

# OPERATING MANUAL

## EF

### Electrofinishing machine

Machine number: EF0/026xxxx  
Machine type: EF-One  
Software version: V2.X



EN

**Read manual before beginning any work!**

Please keep for later use

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Original operating manual  
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This manual allows you to use your new machine safely and efficiently. This manual is part of the machine and must be stored in the immediate vicinity thereof, where it can be referred to by personnel at all times.

Personnel must read this manual carefully and ensure they understand it before starting any work. Compliance with all of the indicated safety and action instructions in this manual is a basic condition for working safely with the machine. In addition to this, ensure compliance with the local accident prevention regulations and general safety provisions for the area in which the machine is used.

The images in this manual are intended to facilitate basic understanding, and may vary from the actual configuration.

#### **Other applicable documents**

The following documents, which are stored on the machine tab in the customer portal, also apply in addition to this manual:

- Technical data sheets for abrasives
- Safety data sheets for abrasives
- Processing log (for sample processing)
- Spare parts list

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- Incorrect or negligent handling
- Incorrect assembly or commissioning
- Unsuitable or improper operation or usage
- Improper maintenance
- Unsuitable equipment
- Defective assembly work
- Unsuitable areas of application
- Chemical, electrochemical or electrical influences
- Defects based on designs specified or determined by the customer, or based on materials or other items specified, determined or provided by the customer.

**Customer service**

Please contact our headquarters or the OTEC branches and OTEC distributors if you have any questions about the machine, ordering spare parts, or technical enquiries.

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Furthermore, we are always interested in information and experience that result from using our products and could be valuable for improving them.

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## 1 Safety

Symbols in this manual

## 1 Safety

### 1.1 Symbols in this manual

#### Safety instructions

Safety instructions are identified in this manual by means of symbols. The safety instructions begin with a signal word that expresses the extent of the hazard.

#### **DANGER!**

This combination of symbol and signal word indicates an immediate hazardous situation, which will lead to death or serious injuries if it is not prevented.

#### **WARNING!**

This combination of symbol and signal word indicates a potentially hazardous situation, which could lead to death or serious injuries if it is not prevented.

#### **CAUTION!**

This combination of symbol and signal word indicates a potentially hazardous situation, which could lead to light or minor injuries if it is not prevented.

#### **NOTE!**

This combination of symbol and signal word indicates a potentially hazardous situation, which could lead to material damage if it is not prevented.

#### **ENVIRONMENTAL PROTECTION!**

This combination of symbol and signal word indicates potential environmental hazards.

## Additional indicators

The following indicators are used in this manual to highlight action instructions, results, lists, references and other elements:

| Indicator      | Explanation                                                                      |
|----------------|----------------------------------------------------------------------------------|
| 1., 2., 3. ... | Step-by-step action instructions                                                 |
| ⇒              | Results of action instructions                                                   |
| →              | Individual action step, action step in safety instructions                       |
| ↪              | References to sections of this manual and other applicable documents             |
| ▶              | Reference to page number                                                         |
| ■              | Lists in no particular order                                                     |
| Button         | Control elements (e.g. buttons, switches), display elements (e.g. signal lights) |
| "Display"      | Screen elements (e.g. selection menus, menu items)                               |

## Safety instructions in action instructions

Safety instructions may refer to certain individual action instructions. These safety instructions are embedded in the action instructions, so as to not interrupt the reading flow when carrying out the action. The aforementioned signal words are used.

Example:

1. Loosen the screw.



**CAUTION!**

### Risk of entrapment on cover!

2. Close the cover carefully.
3. Tighten the screw.

# 1 Safety

Symbols in this manual

## Special safety instructions

The safety instructions use the following symbols to draw attention to specific hazards:

| Warning signs                                                                      | Danger type                                   |
|------------------------------------------------------------------------------------|-----------------------------------------------|
|   | Warning against dangerous electrical voltage. |
|   | Warning against hot surface.                  |
|   | Warning against hot liquid.                   |
|  | Warning against a hazardous area.             |

## Tips and recommendations

 **INFO**

This symbol highlights useful tips and recommendations, as well as information that can ensure smooth and efficient operation.

## 1.2 Intended use

The electrofinishing machine is used only for electrochemical surface processing of metallic workpieces. Only abrasives that have been approved by the manufacturer (OTEC Präzisionsfinish GmbH) for the material and the machine type may be used for surface processing. The permitted assignment of abrasives to material and machine type can be found in the technical data sheets for the abrasives. Operator safety and process reliability are guaranteed only if approved abrasives are used.

Intended use also includes compliance with all the information in this manual. Any use beyond or other than the intended use shall be deemed misuse.



### **WARNING!**

#### **Danger due to misuse!**

Misuse of the machine can lead to dangerous situations.

- Only process workpieces made from approved materials.
- Do not exceed the maximum permitted workpiece size.
- Only use abrasives (electrolytes and media) approved by the manufacturer.
- Comply with the service life of the specified abrasive.
- Do not operate the machine in explosive atmospheres.
- Do not close the ventilation gap between the processing unit in processing position and the process container. This can increase the hydrogen concentration and thus significantly increase the risk of an explosion.

During continuous operation of the machine with a high processing performance and a full load, the manufacturer recommends that you change the process container if there are signs of overheating in order to prevent any danger and material damage from overheating.

The maximum service life is 10 years subject to compliance with all maintenance intervals.

## 1 Safety

Basic dangers>General risks at work

### 1.3 Basic dangers

#### 1.3.1 General risks at work

##### Dirt and discarded items

#### CAUTION!

##### **Risk of injury from tripping over dirt and discarded items!**

Dirt and discarded items present a risk of slipping and tripping. Such an accident may cause injuries.

- Always keep the work area clean.
- Remove any items that are no longer required from the work area, and keep them away from the floor in particular.
- Ensure that any areas that present an unavoidable risk of slips and trips are identified with yellow and black marking tape.

##### Fluid accumulations

#### CAUTION!

##### **Risk of injury from slipping on fluid accumulations!**

Slipping on fluid accumulations on the floor can lead to falls. Such an accident may cause injuries.

- Wipe up any fluid accumulations immediately with a suitable aid.
- Wear slip-proof safety boots.
- Attach warning and instruction signs on or near areas where fluids may accumulate on the floor.

### 1.3.2 Dangers from electrical energy

#### Electrical current



#### **DANGER!**

##### **Risk of death from electrical current**

Contact with live parts presents the immediate risk of death from electric shock.

Any damage to the insulation or individual components can be fatal.

- Only allow specialist electricians to carry out work on the electrical system.
- If the voltage supply insulation is damaged, switch off the machine immediately and have it repaired.
- Before beginning work on live parts of electrical systems and equipment, disconnect the respective systems from the voltage supply and do not reconnect until work is complete. When doing this, observe the following 3 safety rules:
  - ⇒ Deactivate.
  - ⇒ Secure against reactivation.
  - ⇒ Ensure that the power supply is disconnected.
- Never bypass or deactivate fuses. When replacing fuses, ensure that the new fuses have the correct current rating.
- Keep moisture away from live parts. This may lead to a short circuit.

### 1.3.3 Dangers from hazardous abrasive

#### Bodily contact with abrasive



#### **WARNING!**

##### **Risk of injury and chemical burns from eye and skin contact with abrasives and from inhaling abrasive dust, vapour or gas!**

Eye and skin contact with the abrasive can cause burns and injuries. Inhaling dust, vapours or gases can cause injuries.

- Avoid contact by wearing personal protective equipment such as goggles, safety gloves and work clothing.
- Avoid dust, vapour or gas inhalation by wearing respiratory equipment.
- Read the safety data sheets for abrasives.

## 1 Safety

Basic dangers>Dangers due to hot surfaces

### 1.3.4 Dangers due to hot surfaces

**Contact with workpiece holders and workpieces**



#### **WARNING!**

##### **Risk of injury from hot surfaces!**

The workpiece holders and workpieces can get very hot after processing. Skin contact with hot surfaces causes severe burns.

→ Avoid contact by wearing personal protective equipment such as safety gloves.

**Contact with the cathode plate**



#### **WARNING!**

##### **Risk of injury from hot cathode plate**

The cathode plate in the process container can get very hot after processing. Skin contact with hot surfaces causes severe burns.

→ Avoid contact by wearing personal protective equipment such as safety gloves.

### 1.3.5 Dangers from hot liquids



#### **WARNING!**

##### **Risk of burns from hot electrolyte in the abrasive**

The electrolyte can get very hot after processing. Skin contact with hot liquids causes severe burns.

→ Avoid contact by wearing personal protective equipment such as safety gloves.

→ Read the safety data sheets for abrasives.

### 1.3.6 Dangers from explosive materials



#### **WARNING!**

##### **Risk of injury caused by explosive atmosphere in process container**

Electrochemical polishing can produce a flammable vapour-air mix. If the vapour-air mix does not escape through the ventilation slits, this can produce a flammable atmosphere in the process container.

→ Always keep the ventilation slits open.

→ Make sure there are no ignition sources or naked flames within a radius of 1.5 m around the machine.

### 1.3.7 Danger: rotating parts



#### **WARNING!**

##### **Risk of injury from long hair caught in planetary gear!**

During operation the ventilation slits may suck in hair which can then get wound around the planetary gear. This can lead to serious injuries.

→ Personnel with long hair must not work on the machine without a hairnet.

## 1 Safety

### Personal protective equipment

#### 1.4 Personal protective equipment

Personal protective equipment helps protect personnel against risks to their health and safety when working.

Personnel must wear personal protective equipment when performing the various tasks on and with the machine. The individual sections of this manual make special reference to the respective equipment necessary.

The personal protective equipment is described below:

##### Description of personal protective equipment



##### Protective work clothing

Protective work clothing is tightly fitting work clothing with low tear resistance, tight sleeves and no protruding parts.



##### Chemical-resistant safety gloves

Chemical-resistant safety gloves help protect the hands against aggressive chemicals.



##### Respiration mask

The respiration mask helps prevent inhalation of dangerous aerosols and vapours produced while using electrolytes.



##### Tightly fitting goggles

Tightly fitting goggles help protect the eyes against flying parts and splashing liquid.



##### Safety gloves

Safety gloves help protect the hands against friction, abrasion, puncturing or deeper injuries, as well as contact with hot surfaces.



##### Safety boots

Safety boots protect the feet against crushing, falling parts and slips on slippery surfaces.

## 1.5 Environmental protection



### ENVIRONMENTAL PROTECTION!

#### **Danger to the environment from incorrect handling of environmentally hazardous substances!**

Incorrect handling of environmentally hazardous substances can cause severe damage to the environment, especially when disposed of incorrectly.

- Always observe the following instructions for handling and disposing of environmentally hazardous substances.
- Take immediate action if environmentally hazardous substances are accidentally released into the environment. If in doubt, inform the local municipal authorities of the damage and ask what suitable measures should be taken.

#### **The following environmentally hazardous substances are sometimes used in the process:**

##### **Electrolyte**

Electrolyte can contain corrosive substances. Some electrolytes are harmful to aquatic organisms and cause long-term effects. It must not be released into the environment. Disposal must be carried out by a specialist disposal company.

##### **Media**

Media must not be released into the environment due to abraded material. Disposal must be carried out by a specialist disposal company.

##### **Lubricants**

Lubricants such as oils and greases contain toxic substances. They must not be released into the environment. Disposal must be carried out by a specialist disposal company.

Further information about recovery and disposal can be found in the section [↗](#).

