OrthoPhaser®

Micro-Pulse Welding Unit
REF 090-400-00

Instructions for use
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EU DECLARATION OF CONFORMITY

The company
Dentaurum
J.P.Winkelstroeter KG
Turnstraße 31
75228 Ispringen
Germany

declares that the design and construction of the machine described below and also the model put on
the market comply with the relevant basic health and safety requirements of EU directives. This
declaration is no longer valid if the machine is modified in any way without our prior consent.

Description
OrthoPhaser®
Micro Pulse Welding Unit

REF
090-400-00

Serial no.
from 135-0001

EU directives
EU Machine Directive 89/37 EG
Annex IIA
EU Low Voltage Directive 73/23 EWG
EU Electromagnetic Compatibility Directive 89/336 EWG

National regulations
DIN VDE 0543
DIN EN 60529

Applied harmonized standards
EN 50199

Date / Manufacturer’s signature: 02.08.04 ..........................................

Designation of signatory: pp Dipl.Ing.(FH)K.Merkle
Production Manager Manufacturing
Introduction

Thank you for choosing a Dentaurum quality product. It is essential to read these instructions for use carefully and adhere to them to ensure safe, efficient use of the OrthoPhaser® and ensure that you and your patients gain full benefit from this product.

As instructions for use cannot cover every eventuality and possible application, contact our Hotline if you have any questions or require advice.

Our products are regularly upgraded to incorporate the latest technical developments. Even though you frequently use the same product, we still recommend that you always carefully read the current instructions for use included with the product.

Correct use of the unit begins by following the step-by-step procedure below!

1. Unpack the unit, microscope components and peripheral products. Lay out all the components for each item and check the invoice (and/or delivery note) to ensure that the delivery is complete.

2. Assemble and install the OrthoPhaser® as described in the assembly and installation instructions (Page 6 to 11). At this point do not connect the unit and the mains adaptor of the microscope to the 230 volt safety socket.

3. Carefully read all the safety regulations and instructions on personal safety and risks (Page 12 to 14). Take all necessary precautions before using the OrthoPhaser® for the first time.

4. Connect the unit and the mains adaptor of the microscope to the 230 volt safety socket, but do not switch it on. Follow the instructions, in particular those for installing the unit, initial operation and welding with the OrthoPhaser®.
OrthoPhaser® package contents

1 Control unit with mains cable 230 V, 50/60 Hz
1 Handpiece with integrated gas supply
10 Special tungsten electrodes
2 Crocodile clips with cable
1 Diamond grinding disc
1 Glass fibre brush
1 Stereo zoom microscope
1 Electronic anti-glare device with replacement shutter
1 Halogen light with 230 V adaptor
1 Handpiece holder
1 Eye shield
2 Handrests
2 Eyecups
1 Dust protection cover
1 Allen key
1 Prong wrench
Connecting the control unit

1. **Location:**
   Set the OrthoPhaser® control unit on a stable, level, fire-resistant, insulating base (e.g. a laboratory bench).

2. **Connect the handpiece by inserting it into the large socket provided on the right at the front of the unit.**

3. **Ensure that the pins in the handpiece plug are aligned with the slots in the socket.**

4. **Carefully turn the cap nut of the plug clockwise until it is finger tight.**

5. **Insert the crocodile clip into one of the clip sockets provided on the front of the unit.**

6. **Back of the unit:**
   - Socket for the anti-glare device (shutter)
   - Mains supply socket
   - Fuse holder
   - Argon connection

7. **Insert the mains cable into the mains supply socket provided.**
   **Caution: Do not insert the mains plug into the mains socket until installation is complete.**

8. **Remove the protective cap for the argon connection (hose screw connection).**

9. **Unscrew the cap nut of the hose screw connection and slide it over the argon gas hose. Then push the argon gas hose onto the connector support and tighten the cap nut.**

10. **To remove the argon gas hose from the unit, unscrew the cap nut.**
Assembling the microscope (1)

11. First attach the handpiece holder to the microscope stand.

12. Screw the handpiece arm onto the black base unit.

13. Loosen the central Allen screw to remove the silver-coloured base plate.

14. Place the black base unit onto the microscope stand base, position the silver-coloured base plate underneath, then ...

