical tank with a flat bottom. In the central part of the bottom a waste cell is located, connected with a control box, which is equipped with two mushroom-type valves. One valve is controlled by a pneumatic servomotor and the other is controlled manually. The material is introduced to the space above the aerator in the flotation cell through a feed cell, located in the centre of the upper part of the flotation cell, and the waste goes out of the machine through a waste cell, located under the aerator. Thus created vertical pulp flow through the flotation cell ensures multiple flow of grains undergoing flotation through the area of aeration which results in a high degree of froth product enrichment. To the side surface a circumferential froth product runner is mounted, and connected with six radial runners. That system ensures possibility for reception of large volume of froth product. There are two carrying beams at the top of the cell where basis of the aerator of welded construction is mounted. The cell is placed on four supporting arms welded to the side surface. The flotation cell and supporting structure of aerator drive are protected against corrosion by thick epoxy – acrylic coating. The waste cell, in the area where erosion may occur, is made of abrasion resistant steel. The inner surfaces of the cell can be protected with a steel, polymeric or ceramic lining, while the bottom of the cell with abrasion-resisting ceramic lining.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor, a stator and a base of the stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. Components of the aerator are protected against erosion by high quality abrasion-resisting coating, which ensures five year proper operation. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts.

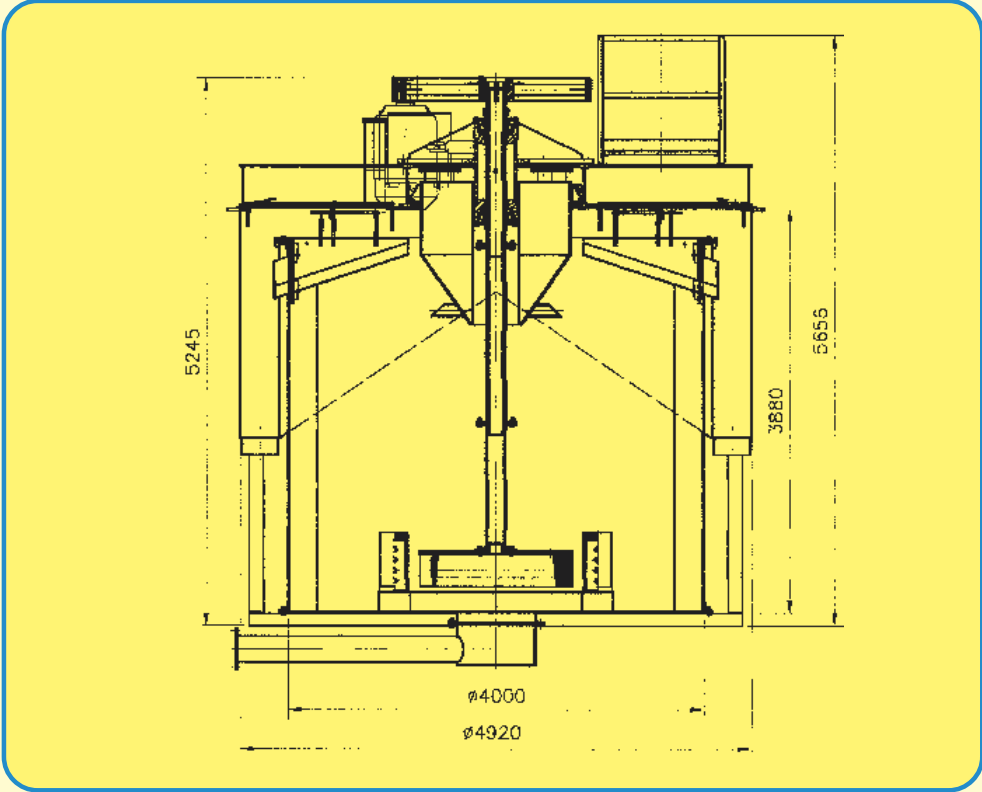
### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The automatic air flow control system is composed of an air flow intensity meter, a manometer, a throttling valve powered by pneumatic servomotor with a positioner. The automatic pulp level control system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with a positioner, connected to a control valve. For a single flotation machine installation, a two-channel microprocessor controller is used. Changes into set values (of level and of air flow) for control systems are introduced from a panel in the controller. When there are several flotation machines IF-30RC installed, the control system uses PLC controller type GE Fanuc 90-30. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHERNET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	34.0 m <sup>3</sup>
- Working space	30.0 m <sup>3</sup>
- Maximum pulp flow	500 m <sup>3</sup> /h
- Maximum air flow	< 480 Nm <sup>3</sup> /h
- Supplied air pressure	0.05 MPa
- Air pressure in the control system	0.30 – 0,60 MPa
- Electric motor rated power	30 kW
- Cell weight	13.1 Mg