2 Overview

2.1 Front view

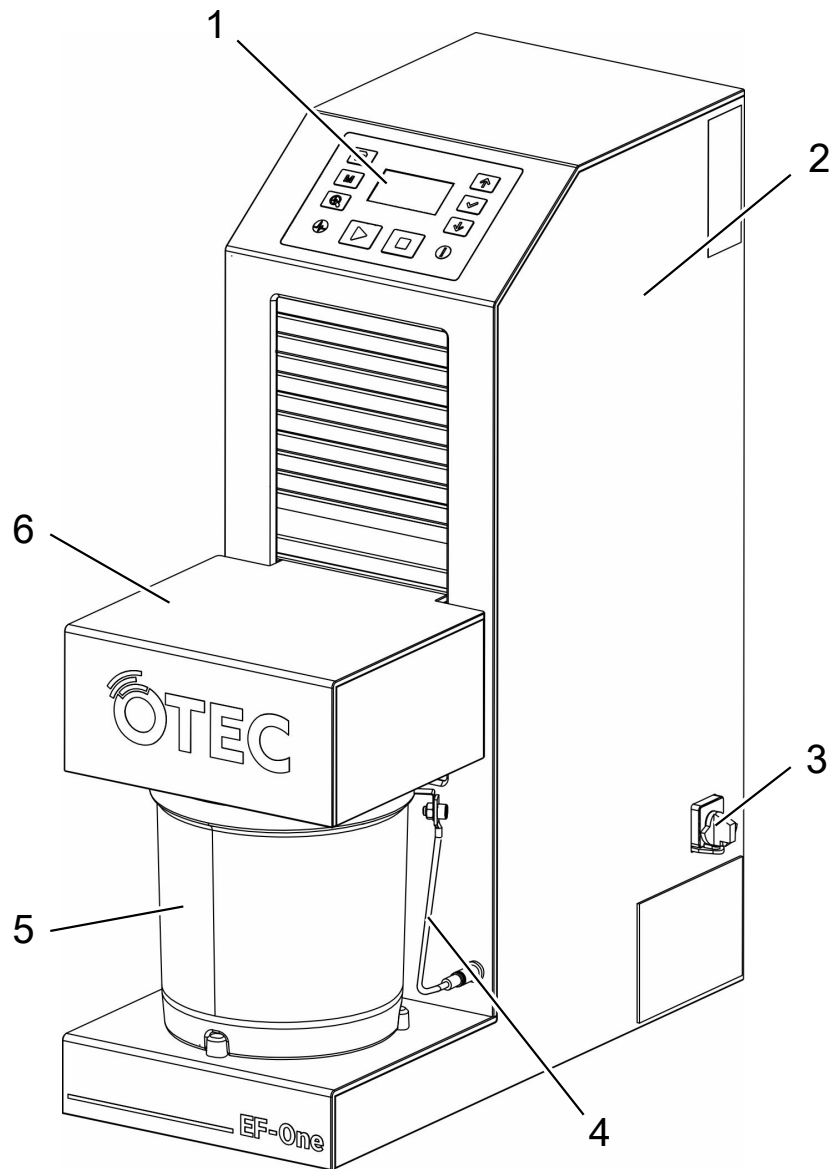


Fig. 1: EF-One front view

|   |                 |   |                                   |
|---|-----------------|---|-----------------------------------|
| 1 | Membrane keypad | 4 | Cathode cable                     |
| 2 | Machine         | 5 | Process container                 |
| 3 | Main switch     | 6 | Processing unit in start position |

## 2.2 Rear view

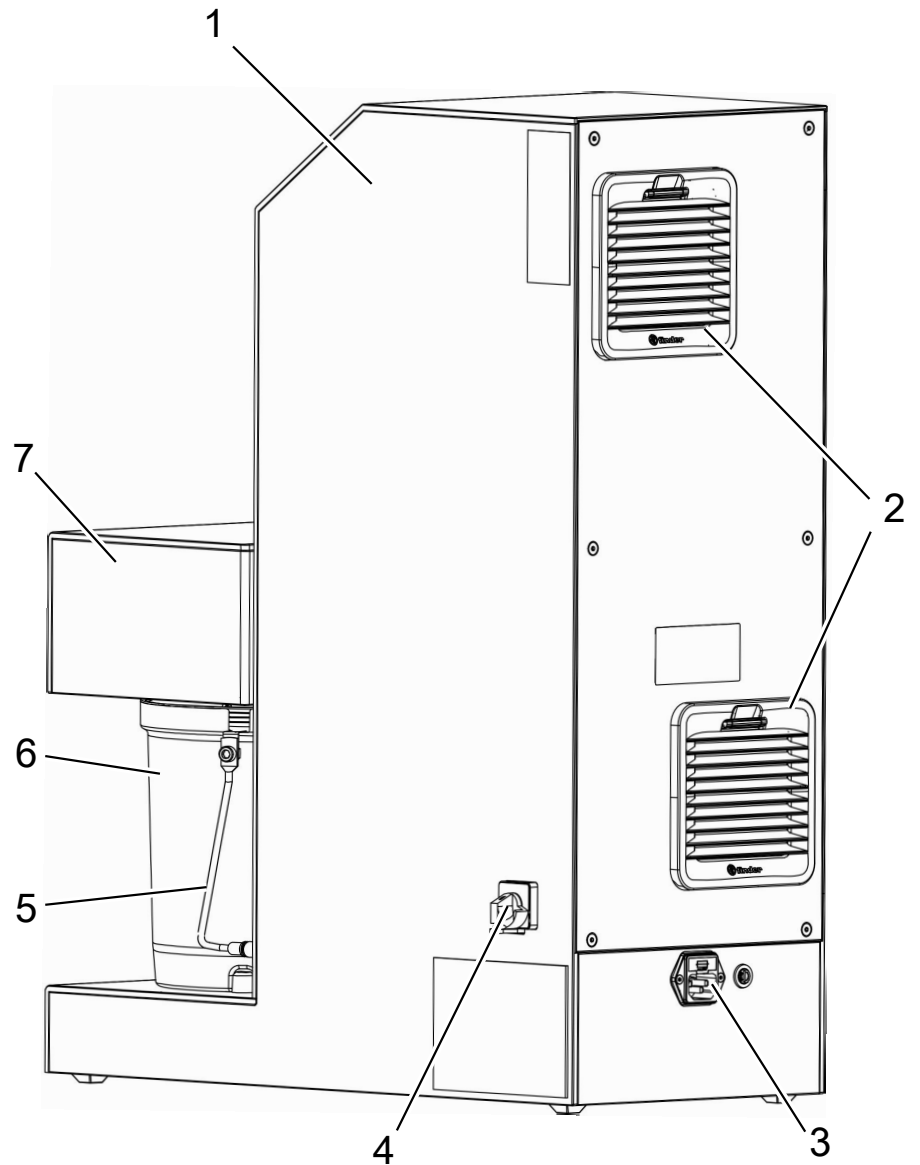


Fig. 2: EF-One, rear view

|   |                     |   |                                        |
|---|---------------------|---|----------------------------------------|
| 1 | Machine             | 5 | Cathode cable                          |
| 2 | Ventilation grilles | 6 | Process container                      |
| 3 | Power connection    | 7 | Processing unit in processing position |
| 4 | Main switch         |   |                                        |

### 3 Design and function

#### Design

The EF-One electrofinishing machine is designed for a lower level of utilisation.

It is used for improving the surface of smaller workpieces using an abrasive. A variety of abrasives may be used according to the required processing results. Workpieces can be processed by smoothing, polishing and deburring.

The EF-One consists of the actual machine (↗ *Fig. 1/2*) and an interchangeable process container (↗ *Fig. 1/5*).

The process area of the machine is in the process container, which is filled with an appropriate electrolyte (electrically conductive liquid) and abrasive, depending on the type of processing planned. The workpieces are attached in workpiece holders. This workpiece holder is secured to a mount in the machine's processing unit. The processing unit houses the planetary gear that drags the workpiece holders through the abrasive in a circular motion.

For processing, the processing unit must be moved down from the start position to the processing position. This is performed manually.

Specific processing is possible by adjusting the combination of electrolyte, abrasive, speed and amperage. Various processing programs allow coarse and fine polishing (e.g. of gold) in a single process.

The process container is removable and can be replaced. Generally, the process containers are delivered with the appropriate abrasive. The type of process container/abrasive is indicated by a label on the process container. Each process container must only be filled with the relevant abrasives to avoid uncontrolled processes. When changing the process container, the cathode plate must be installed in the new process container.

**Operating principle**

Electropolishing is an electrochemical material removal process. The workpiece holder applies an electric current (anode, positive charge) to the workpiece and oxidises it. The abrasive removes the oxide layer, which is then carried to the edge of the process container (cathode, negative charge) by the electrolyte and abrasive.

Electropolishing reduces surface roughness. The process reduces the micro-roughness of the workpiece surface. It removes roughness peaks faster than it removes valleys. It also removes more material from edges and corners, resulting in extra-fine deburring of the whole surface area. The process can therefore also be used for electrochemical deburring.

 **INFO**

Electrolytes continuously degrade due to chemical reactions, material abrasion, ageing and contaminants during surface processing, which reduces their effectiveness. Periodic replacement is therefore essential in order to ensure uniform processing quality and process reliability.

---

**Optional pulse function**

The machine is equipped with an optional pulse function. The pulse function is used for high-gloss polishing of metal surfaces. Depending on the material, different pulse variants can be selected in the control system for processing.

### 3 Design and function

#### Membrane keypad

### 3.1 Membrane keypad

The machine is controlled using the buttons on the membrane keypad. All active buttons light up once selected. A display for showing the machine settings and processing parameters is integrated in the membrane keypad.

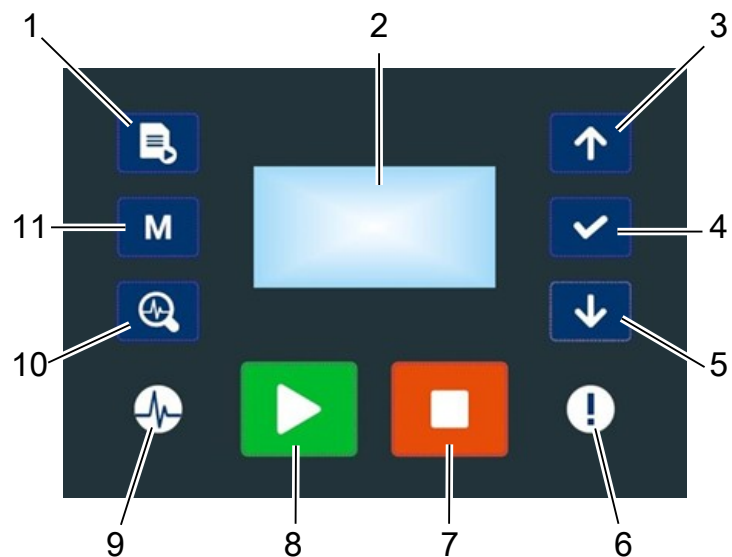


Fig. 3: Membrane keypad

|   |                     |    |                                   |
|---|---------------------|----|-----------------------------------|
| 1 | Program mode button | 7  | Stop button                       |
| 2 | Display             | 8  | Start button                      |
| 3 | Up button           | 9  | Media status LED                  |
| 4 | Edit button         | 10 | Reference measurement mode button |
| 5 | Down button         | 11 | Manual mode button                |
| 6 | Machine status LED  |    |                                   |

### 3.2 Control elements

#### Program mode button



Eight preset processing programs can be selected. Once the button is selected, it lights up. (↪ *Sec. 8.4.3 Program mode ▶ 46*)

Fig. 4: Program mode button

#### Manual mode button



Manual mode allows the processing of workpieces to be selected manually in a single processing step. The speed, voltage, current and processing time can be set. (↪ *Sec. 8.4.4 Manual mode ▶ 46*)

Fig. 5: Manual mode button

#### Reference measurement mode button



A reference measurement can be started using this button when a reference electrode is inserted. (↪ *Sec. 8.4.2 Reference measurement mode ▶ 46*)

Fig. 6: Reference measurement mode button

#### Up button



The input values for speed, voltage, current and processing time are increased or processing programs are selected with this button.

Pressing the  and  buttons simultaneously activates and deactivates the pulse function.

Fig. 7: Up button

#### Edit button



This button opens the edit mode for setting the processing parameters. The button can be used for switching between the input fields and for acknowledging alarm messages.

Fig. 8: Edit button

### 3 Design and function

#### Control elements

##### Down button



Fig. 9: Down button

The input values for speed, voltage, current and processing time are decreased or processing programs are selected with this button.

Pressing the  and  buttons simultaneously activates and deactivates the pulse function.

##### Start button



Fig. 10: Start button

The button flashes as soon as all start conditions (*Sec. 8.5.1 Start conditions* ► 47) have been met. Pressing this button starts the selected process

##### Stop button



Fig. 11: Stop button

Pressing this button unlocks the processing unit. The processing unit moves to the start position (top). This happens irrespective of the current operating state. The current process is interrupted. Briefly pressing this button pauses processing. (*Sec. 8.5.5 Pausing the process* ► 50) Pressing this button for three seconds stops processing (*Sec. 8.5.6 Stopping the process* ► 50).

##### Main switch



Fig. 12: Main switch with emergency shutdown function

The main switch has an emergency shutdown function. In "0" position, the machine is disconnected from the power supply, i.e. switched off. In "1" position, the machine is supplied with power and is switched on.

### 3.3 Display elements

A display for showing the machine settings and processing parameters is integrated in the membrane keypad.

#### INFO

After the machine is switched on via the main switch, the start screen showing the current software version is displayed.

#### 3.3.1 Program mode display

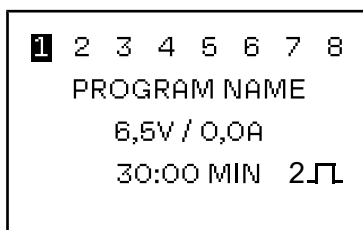


Fig. 13: Program mode display

| Line          | Display                                                                                |
|---------------|----------------------------------------------------------------------------------------|
| Line 1        | Eight preset processing programs can be selected. The selected program is highlighted. |
| Line 2        | Name of the selected program                                                           |
| Line 3        | Voltage and current.                                                                   |
| Line 4        | Pending or remaining processing time.                                                  |
| Line 4, right | Active pulse pattern; visible as soon as a pulse is activated.                         |

#### 3.3.2 Manual mode display

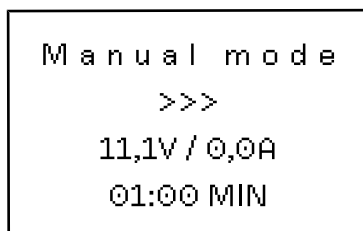


Fig. 14: Manual mode display

| Line   | Display                                                                                |
|--------|----------------------------------------------------------------------------------------|
| Line 1 | "Manual mode" is displayed.                                                            |
| Line 2 | The set speed is indicated by the number of arrows.<br>> Slow<br>>> Medium<br>>>> Fast |
| Line 3 | Voltage and current.                                                                   |
| Line 4 | Pending or remaining processing time.                                                  |

### 3 Design and function

Display elements>Reference measurement mode display

#### 3.3.3 Reference measurement mode display

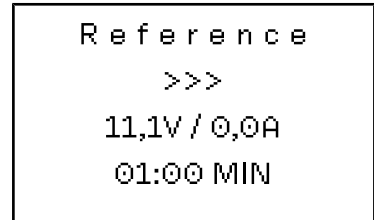


Fig. 15: Reference measurement mode display

| Line   | Display                                                                                |
|--------|----------------------------------------------------------------------------------------|
| Line 1 | "Reference" mode is displayed.                                                         |
| Line 2 | The set speed is indicated by the number of arrows.<br>> Slow<br>>> Medium<br>>>> Fast |
| Line 3 | Voltage and current.                                                                   |
| Line 4 | Pending or remaining processing time.                                                  |

#### 3.3.4 Media status LED



Fig. 16: Media status indicator

Status messages (↩ *Sec. 10.2.1 Media status fault messages table ▶ 62*) are reported in colour by an LED on the media status indicator.

#### 3.3.5 Machine status LED

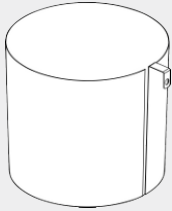
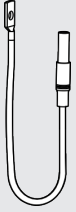


Fig. 17: Machine status indicator

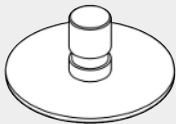
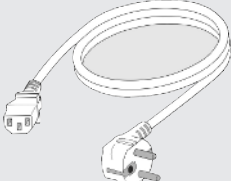
Status messages (↩ *Sec. 10.2.2 Machine status fault messages table ▶ 63*) are reported in colour by an LED on the machine status indicator.

## 4 Components and accessories

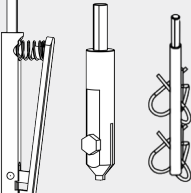
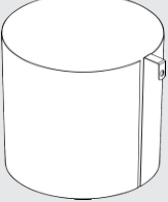
### Components

| Figure                                                                              | Description                                                                                                                              |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
|    | Standard cathode plate                                                                                                                   |
|    | Reference electrode                                                                                                                      |
|   | Quick-clamping holder (standard)                                                                                                         |
|  | Cathode cable                                                                                                                            |
|  | Hexagon socket<br>The hexagon socket (size 8) is required for changing the workpiece holders.                                            |
|  | Measuring beaker<br>The measuring beaker is used to top up electrolyte or water. It can also be used to perform inspection measurements. |

## 4 Components and accessories

| Figure                                                                            | Description      |
|-----------------------------------------------------------------------------------|------------------|
|  | Liquid indicator |
|  | Mains cable      |

### Accessories

| Figure                                                                              | Description                               |
|-------------------------------------------------------------------------------------|-------------------------------------------|
|   | Various workpiece holders (example)       |
|  | Cathode plate for Wg-Pd                   |
|  | Process container with abrasive and cover |

### 4.1 Workpiece holder overview

| Name                                                           |
|----------------------------------------------------------------|
| Quick-clamping holder (standard)                               |
| Coated quick-clamping holder (required for finishing titanium) |
| Holder for crowns and bridges                                  |
| Holder for orthodontics                                        |
| Titanium clamp holder D 5 mm                                   |
| Quick-clamping holder (narrow)                                 |
| Clamp holder                                                   |
| Holder for 6 rings                                             |
| Reference electrode                                            |

Tab. 1: Workpiece holders and reference electrodes

## 5 scope of delivery, packaging and storage

Transporting with a forklift truck/pallet jack

## 5 scope of delivery, packaging and storage

### 5.1 Transporting with a forklift truck/pallet jack

#### Incorrect transport



#### **WARNING!**

##### **Risk of death from falling and/or toppling transport units!**

Transport units may topple, slip and/or fall if transported incorrectly. This can lead to death or serious injury.

- Pay attention to any markings and information about the centre of gravity on the transported items.
- Transport may only be performed by qualified and safety-trained personnel.
- Only use approved and tested forklift trucks/pallet jacks with sufficient load-bearing capacity.
- Avoid jerky movements and shocks when lifting the packaging units.
- Never walk into or beneath the transport area during transport.



#### **NOTE!**

##### **Material damage from incorrect transport!**

Incorrect transport can cause transported items to fall or topple. This can lead to serious material damage.

- Proceed carefully when unloading the transported items on delivery and when transporting internally. Observe the symbols and instructions on the packaging.
- Only use the intended sling points.
- Only remove the packaging shortly before assembly.

##### **Personnel:**

- Transport specialist

##### **Protective equipment:**

- Industrial helmet
- Safety boots

Check the transport conditions:

- Transport must take place over level and smooth surfaces.
- Affix an additional safety fixture against tilting/slipping if transported items have to be transported on inclined surfaces.
- Check the floor's load-bearing capacity and the dimensions of doors and lifts.
- Observe the specified weights of the machine and the machine components.

1. When positioning lifting forks under the pallet, make sure not to damage or topple the machine.
2. Carefully transport the machine to the installation location.

### 5.2 Scope of delivery

The machine is delivered in compact cardboard packaging.

The scope of delivery includes:

| Item                             |
|----------------------------------|
| Machine                          |
| Mains cable                      |
| Cathode plate of stainless steel |
| Cathode cable                    |
| Reference electrode              |
| Liquid indicator                 |
| Ti5 quick-clamping holder        |
| Hexagon socket                   |
| Measuring beaker                 |

Tab. 2: EF-One scope of delivery

### 5.3 Checking the scope of delivery

Check the delivery immediately upon receipt for completeness and transport damage.

If you detect any external transport damage, proceed as follows:

- Refuse delivery or only accept conditionally.
- Note the extent of the damage on the transport documents or the carrier's delivery note.
- Lodge a complaint.



#### INFO

Make a complaint for all damages as soon as they are detected.

Damage claims may only be asserted within the valid claim periods.

### 5.4 Packaging

#### Handling packaging material

Dispose of packaging material in accordance with the valid legal provisions and local regulations.

#### About the packaging

The individual packages are packed according to the expected transport conditions. Only environmentally friendly materials were used for the packaging.

The packaging is intended to protect the individual components against transport damage, corrosion and other damage up to the point of assembly. For this reason, do not destroy the packaging and only remove it shortly before assembly.

## 5.5 Storage conditions

Please observe the following points if the machine or its individual components is/are put into intermediate storage, instead of being assembled immediately.

Store the machine under the following conditions:

- If the machine has already been used, decommission it before putting it into storage.
- Do not store in the open air.
- Store in a dry place that is free of dust.
- Do not expose the machine to aggressive media.
- Protect against solar radiation.
- Avoid mechanical shocks.
- Store horizontally on a level surface.
- Storage temperature: 5–40°C
- Relative humidity: 50% at a maximum temperature of 40°C, non-condensing. Higher relative humidity is permissible at lower temperatures (e.g. 90% at 20°C).
- If storing for longer than 3 months, regularly check the general state of all parts and the packaging. Refresh or replace the conservation agent if required.
- Protect the steel parts of the machine against corrosion (e.g. using anti-corrosion oil or VCI packaging).

## 6 Installation

Establishing electrical connection

## 6 Installation

### 6.1 Installing the machine



#### INFO

The machine is a table-top machine. Take the technical data, such as size and weight, into account during installation.

#### Personnel:

- Transport specialist
- Fitter
- Service technician

#### Protective equipment:

- Protective work clothing
- Safety boots

#### Condition:

- The installation location is prepared.

1. Lift the machine onto the table with the help of a second person if necessary.
2. Place the process container and abrasive on the table.

### 6.2 Establishing electrical connection

#### Personnel:

- Machine operator

#### Protective equipment:

- Protective work clothing
- Safety boots

➔ Connect the machine to the power supply using the supplied mains cable.

## 7 Commissioning

### 7.1 Preparing components for the process

**Personnel:**

- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Materials:**

- EF media, EP media  
or
- EF liquid with solids (e.g. LFPP 3)
- Process container
- Cathode plate
- Cathode cable
- Cleaning cloth

**Conditions:**

- The electrical connection is established.
- The machine is switched off at the main switch.
- Sufficient space on the work surface.
- A used cathode plate has been cleaned.

## 7 Commissioning

Preparing components for the process

### Inserting cathode plate into process container

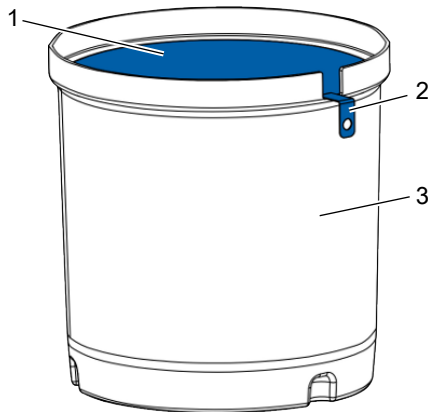


Fig. 18: Inserting the cathode plate

|   |                   |
|---|-------------------|
| 1 | Cathode plate     |
| 2 | Connecting lug    |
| 3 | Process container |

#### INFO

OTEC recommends always inserting the cathode plate into an empty process container.

There should not be any media between the cathode plate and the inside of the process container.

1. Push the cathode plate down into the process container until it is sitting on the centring points (↪ Fig. 20/4) of the process container.
2. The connecting lug (↪ Fig. 18/2) of the cathode plate must be in the opening on the process container.
3. Bend the connecting lug of the cathode plate over.