# FLOTATION MACHINE IF-45W



## FLOTATION MACHINE IF-45W

The flotation machine IF-45W is a one-cell machine designed for mineral processing by flotation. The design of the machine is optimised for flotation of minerals of high froth product output, such as coal, graphite or sulphur. The flotation machine is used as a single cell, equipped with all components for automatic control of flotation process conditions. When the need arises for application of multiple flotation machines it is recommended to use them in a parallel layout.

### Flotation cell

The cell is constructed in a form of a cylindrical tank with a flat bottom. In the central part of the bottom a waste cell is located, which is connected to a waste box equipped with mushroom valves. The upper part of the cell contains froth product runners in a radial arrangement connected to an outer cumulative runner. The outer froth product cumulative runner runs the whole perimeter of the flotation cell. In the upper part of the cell there is a closed feeding cell, which guarantees uniform feed introduction to the flotation cell. The flotation cell and its components having contact with pulp are protected against corrosion by thick epoxy – acrylic coating. The waste box, in the area where erosion may occur, is made of abrasion resistant steel. The inner surfaces of the cell can be protected with a steel, polymeric or ceramic lining, while the bottom of the cell with abrasion-resisting ceramic lining.

### Aerator

The task of the aerator lies in pulp mixing in the whole volume of the cell, in dispersion of the air, which is supplied into the flotation process, and in generation of inner circulation of the pulp of appropriate intensity and configuration. The aerator consists of a rotor and a stator. The rotor is mounted to the bottom flange of a hollow shaft by bolts. The stator base is central mounted at the bottom of the cell by means of wedges. The sections of the stator are mounted to the base by bolts built of two half-sections and a base of the stator. Components of the aerator are protected against erosion by an abrasion-resisting coating, which ensures five year proper operation.

### Automatic control system for the flotation machine

The system consists of an automatic system controlling flow of the air supplied to the aerator and an automatic pulp level control system. The automatic air flow control system is composed of an air flow intensity meter, a manometer, a throttling valve powered by a pneumatic servomotor with a positioner. The automatic pulp level control system consists of an ultrasonic module for measuring pulp level, a working unit comprising the pneumatic servo with a positioner, connected to a valve. For a single flotation machine installation, a two-channel microprocessor controller is used. Changes into set values (of level and of air flow) for control systems are introduced from a panel in the controller. When there are several flotation machines IF-45W installed, the control system uses PLC controller type GE Fanuc 90-30. Another types of controllers can be used at customer's request. Additionally, the system is equipped with an ETHERNET modem for communication with a supervisory system. Changes into set values (of level and of air flow) for control systems, as well as observation and overview of values — measured, set and controlled in every flotation machine, are performed from a remote panel located in a control cabinet. The remote panel consists of a communication module GENIUS, an analog input/output module and a graphic panel Data Panel 160.

### Technical specification

- Geometrical volume	45m <sup>3</sup>
- Working space	36m <sup>3</sup>
- Maximum pulp flow	780 m <sup>3</sup> /h
- Maximum air flow	< 1,200 Nm <sup>3</sup> /h
- Supplied air pressure	0.045MPa
- Air pressure in a control system	0.30 — 0.60 MPa
- Electric motor rated power	45 kW
- Cell weight	18.6 Mg



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