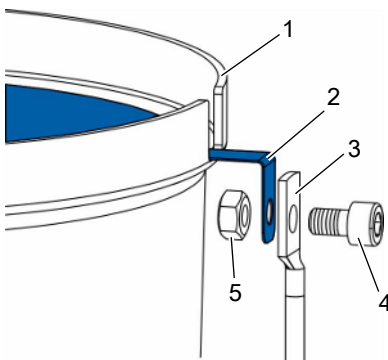
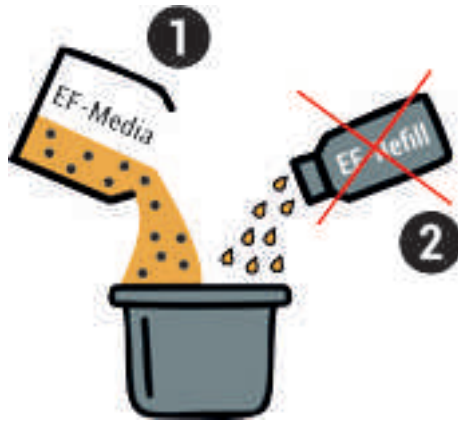


Fig. 19: Fitting the cathode cable on the cathode plate

|   |                   |
|---|-------------------|
| 1 | Process container |
| 2 | Connecting lug    |
| 3 | Cable lug         |
| 4 | Fastening screw   |
| 5 | Clamp nut         |

4. Secure the cable lug of the cathode cable (↪ Fig. 19/3) with the fastening screw (↪ Fig. 19/4) and the clamp nut (↪ Fig. 19/5) to the connecting lug of the cathode plate (↪ Fig. 19/2).
- ⇒ The cathode plate is now secured in the process container.

### Filling the process container



#### **i** INFO

A refill liquid is included with the abrasive. This must **not** be filled into the process container together with the abrasive.

Use the refill liquid only for subsequent dosing, as per the technical data sheet.

The technical data sheet is included with the abrasive.

→ Open the packaging of the abrasive and add it all into the process container.

⇒ The process container is ready for use in the machine.

### Inserting the process container

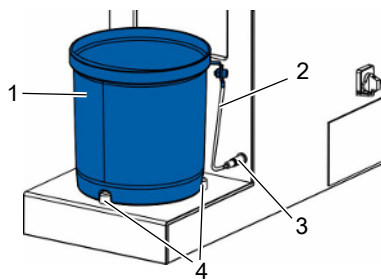


Fig. 20: Inserting the process container

|   |                                     |
|---|-------------------------------------|
| 1 | Process container                   |
| 2 | Cathode cable                       |
| 3 | Connection socket for cathode cable |
| 4 | Centring points                     |

### 7.1.1 Replacing abrasives

#### **i** INFO

The abrasives are assigned to the process containers. Always replace abrasives using the assigned process containers.

### 7.1.2 Storing process containers

#### INFO

The covers are designed so that several process containers can be stacked.

The cover does not seal the process container fully and as a result, media can escape when the process container is tipped over.

Process containers with abrasives that are not currently being used should be covered to protect the abrasives against contamination and drying out.

Material:

- Process container with cathode plate and abrasive
  - Process container cover
1. Take the process container with the abrasive out of the machine.
  2. Place the cover on the process container.
    - ⇒ The process container is ready for storage.

### 7.1.3 Cleaning the cathode plate

**Personnel:**

Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Materials:**

Collection tray

Lint-free cleaning cloth

**Condition:**

- The cathode plate is undamaged
- The cathode cable is not connected to the machine

1. Remove the cathode plate from the process container.
2. Clean the collection tray by rinsing it under running water.
3. Dry it with a cleaning cloth.
4. Dispose of any residual abrasive and the cleaning cloth properly.
  - ⇒ All residual abrasive is now removed.

## 8 Operation

Inserting/removing workpiece holders/reference electrodes

## 8 Operation

### 8.1 Inserting/removing workpiece holders/reference electrodes

#### Inserting the workpiece holder/reference electrode

##### Personnel:

- Machine operator

##### Protective equipment:

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment



#### **WARNING!**

##### **Risk of injury from hot surfaces!**

The workpiece holders, workpieces, abrasive and cathode plate can get very hot after processing. Skin contact with hot surfaces causes severe burns.

➔ Avoid contact by wearing personal protective equipment such as safety gloves.

##### Conditions:

- Machine is switched off
- Processing unit is in start position
- Process container with abrasive is fitted in the machine
- Workpiece holder mount is free

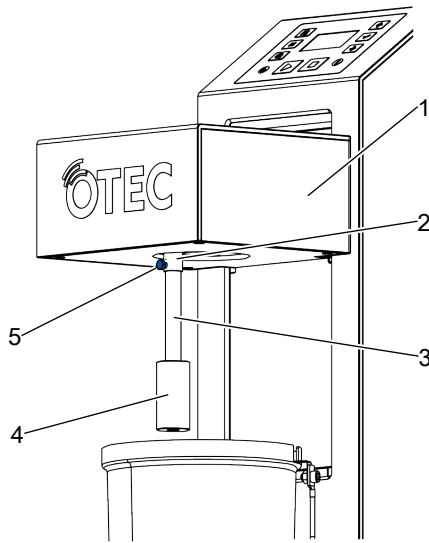


Fig. 21: Inserting the reference electrode

|   |                                   |
|---|-----------------------------------|
| 1 | Processing unit in start position |
| 2 | Mount                             |
| 3 | Reference electrode holder        |
| 4 | Reference electrode               |
| 5 | Locking screw                     |

1. Carefully push the workpiece holder/reference electrode (↘ Fig. 21/4) into the mount (↘ Fig. 21/2).
2. Tighten the locking screw (↘ Fig. 21/5) against the flat surface on the workpiece holder/reference electrode using a hexagon socket.  
⇒ The workpiece holder/reference electrode is in place.



Fig. 22: Example with holder in place

### Removing the workpiece holder/reference electrode

3. Hold the workpiece holder/reference electrode (↘ Fig. 21/3) securely with one hand.
4. Use your other hand to loosen the locking screw (↘ Fig. 21/5) using the hexagon socket.  
⇒ The workpiece holder/reference electrode disengages from the mount.

## 8.2 Inserting workpieces into quick-clamping holder



### WARNING!

#### Risk of injury from hot surfaces!

The workpiece holders and workpieces can get very hot after processing. Skin contact with hot surfaces causes severe burns.

→ Avoid contact by wearing personal protective equipment such as safety gloves.

 **NOTE!**

**Material damage caused by oversized workpieces or incorrectly secured workpieces**

Oversized workpieces (  ) can hit against the cathode, workpiece holders or dome during processing in the process container and severely damage them. Incorrectly secured workpieces can also hit against other components and damage them.

- ➔ Do not exceed the maximum workpiece size.
- ➔ Consult the manufacturer if your workpiece sizes deviate from the specification.
- ➔ Check envelope-shape geometry when securing the workpieces.

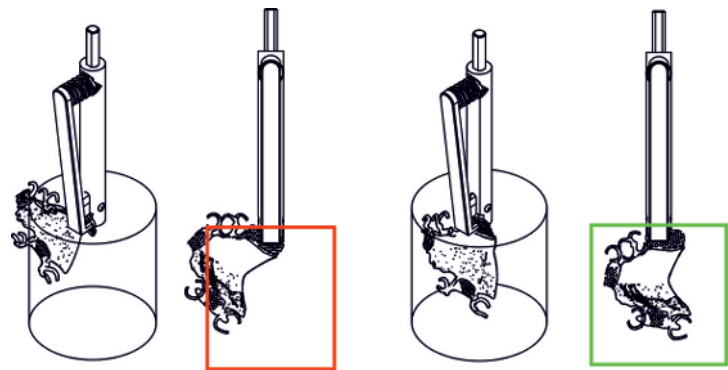


Fig. 23: Envelope-shape geometry for permitted workpiece size and for securing workpieces, example

|              |                                                                                                                                                         |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Red</b>   | The workpiece is not secured correctly. The workpiece breaks through the envelope shape. There is a risk of hitting other components during processing. |
| <b>Green</b> | The workpiece is inside the envelope shape. The workpiece is the correct size and is secured correctly.                                                 |

**Personnel:**

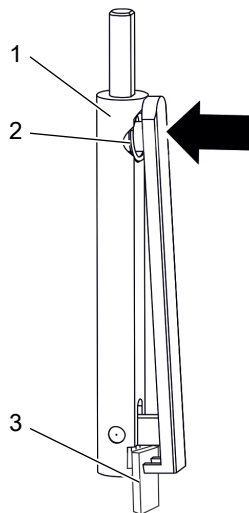
- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

Condition:

- The processing unit with the workpiece holder is in the start position.



1. Press and hold the actuation point (↗ Fig. 24/arrow).  
⇒ The clamp holder opens.
2. Insert the workpiece (↗ Fig. 24/3) into the clamp holder (↗ Fig. 24/1).
3. Release the actuation point (↗ Fig. 24/arrow).  
⇒ The workpiece is inserted.

*Fig. 24: Inserting workpiece into quick-clamping holder*

|       |                       |
|-------|-----------------------|
| 1     | Quick-clamping holder |
| 2     | Spring                |
| 3     | Workpiece, example    |
| Arrow | Actuation point       |

## 8 Operation

Machine settings/operating state>Machine settings

### 8.3 Machine settings/operating state

#### 8.3.1 Machine settings



Settings cannot be changed in the "Reference measurement" and "Program" modes. Settings can only be changed in "Manual" mode.

The following settings can be changed in *manual mode*:

Fig. 25: Fig.: Manual mode button

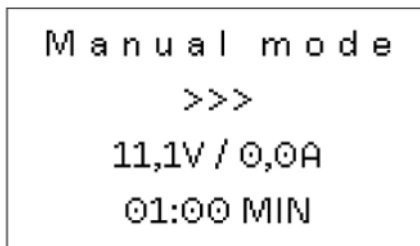


Fig. 26: Manual mode display

#### Speed

The speed can be set to 3 different settings: Slow, Medium and Fast. This is indicated by arrow symbols >>> in Line 2. To set, press the  button until the cursor is in the required input field. Use the  or  buttons to select the required speed. This setting is made before or during operation.

#### Voltage/current

The voltage and current rating values are shown on the display. Either the voltage or the current can be set. The other value is then calculated automatically and displayed during processing.

To set, press the  button until the cursor is in the required input field. The input value can be increased or decreased by pressing the  and  buttons.

The **voltage** can be set in the range from 0 to 24 V DC. If the resulting current consumption exceeds 6 A, processing will be interrupted and a fault alarm will be displayed. (↪ Sec. 3.3.4 Media status LED ► 26) ↪ Sec. 3.3.5 Machine status LED ► 26)

The **current** can be set in the range from 0 to 6 A.

#### Processing time

The processing time can be set in minutes. The processing time counts down in seconds.

### Pulse module



Fig. 27: Pulse display

Pressing the  and  buttons simultaneously will activate/deactivate the pulse function. The pulse function can only be activated if the active abrasive enables pulse processing, as indicated by the label on the process container. If the process container is removed from the machine, the pulse function is deactivated.

#### INFO

When the **voltage** is entered, all pulse patterns are available.

When the **current** is entered, the pulse patterns are available only to a limited extent depending on the media used.

#### INFO

Refer to the technical data sheet for more information about pulse numbers and pulse processing.

The technical data sheet is included with the abrasive or is available from OTEC.

### 8.3.2 Operating state

The machine can switch between the operating states "Started", "Paused" and "Stopped" in each operating mode. The start conditions ( *Sec. 8.5.1 Start conditions* ► 47) must be met.

## 8 Operation

Operating modes>Selecting the operating mode

### 8.4 Operating modes

#### 8.4.1 Selecting the operating mode

Select the operating mode using the corresponding button on the membrane keypad. The machine must be stopped in order to change an operating mode.

#### 8.4.2 Reference measurement mode



Fig. 28: Reference measurement mode button

After restarting the machine, Reference measurement mode is activated. If the start conditions (↪ *Sec. 8.5.1 Start conditions* ► 47) are met and the reference electrode is inserted, a reference measurement can be started. The necessary processing parameters are set automatically. The status of the measurement is indicated by the media status LED.

The operating mode "Reference" appears on the display.

#### 8.4.3 Program mode



Fig. 29: Program mode button

Eight programs are stored in the machine.

Activate program selection using the  button. Select the program using the  and  buttons. Confirm the selection using the  button. The selected program is displayed with its number and name. If all start conditions (↪ *Sec. 8.5.1 Start conditions* ► 47) are met, processing can start.

#### 8.4.4 Manual mode



Fig. 30: Manual mode button

The operating mode "Manual mode" appears on the display. Manual mode allows manual processing of workpieces in a single processing step. After switching to this operating mode, the last activated processing parameters from the previous process are retained. Use the ,  and  buttons to set the values for speed, voltage, current and processing time.

#### 8.4.5 Pulse pattern



Fig. 31: Pulse display

As soon as a program with pulse capability is selected, the pulse module together with the number of the active pulse pattern will appear on the display.

Activation of the pulse function.

## 8.5 Processing workpieces

### 8.5.1 Start conditions

To start processing or to start a reference measurement, the start conditions must be met.

Requirements

- The machine is switched on.
- The process container with abrasive is inserted.
- The machine status LED lights up green.
- The processing unit is loaded with a workpiece holder or a reference electrode.
- The processing unit was moved to the processing position manually.
- The media status LED does not indicate any faults.

→ Start the process or reference measurement.

⇒ The machine is ready to start.

### 8.5.2 Starting the machine



#### INFO

During processing, process parameters can be changed by making changes in the required fields.

→ The changed parameters are not applied in the active program.

#### Personnel:

Machine operator

#### Protective equipment:

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

### **NOTE!**

#### **Wear on the workpiece holders during titanium processing in the EF-One**

If the workpiece holder is made of titanium, it will wear during processing of titanium workpieces.

### **WARNING!**

#### **Risk of injury from electromagnetic radiation from the pulsed process stream**

Processing workpieces using a pulsed process stream (pulse frequency of up to 25 kHz) can produce electromagnetic radiation. Electromagnetic radiation can influence the function of pacemakers and implantable cardioverter-defibrillators (ICDs).

These magnetic fields can render sensitive measuring equipment, clocks and data carriers such as cheque cards, disks, etc. permanently unusable. The same applies to pacemakers.

- ➔ People with pacemakers and implantable cardioverter-defibrillators must stay 1 m away from the machine.
- ➔ Always warn people with pacemakers and implantable cardioverter-defibrillators before approaching the machine.

### **WARNING!**

Risk of injury caused by inhaling dust, vapours and gases. Risk of burns and injuries from eye and skin contact with abrasive!

Conditions:

- The machine is connected to the power supply and switched on via the main switch
- A process container with approved abrasive is in place, and the abrasive's service life is OK
- While the machine is starting, all buttons and status LEDs light up white. This indicates that there are no faults and the machine is ready

1. Manually push the processing unit down to processing position.  
⇒ The processing unit is now locked.
2. In Reference measurement mode or Program mode, select a suitable program for the abrasive (↪ *Sec. 8.4 Operating modes* ► 46).
3. The Start button flashes.  
⇒ Processing or a reference measurement can be activated using the  button.

### 8.5.3 Starting a reference measurement

#### Performing a reference measurement



Fig. 32: Reference measurement mode button

- The start conditions (↪ *Sec. 8.5.1 Start conditions* ► 47) must be met.
- The reference electrode is installed.

1. Press the  button.
2. Press the  button.  
⇒ The machine stirs the abrasive for two minutes.  
⇒ The machine then performs the actual reference measurement for one minute.  
⇒ The reference voltage stored on the container is then visible on the display.

### 8.5.4 Starting the process

#### Performing processing



Fig. 33: Program mode button

- The start conditions (↪ *Sec. 8.5.1 Start conditions* ► 47) must be met.
- The workpiece holder with workpieces loaded is installed.

1. Press the  button.
2. Select a processing program.
3. Press the  button.  
⇒ The machine switches to the operating state "Started".  
⇒ The set parameters are activated and the processing time counts down.
4. The processing time is reset after the processing or measurement duration has elapsed.  
⇒ Processing is finished.

## 8 Operation

Processing workpieces>Pausing the process

### 8.5.5 Pausing the process

#### Interrupting processing

- A processing program is running.
- 1. Briefly press the  button, or if there is an active fault, the operating state will change from "Started" to "Paused".
- 2. The process or measurement is paused and the processing unit moves up to the start position.
  - ⇒ The process is stopped and the remaining processing time is stored.
- 3. Move the processing unit back to the processing position and press the  button. Processing is resumed.
- 4. The processing time is reset after the processing duration has elapsed. The processing unit moves to the start position (top).

### 8.5.6 Stopping the process

#### Stopping processing

##### Requirements

- A processing program is running.
- ➔ Press the  button for three seconds. The operating state changes from "Started" to "Stopped".
  - ⇒ The processing time is reset.
  - ⇒ The processing unit unlocks and automatically moves up to the start position.
  - ⇒ The power supply to the motor is interrupted.
  - ⇒ The process has been stopped.

## 9 Servicing

### 9.1 Wear parts

OTEC recommends holding wear parts in stock to keep your machine operating reliably and efficiently.

The table below lists a few examples of **typical wear parts** that may be required within the first 24 months, depending on machine usage levels.

| Designation                    |
|--------------------------------|
| Cathode plate for Wg-Pd        |
| Standard cathode plate         |
| Cathode cable                  |
| Liquid indicator               |
| Process container              |
| Reference electrode            |
| Clamp holder                   |
| Titanium clamp holder, D 5 mm  |
| Quick-clamping holder, Narrow  |
| Holder for crowns and bridges  |
| Titanium quick-clamping holder |
| Coated quick-clamping holder   |
| Clamping spring set            |

Tab. 3: Wear parts

#### INFO

OTEC does not accept defect claims for wear part durability that is typical for the market or product.

For the precise warranty conditions, please refer to the "Standard Terms and Conditions of Business" at

<https://www.otec.de/en/downloads/terms-of-business/>.

## 9.2 Maintenance plan

The following sections describe the maintenance necessary to ensure optimum and fault-free machine operation.

Should you notice increased wear during the regular inspections, shorten the required maintenance intervals according to the actual wear. **The maintenance intervals are designed for 1-shift operation (40-hour week).** Contact the manufacturer should you have any questions related to maintenance work and intervals (see contact data).

| Operating hours        | Calendar interval |
|------------------------|-------------------|
| 8 operating hours      | Daily             |
| 40 operating hours     | Weekly            |
| 160 operating hours    | Monthly           |
| 480 operating hours    | 3 months          |
| 1,000 operating hours  | 6 months          |
| 2,000 operating hours  | Yearly            |
| 6,000 operating hours  | 3 years           |
| 10,000 operating hours | 5 years           |
| 20,000 operating hours | 10 years          |

Tab. 4: Operating hours and corresponding calendar intervals in 1-shift operation

Perform required measures after carrying out maintenance ☞ .

| Servicing cycle | Additional information                                                                                                                                                            | Personnel        |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Daily           | <i>Cleaning the machine</i> (☞ Sec. 9.3.1 <i>Cleaning the machine</i> ► 53)                                                                                                       | Machine operator |
|                 | <i>Checking electrical conductivity of the abrasives</i> (☞ Sec. 9.3.2 <i>Checking electrical conductivity of the abrasives</i> ► 54)                                             |                  |
|                 | <i>Checking liquid coverage at standstill (only for EF media and EP media)</i> (☞ Sec. 9.3.3 <i>Checking liquid coverage at standstill (only for EF media and EP media)</i> ► 56) |                  |
| Weekly          | <i>Cleaning the cathode plate</i> (☞ Sec. 9.3.4 <i>Cleaning the cathode plate</i> ► 57)                                                                                           | Machine operator |
| As required.    | <i>Replacing abrasives</i> (☞ Sec. 9.3.5 <i>Replacing abrasives</i> ► 58)                                                                                                         | Machine operator |

## 9.3 Maintenance work

### 9.3.1 Cleaning the machine

**Interval: Daily**

**Time required: 5 min**

**Personnel:**

- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Materials:**

- Lint-free cleaning cloth
- Lukewarm water with mild cleaning agent

**Condition:**

- The machine is switched off at the main switch.

1. Remove the process container.
2. Clean the machine with a soft, damp cleaning cloth and mild cleaning agent.
3. Rinse with clean water and dry off.
4. Dispose of any residual abrasive and the cleaning cloth properly.

### 9.3.2 Checking electrical conductivity of the abrasives

Liquid is lost as a result of the heat produced by the reaction and evaporation during processing with the machine. This loss of liquid affects the electrical conductivity of the electrolyte. Check the liquid coverage before checking the electrical conductivity .

The reference electrode measures the electrical conductivity of the electrolyte. The machine operator compares this with the reference current value on the technical data sheet for the abrasive.



#### Reference measurement for which abrasives?

Reference measurement is necessary only for certain abrasives (EF liquid, EF media).

- ➔ Read the technical data sheet for the abrasive before starting processing.
- ➔ To find out the reference current value, refer to the technical data sheet for the abrasive. Call up the technical data sheet using the Media Activation app (scan the QR code of the abrasive) or in the customer portal.

#### Interval: Daily

**Time required: 5 min**

#### Personnel:

- Machine operator

#### Protective equipment:

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

#### Conditions:

- The machine is switched on.
- The process container is filled.
- The processing unit is in the start position, not loaded.

### Inserting the reference electrode

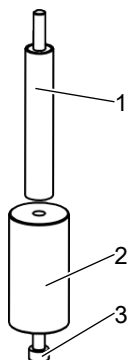


Fig. 34: Inserting the reference electrode

|   |                                    |
|---|------------------------------------|
| 1 | Reference electrode holder         |
| 2 | Reference electrode (exchangeable) |
| 3 | Fastening screw                    |

### INFO

The reference electrode must be changed every 12 months.

Check that the fastening screw is tight prior to every measurement.

1. Unscrew the fastening screw (↗ Fig. 34/3) on the reference electrode holder (↗ Fig. 34/1).
2. Put the reference electrode (↗ Fig. 34/2) onto the reference electrode holder and secure with the fastening screw.
3. Insert the reference electrode holder with reference electrode into the holder mount in the processing unit.
4. Move processing unit to work position (down)

### Performing reference measurement



Fig. 35: Fig.: Reference measurement mode button

5. Press the  button on the membrane keypad.
  - ⇒ Reference measurement mode has been selected.
6. Press the  button
  - ⇒ The machine stirs in the abrasive for two minutes (rectifier off). The machine displays the voltage 0.
  - ⇒ The machine performs the reference measurement for one minute. The current determined is displayed.
  - ⇒ The reference measurement has been performed, and the machine's display indicates whether the measured current value is OK.
  - ⇒ The processing unit unlocks and moves up.

### 9.3.3 Checking liquid coverage at standstill (only for EF media and EP media)

Only for EF media and EP media

**Interval: Daily**

**Time required: 5 min**

**Personnel:**

- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Materials:**

- Liquid indicator

**Condition:**

- The machine is switched off at the main switch.
- The processing unit is in start position or the process container is outside of the machine.
- The process container is filled.

1. Place the liquid indicator on the abrasive in the process container.

⇒ The liquid indicator sinks onto the media.

2. Check the liquid coverage.
3. If the liquid level is below 5 mm, add distilled water or top-up liquid.
4. The correct top-up liquid can be found on the technical data sheet for the abrasive used.

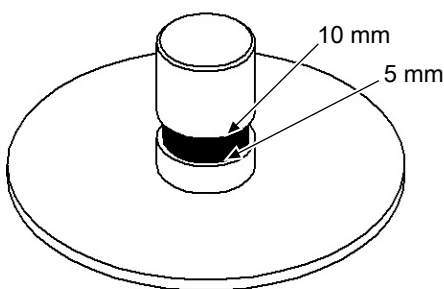


Fig. 36: Liquid indicator, example



**INFO**

#### Notice

For more information, see the technical data sheets.

### 9.3.4 Cleaning the cathode plate

#### INFO

Cleaning the cathode plate makes the recovery of **gold** easier and extends the life of the electrolytes when processing gold with **EF liquid** and **solids (e.g. LFPP 3)**.

When processing gold with EF media or EP media, the beads pick up the worn gold so that it is not reduced on the cathode plate. There is no need to clean the cathode plate in this case.



#### WARNING!

##### **Risk of burns from hot electrolyte in the abrasive**

The electrolyte can get very hot after processing. Skin contact with hot liquids causes severe burns.

- Avoid contact by wearing personal protective equipment such as safety gloves.
- Read the safety data sheets for abrasives.

**Interval: Weekly**

**Time required: 30 min**

**Personnel:**

- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Special tools:**

- Plastic scraper
- Collection tray

**Condition:**

- Machine is switched off.
- Processing unit is in start position.

### Removing the cathode plate

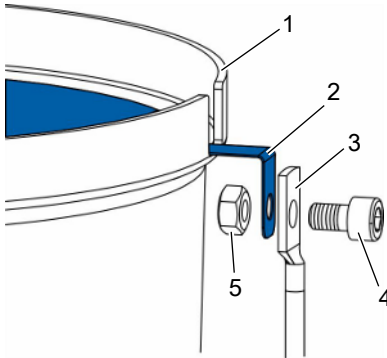


Fig. 37: Removing the cathode plate

|   |                   |
|---|-------------------|
| 1 | Process container |
| 2 | Connecting lug    |
| 3 | Cable lug         |
| 4 | Fastening screw   |
| 5 | Clamp nut         |

1. Pull the cathode cable plug connector out of the connection socket on the machine.
2. Remove the process container from the machine.
3. Loosen the clamp nut (↪ Fig. 19/5) and fastening screw (↪ Fig. 19/4) on the connecting lug (↪ Fig. 19/2) of the cathode cable and remove the cathode cable. Set the fasteners down in a safe place.
4. Carefully pull the cathode plate up out of the process container, taking into account the spring tension, and place it in a collection tray.
5. Using a plastic scraper, scrape the abrasive residues off the cathode plate (↪ /7).
6. If processing gold: Store the abrasive residues for gold recovery.
7. Clean the cathode plate with clean water and dry off with a soft cloth.



### WARNING!

#### Risk of injury from hot surfaces!

The workpiece holders, workpieces, abrasive and cathode plate can get very hot after processing. Skin contact with hot surfaces causes severe burns.

→ Avoid contact by wearing personal protective equipment such as safety gloves.

### 9.3.5 Replacing abrasives



### WARNING!

#### Risk of injury and chemical burns from eye and skin contact with abrasives and from inhaling abrasive dust, vapour or gas!

Eye and skin contact with the abrasive can cause burns and injuries. Inhaling dust, vapours or gases can cause injuries.

→ Avoid contact by wearing personal protective equipment such as goggles, safety gloves and work clothing.

→ Avoid dust, vapour or gas inhalation by wearing respiratory equipment.

→ Read the safety data sheets for abrasives.


**WARNING!**
**Risk of burns from hot electrolyte in the abrasive**

The electrolyte can get very hot after processing. Skin contact with hot liquids causes severe burns.

- ➔ Avoid contact by wearing personal protective equipment such as safety gloves.
- ➔ Read the safety data sheets for abrasives.

**Interval: as required**

**Time required: 10 min**

**Personnel:**

- Machine operator

**Protective equipment:**

- Protective work clothing
- Safety boots
- Chemical-resistant safety gloves
- Tightly fitting goggles
- Respiratory equipment

**Special tools:**

- Collection tray
- Lint-free cleaning cloth

**Condition:**

- The machine is switched off at the main switch.
- Processing unit is in start position. ↺ .

1. Take the process container out of the machine and set it down
2. Remove the cathode plate from the process container and clean it.
3. Dispose of the process container together with the abrasive properly or take them to a refinery. ↺ .
4. Thoroughly clean and dry all components that come into contact with electrolyte (such as the cathode plate and processing units).
5. Insert the new prepared process container with abrasive into the machine.
6. Switch on the machine at the main switch.

### **NOTE!**

#### **Electrolyte impairment due to improper cleaning**

Failing to clean the cathode plate thoroughly when changing the process container can lead to cross-contamination between the electrolytes. This impairs the electrolyte's function.

→ Clean the cathode plate thoroughly.

## 10 Faults

### 10.1 Safety instructions for troubleshooting

#### Electrical system



#### **DANGER!**

##### **Risk of death from electrical current!**

Contact with live components presents a risk of death. Active electrical components can cause uncontrolled movements resulting in very serious injury.

- Before maintenance and repair work where no electrical power is required, switch them off and secure them against reactivation.

#### Incorrectly performed troubleshooting work



#### **WARNING!**

##### **Risk of injury from incorrectly performed troubleshooting!**

Incorrectly performed troubleshooting can lead to serious injury and severe material damage.

- Switch off the machine prior to all troubleshooting work that does not require machine functions, and secure against reactivation. Switch off any partial areas if necessary
- Ensure sufficient installation clearance before starting work.
- Ensure that the assembly location is clean and tidy! Components and tools that are discarded or placed loosely on top of each other can cause accidents.
- If components have been removed, ensure that they are correctly assembled, reinstall all fastening elements and comply with the screw tightening torques.
- Ensure before restarting that all troubleshooting work has been conducted and completed according to the information and instructions in this manual.
- Ensure before restarting that there are no persons present in the hazard area.
- Ensure before restarting that all covers and safety mechanisms are installed and function properly.

10.2 Displaying and acknowledging faults/fault messages

 **INFO**

**Info**  
When a fault occurs, the colour of the media or machine status LED changes.

- Requirements
- Machine is switched on.



Fig. 38: Media status indicator



Fig. 39: Machine status indicator

- A fault is indicated by the media or machine status LED.
- Acknowledge the fault using the  button.  
⇒ The fault is corrected.

10.2.1 Media status fault messages table

| Colour                                                                              | Flashing | Cause/remedy                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |          | <b>Cause</b><br>Reference measurement finished with a negative result, conductivity of the abrasive is too high.<br><b>Remedy</b><br>→ Replace the process container and abrasive or contact OTEC Service. |
|  | X        | <b>Cause</b><br>Maximum life of the abrasive has been exceeded.<br><b>Remedy</b><br>→ Insert a new process container with abrasive, dispose of the old process container and abrasive.                     |

| Colour                                                                             | Flashing | Cause/remedy                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |          | <b>Cause</b><br>Media temperature, media could be too hot.<br><b>Remedy</b><br>→ Let the process container cool down or replace it with a cool process container.                                                                                                   |
|   | X        | <b>Cause</b><br>Maximum ampere-hours will soon be reached.<br><b>Remedy</b><br>→ Get new abrasive.                                                                                                                                                                  |
|   |          | Reference measurement successful, media OK, no machine operator intervention required.                                                                                                                                                                              |
|  |          | <b>Cause</b><br>Conductivity of the abrasive is too low. (See also the relevant technical data sheets).<br><b>Remedy</b><br>1. Add distilled water.<br>2. Insert new process container with abrasive, dispose of the old process container or contact OTEC Service. |

Tab. 5: Media status LED

### 10.2.2 Machine status fault messages table

| Colour                                                                              | Flashing | Acknowledge | Cause/remedy                                                                                                                                   |
|-------------------------------------------------------------------------------------|----------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------|
|  |          |             | <b>Cause</b><br>Motor rotation monitoring, motor is not turning.<br><b>Remedy</b><br>1. Check if the rotor is stiff, the motor may be blocked. |

## 10 Faults

Displaying and acknowledging faults/fault messages>Machine status fault messages table

| Colour                                                                              | Flashing | Acknowledge | Cause/remedy                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------|----------|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                     |          |             | 2. Check if the media is stiff.                                                                                                                                                                                                                            |
|    | X        | X           | <b>Cause</b><br>Process container was not detected.<br><b>Remedy:</b><br>→ Insert the container again, or container is not approved for this machine.                                                                                                      |
|    |          |             | <b>Cause</b><br>Permissible processing current limit value exceeded.<br><b>Remedy:</b><br>1. Reduce the set voltage<br>2. Reduce the number of workpieces.                                                                                                 |
|   | X        | X           | <b>Cause</b><br>Permissible processing voltage limit value exceeded or not reached.<br><b>Remedy:</b><br>1. Processing parameters need to be changed.<br>2. Change the voltage/number of workpieces/pulse pattern.<br>3. Check the condition of the media. |
|  |          |             | Process container detected.                                                                                                                                                                                                                                |
|  | X        |             | <b>Cause</b><br>Communication fault with pulse module, pulse module may be damaged.<br><b>Remedy:</b><br>Contact OTEC Service.                                                                                                                             |

Tab. 6: Machine status LED

### 10.3 Frequently asked questions (FAQs)

#### How long does an electrolyte mixture last?

With **gold**, 1 l of electrolyte can process approx. 2 kg of workpieces. This is an average value. The actual quantity of gold that you can polish with 1 l of electrolyte depends on your specific production conditions.

With **silver**, 1 l of electrolyte mixture can process approx. 0.5–1.0 kg of workpieces. This is an average value. The actual quantity of silver that you can polish with 1 l of electrolyte depends on your specific production conditions.

#### How do I tell if my electrolyte needs changing?

The process efficiency could decrease near the end of the media service life. Possible measures are extending the processing time and adjusting the process parameters (voltage/current).

#### How do I properly dispose of used or expired electrolyte?

Dispose of used abrasive in accordance with the instructions in the safety data sheet. Refer to the relevant safety data sheet for the EWC code (EWC = European Waste Catalogue) or waste code. The EWC code only applies to the unused product.

All electrolyte and contaminated surfaces (container and media) must be disposed of in compliance with local regulations. OTEC recommends that you look for a specialist disposal partner in your area and give them the product safety data sheet.

With gold, make sure to filter the electrolyte completely before disposal to ensure that you recover as much as possible.

#### How can I clean my workpieces after electropolishing?

After electropolishing, rinse the workpieces with tap water. Then clean the workpieces in the ultrasound bath. Finally, rinse the workpieces with tap water again. Dry the workpieces.

## 10 Faults

Frequently asked questions (FAQs)>Processing tips

### 10.3.1 Processing tips

#### Dental, Industry

| Problem                                                                                                                      | Cause                                                    | Remedy                                                |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------|
| Green marks on the workpiece surface                                                                                         | Green oxidation marks from the manufacturing process     | Clean the workpiece. Remove oxidation marks.          |
| Too much abrasion on the workpiece                                                                                           | Current or voltage too high or processing time too long. | Reduce current or voltage or shorten processing time. |
| Good shine and smooth finish on bare surface                                                                                 | Not adequately prepared, initial roughness is too high.  | Prepare the surface better.                           |
| Shine without smooth finish                                                                                                  | Electrolyte is not used correctly.                       | Change electrolyte and media (🔄 ).                    |
| Black workpiece surface                                                                                                      | Alloy not suitable.                                      | No possible solution. Contact OTEC Service.           |
| Polished workpieces start to look matt. The proven electrofinishing parameters no longer give the desired processing result. | Electrolyte is depleted.                                 | Change electrolyte and media (🔄 ).                    |

## 10.4 Common problems and their solutions

### General problems:

#### **After processing, the workpieces look unfinished. Why?**

Check that metal is being abraded. If it is not being abraded, the most likely issue is a problem with the electrical contact.

Start a new process and check how many amperes are flowing during the process.

If there is no current flow, check that the parameters were entered correctly (time, voltage, current limit).

If everything is OK, check whether the workpieces and the cathodes are receiving a current (holder not properly secured or a screw not tightened enough?).

#### **Abrasion was excessive during electropolishing.**

Reduce the processing time and/or the voltage.

### With gold:

#### **Gold samples are shiny, but are dark or yellowed when using white gold.**

Reduce the voltage in 0.5 V increments until the dark/yellowed spots disappear.

#### **Gold parts are matt rather than shiny. Why?**

Increase the voltage in 0.5 V increments until you obtain the required shine.

#### **Gold samples are shiny, but are not smooth.**

Improve the preparation process. You can improve the quality of the initial surface by increasing the magnetic polishing time, by using preliminary wet grinding, or by adding an initial processing step in the electrofinishing machine at a higher voltage.

### With silver/brass:

#### **Silver parts are tinged with yellow. What can I do?**

Wet polish the workpieces with zirconium oxide beads. If this does not solve the problem completely, increase the voltage. If increasing the voltage does not help, try reducing it to below the starting value.

Example: You usually process silver at 8 V. To remove the yellow tinge, increase the voltage to 10 V. If this does not help, do the opposite: reduce the voltage from 8 V (starting value) to 6 V.

#### **The shine on the workpieces is not as good as it could be. Why?**

Adjust the voltage. Increase or reduce the voltage in 2 V increments between 6 V and 12 V until you obtain the desired results

#### **After using the electrolyte mixture for a long time, the MFB media changes colour (black with silver/green with brass).**

## 10 Faults

---

### Common problems and their solutions

The discolouration indicates that the electrolyte is ageing. If processing is no longer working, change the electrolyte.

## 11 Technical data

### 11.1 Dimensions and weight

| Information |       | Value      | Unit |
|-------------|-------|------------|------|
| Length      |       | 510        | mm   |
| Width       |       | 220        | mm   |
| Height      |       | 640        | mm   |
| Weight*     | empty | approx. 26 | kg   |
|             | full  | approx. 30 | kg   |

\* Weight for machine base and process container

### 11.2 Electrical connection

| Information         | Value     | Unit |
|---------------------|-----------|------|
| Operating voltage   | 100 – 240 | V    |
| Power consumption   | 0.5       | kVA  |
| Rated current       | 2.5 – 5   | A    |
| Frequency           | 50 – 60   | Hz   |
| Pre-fusing          | Max. 16   | A    |
| IP protection class | 30        |      |

### 11.3 Permitted workpiece sizes

| Information            | Value     | Unit |
|------------------------|-----------|------|
| Maximum workpiece size | Ø 70 x 80 | mm   |

11.4 Type plate

The type plate is located on the side of the machine and contains the following information:



Fig. 40: Type plate, example

|   |                                           |    |                   |
|---|-------------------------------------------|----|-------------------|
| 1 | CE mark                                   | 9  | Power consumption |
| 2 | May not be disposed of as municipal waste | 10 | Operating voltage |
| 3 | Wiring diagram number                     | 11 | Machine number    |
| 4 | Year of manufacture                       | 12 | Machine type      |
| 5 | Weight                                    | 13 | Manufacturer      |
| 6 | Max. pre-fusing                           | 14 | Made in Germany   |
| 7 | Frequency                                 | 15 | EAC mark          |
| 8 | Rated current                             |    |                   |

## 12 Recovery and disposal



This electrical equipment must not be disposed of in household waste. If in doubt, request information about environmentally responsible disposal from the local municipal authorities or specialist disposal service providers.

Dispose of used abrasive in accordance with the instructions in the safety data sheet. Refer to the relevant safety data sheet for the EWC code (EWC = European Waste Catalogue) or waste key. The EWC code only applies to the unused product.

### INFO

Analyse the waste independently after processing!

### WARNING!

**Risk of injury and chemical burns from eye and skin contact with abrasives and from inhaling abrasive dust, vapour or gas!**

Eye and skin contact with the abrasive can cause burns and injuries. Inhaling dust, vapours or gases can cause injuries.

- Avoid contact by wearing personal protective equipment such as goggles, safety gloves and work clothing.
- Avoid dust, vapour or gas inhalation by wearing respiratory equipment.
- Read the safety data sheets for abrasives.

### ENVIRONMENTAL PROTECTION!

**Improper disposal poses a danger to the environment!**

Improper disposal can pose a danger to the environment.

- Have all electrical waste, electronic components, lubricants and other auxiliary materials disposed of by approved specialist service providers.
- Dispose of environmentally hazardous abrasives in accordance with the instructions provided in the safety data sheets.
- If in doubt, request information about environmentally responsible disposal from the local municipal authorities or specialist disposal service providers.

## Glossary

### Abrasive

The term abrasive refers to all substances that are required in the machine for the processing procedure: Media (solid abrasive component, e.g. granulate), water, compound, pastes, adhesive oil, etc.

### Electrofinishing

Electrofinishing is an electrochemical material removal (abrasion) process for metallic workpieces using an external source of electric current. It is used for smoothing and polishing surfaces. A bath of electrolyte specially selected for the material removes metal from the surface, visibly reducing roughness. It also removes more material from edges and corners, resulting in extra-fine deburring of the whole surface area. The process can therefore also be used for electrochemical deburring.

### Electrofinishing liquid

Electrofinishing liquid (EF liquid) is an electrolyte, an electrically conductive liquid, that softens the surface layer of the workpiece.

### Electrofinishing machine

The electrofinishing machine (EF machine) is used for electrochemical surface processing of metallic workpieces using an external source of electric current. The machine can be used for deburring, smoothing and polishing workpieces.

### Electrofinishing media

Electrofinishing media (EF media) is the ready-to-use electrolyte/media mixture for electrofinishing (not for processing gold). The electrofinishing media results in more abrasion and less shine after polishing.

### Electropolishing media

Electropolishing media (EP media) is the ready-to-use electrolyte/media mixture for electropolishing (not for processing gold). The electropolishing media results in less abrasion and more shine after polishing.

### Media

Media is the term used to describe the solid abrasion medium and polishing medium. The media must be used only in combination with an electrofinishing liquid for processing gold.

## 13 Appendix

|      |                                    |    |
|------|------------------------------------|----|
| 13.1 | EU Declaration of Conformity ..... | 74 |
| 13.2 | Layout .....                       | 75 |

### 13.1 EU Declaration of Conformity

Manufacturer: OTEC Präzisionsfinish GmbH  
Heinrich-Hertz-Strasse 24  
75334 Straubenhardt-Conweiler  
Germany

Product designation: **ELECTROFINISHING MACHINE**

Machine type: EF-One

Machine number: EFO/O26xxxx

Function description: The EF machine is used for electrochemical surface processing of metallic workpieces using an abrasive approved by the manufacturer.

We hereby declare that the above product corresponds to all relevant provisions of the following European directives:

**2006/42/EC Machinery Directive**

**2014/30/EU EMC Directive**

**2011/65/EU RoHS Directive**

The protective goals of Low Voltage Directive 2014/35/EU have been complied with in accordance with Appendix I, No. 1.5.1, of Machinery Directive 2006/42/EC.

The following harmonised standards have been applied:

- DIN EN ISO 12100:2011 Safety of Machinery
- DIN EN 60204-1:2019 Electrical equipment of machines – Part 1: General requirements
- DIN EN ISO 13849-1:2016 Safety-related parts of control systems – Part 1: General principles for design
- DIN EN ISO 13850:2016 Safety of Machinery – Emergency stop function – Principles for design
- DIN EN 55011:2022-05 Industrial, scientific and medical equipment – Radio-frequency disturbance characteristics – Limits and methods of measurement

Authorised representative for the composition of technical documentation: *B.Sc. Nico Gegenheimer*, see Manufacturer for address



Nico Gegenheimer, Managing Director

75334 Straubenhardt, Germany 17/07/2026

## 13.2 Layout

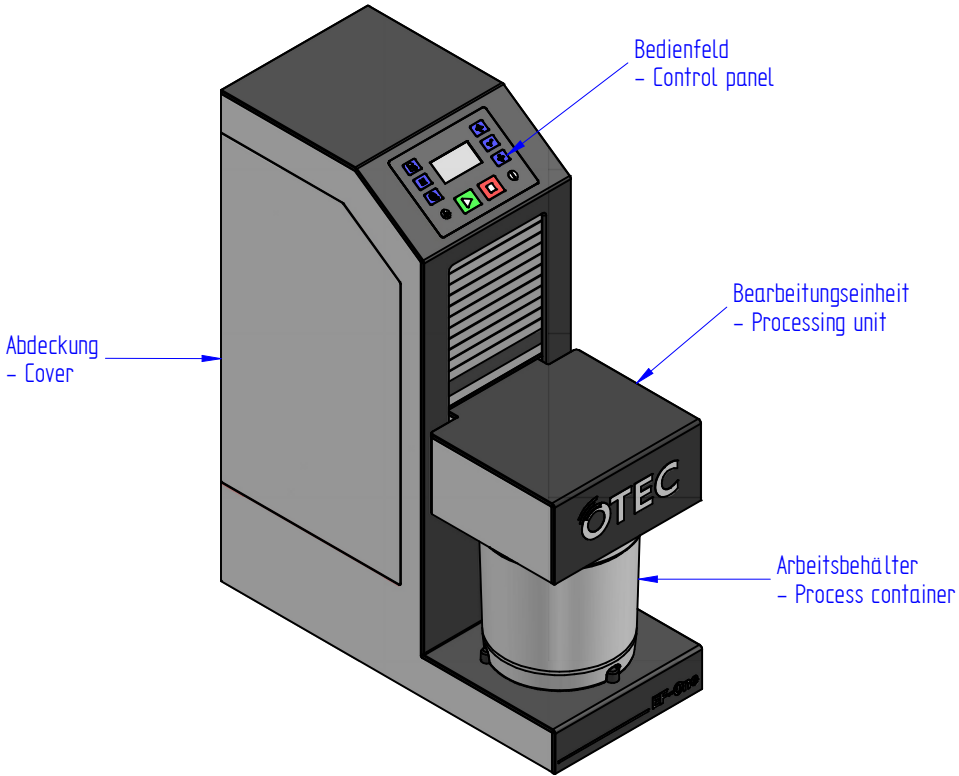
### See also

 [Layout EF-One](#)  76]

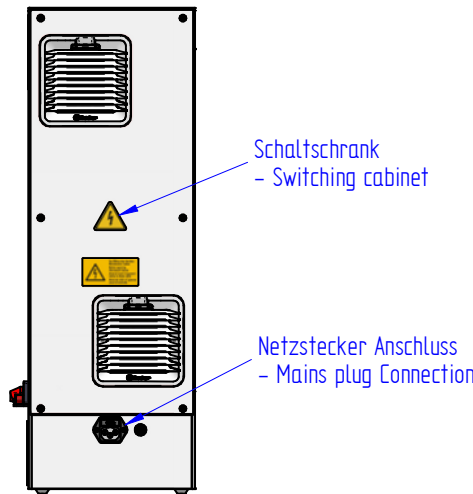
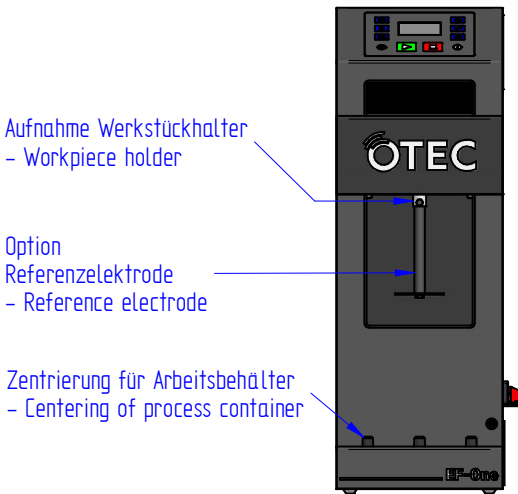
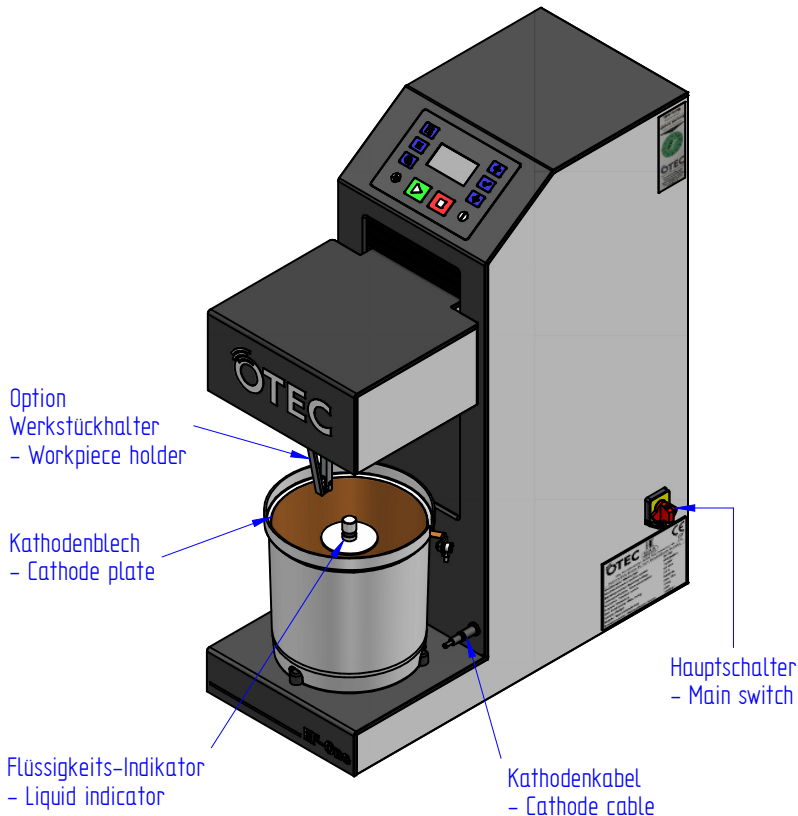
|                            |
|----------------------------|
| Freigabe / Authorisation : |
| Datum / Date :             |
| Unterschrift / Signature : |

# Bearbeitungsposition - Processing position

EF - One

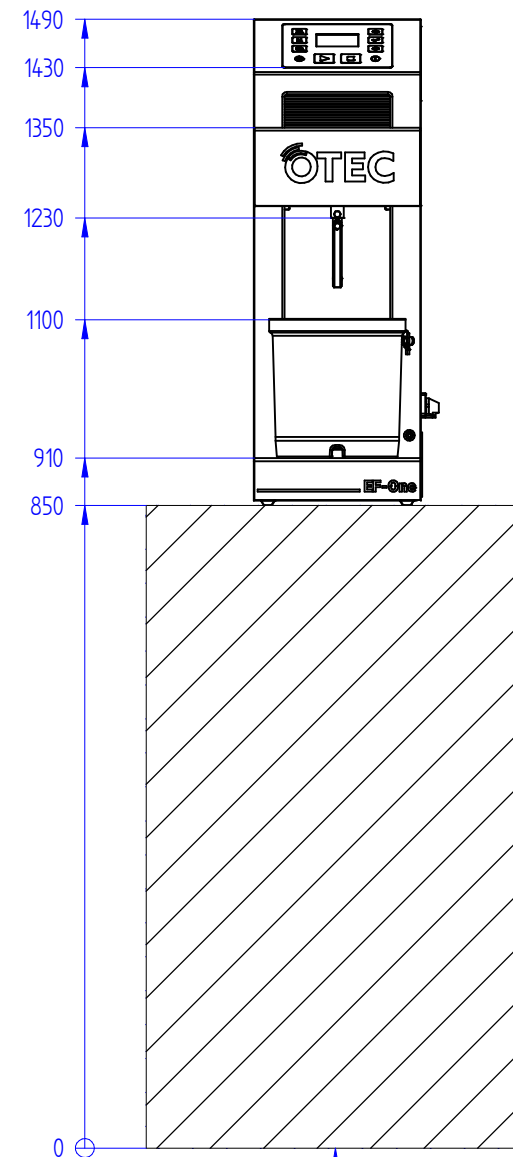
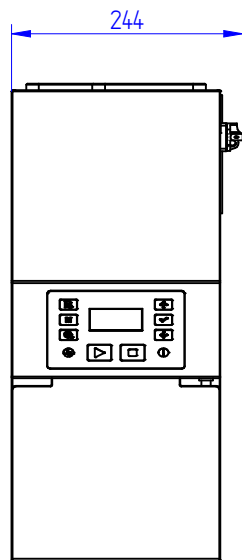
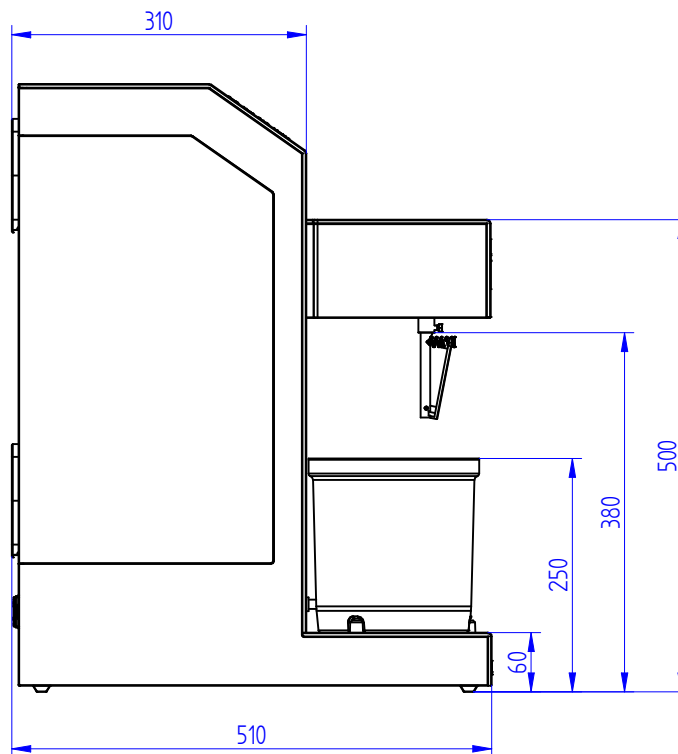
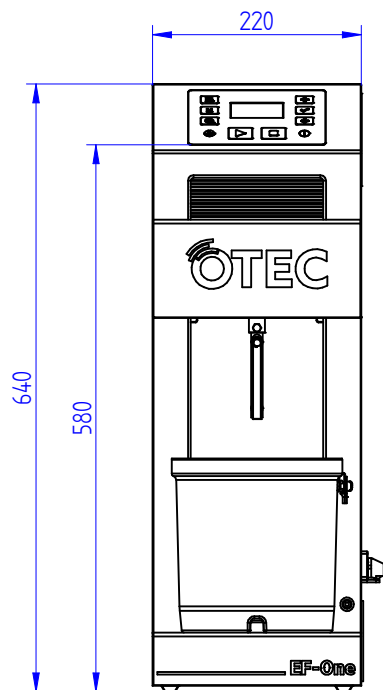


# Grundposition - Basic position



|                                                                                      |  |                                 |              |
|--------------------------------------------------------------------------------------|--|---------------------------------|--------------|
| Technische Änderungen vorbehalten<br>Specifications subject to change without notice |  | Dokumentiert<br>Machine layout  |              |
| Erstellt durch<br>v.ennrich                                                          |  | Genehmigt von                   |              |
| Titel, Zusätzlicher Titel<br>EF-One                                                  |  | Zeichnungsnummer<br>#EF-One/000 |              |
| Elektrofinish-Maschine                                                               |  | Maßstab<br>1:4                  | Blatt<br>1/3 |

**OTEC**  
Otec Präzisionsfinish GmbH  
Heinrich-Hertz-Str. 24 | 75334 Straubenhardt | Germany  
Phone +49(0) 7062 4511 20 | E-Mail: info@otec.de | www.otec.de

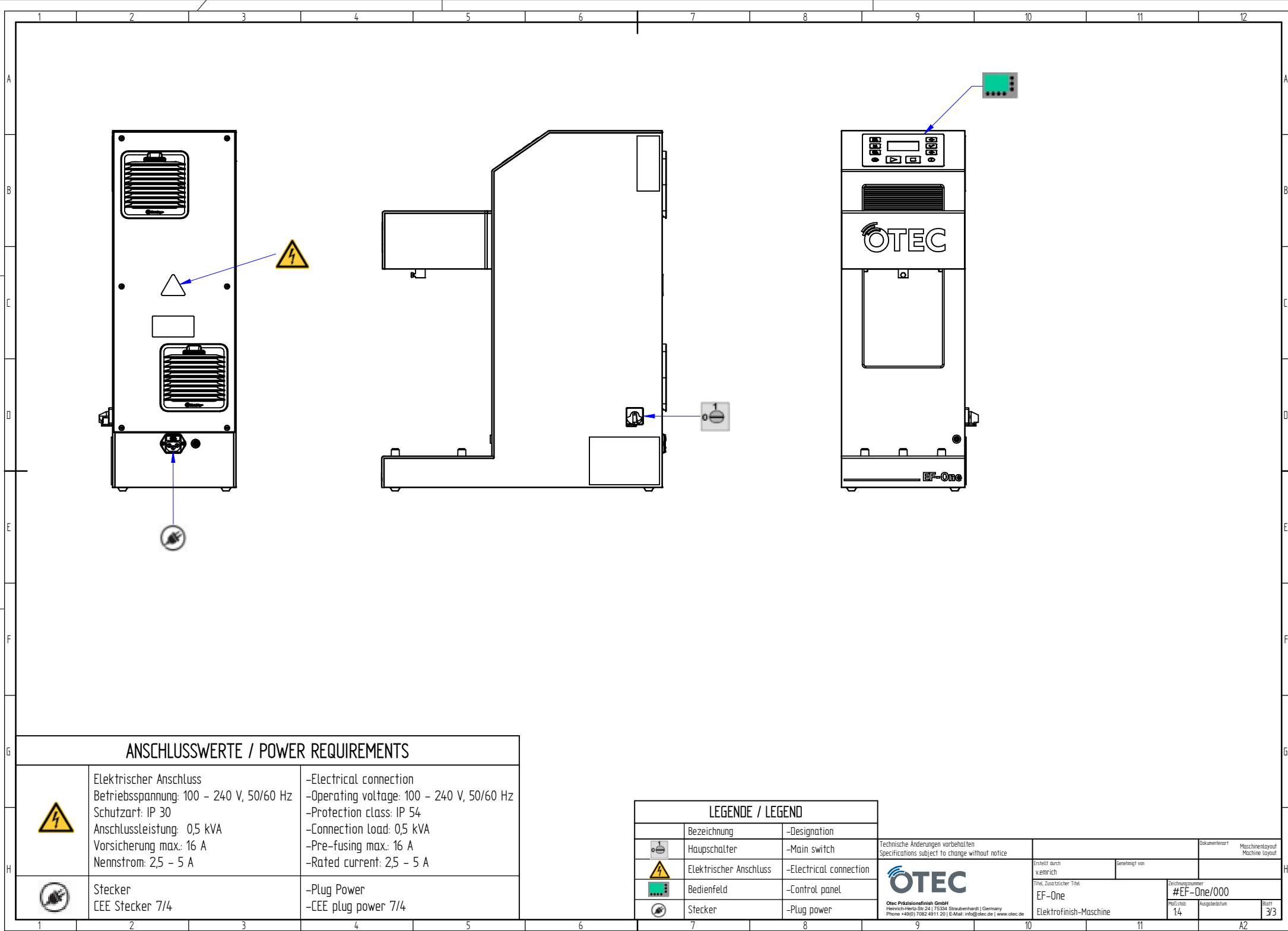


empfohlene Aufstellhöhe  
- Recommended installation height

|                                                                                      |  |                                                    |             |
|--------------------------------------------------------------------------------------|--|----------------------------------------------------|-------------|
| Technische Änderungen vorbehalten<br>Specifications subject to change without notice |  | Dokumentenart<br>Maschinenlayout<br>Machine layout |             |
| Erstellt durch<br>v.enrich                                                           |  | Genehmigt von                                      |             |
| Titel, Zusätzlicher Titel<br>EF-One                                                  |  | Zeichnungsnummer<br>#EF-One/000                    |             |
| Elektrofinish-Maschine                                                               |  | Modifiziert<br>14                                  | Blatt<br>23 |



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ANSCHLUSSWERTE / POWER REQUIREMENTS

|  |                                                                                                                                                                        |                                                                                                                                                                                     |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | Elektrischer Anschluss<br>Betriebsspannung: 100 – 240 V, 50/60 Hz<br>Schutzart: IP 30<br>Anschlussleistung: 0,5 kVA<br>Vorsicherung max.: 16 A<br>Nennstrom: 2,5 – 5 A | -Electrical connection<br>-Operating voltage: 100 – 240 V, 50/60 Hz<br>-Protection class: IP 54<br>-Connection load: 0,5 kVA<br>-Pre-fusing max.: 16 A<br>-Rated current: 2,5 – 5 A |
|  |                                                                                                                                                                        | -Plug Power<br>-CEE plug power 7/4                                                                                                                                                  |

LEGENDE / LEGEND

|  | Bezeichnung            | -Designation           |
|--|------------------------|------------------------|
|  | Hauptschalter          | -Main switch           |
|  | Elektrischer Anschluss | -Electrical connection |
|  | Bedienfeld             | -Control panel         |
|  | Stecker                | -Plug power            |

Technische Änderungen vorbehalten  
Specifications subject to change without notice

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|                                                               |             |                                                                |
|---------------------------------------------------------------|-------------|----------------------------------------------------------------|
| Erstellt durch<br>v.enrich                                    | Gemerkt von | Dokumentenart<br>Maschinenlayout<br>Machine layout             |
| Titel, Zusatzlicher Titel<br>EF-One<br>Elektrofinish-Maschine |             | Zeichnungsnummer<br>#EF-One/000<br>14<br>Ausgabenstatus<br>3/3 |