15. ... tighten the base unit and base plate with the Allen screw. The screw only has to be finger tight. We recommend connecting the base unit and base plate ...

16. ... by holding the screw in position from above and turning the base plate. Place the handrests to the right and left of the base unit.

17. Mount the microscope holder with the light unit onto the microscope stand and lock the holder in position by ...

18. ... tightening the screw at the back. Then slide the ring on the slide rail of the microscope stand under the microscope holder and lock it in position.

19. Insert the light unit cable into the socket provided on the top of the slide rail.

20. The microscope holder correctly mounted on the microscope stand.
Assembling the microscope (2)

21. Insert the microscope into the ring on the microscope holder ...

22. ...and at the same time mount the eye shield between the microscope and the ring of the holder.

23. Lock the microscope in position with the locking screw on the microscope ring.

24. The microscope correctly mounted in the microscope holder.

25. Screw the lens (0.5 X) onto the electronic anti-glare device (shutter) and secure it with the slotted screw on the side.

26. To attach the electronic anti-glare device (shutter), first unscrew the black protective ring to expose the thread. Place the shutter in position.

27. Screw the shutter on carefully (without damaging the thread) and hang the cable in the cable holder.

27. Put the eyecups on the microscope oculars ...

28. ... with the raised sides facing outwards to prevent lateral light infiltration.

29. Insert the light unit cable into the adaptor.

30. The microscope light can be switched on with a separate cable switch. This allows the microscope to be used independently of the OrthoPhaser©.
Assembling the OrthoPhaser® handpiece and connecting the shutter

31. The OrthoPhaser® is supplied with 10 special long-life tungsten electrodes.

36. The handpiece can either be used freehand or with the handpiece holder. To use the support, insert the handpiece into the holder ...

32. Unscrew the handpiece nozzle from the handpiece.

37. ... and lock it in position with the wing screw on the right side of the support.

33. Open the chuck and insert the electrode into the chuck jaw. Caution: Risk of injury! The electrode is very sharp.

38. Then connect the electronic anti-glare device (shutter) to the control unit by inserting the cable connector into the filter socket on the back of the unit.

34. Turn the chuck until finger tight. Do not use a chuck key.

39. Screw the cable connector in finger tight. The connector is quite difficult to screw in, as it has a special thread.

35. The electrode should protrude 7-10 mm from the handpiece nozzle. Both ends of the electrode can be used before resharpening.

40. The electrodes can be resharpened with the diamond disc supplied. The glass fibre brush is used for quickly cleaning the welding area.
Setting the microscope

41. The interocular distance has to be set to provide an optimum view of the workpiece to be welded through the microscope. To do this ...

42. ...first turn both ocular holders outwards and then rotate them slowly inwards until one round image is seen through the microscope.

43. The eyecups prevent lateral light infiltration.

44. Spectacle wearers can turn the eyecups back if necessary.

45. The dioptré control ring has the zero mark at the silver line on each eyepiece.

46. When the oculars are rotated upwards away from the silver line, it increases the dioptré setting (+).

47. When the oculars are rotated downwards beyond the silver line, it decreases the dioptré setting (-).

48. The magnification is adjusted progressively from 1 – 4 using the knobs on the sides of the microscope. This represents a 4 to 20 x magnification.

49. The sharpness of the workpiece is adjusted using the knob on the microscope holder. If this is not possible, adjust the height of the holder.
Connecting the pressure reducer to an argon gas bottle containing at least 4.6 quality argon – Setting the pressure reducer

50. Carefully read the instructions for use supplied for the bottle pressure reducer before connecting it to the argon gas bottle.

54. Connect the free end of the argon gas hose already attached to the control unit to the hose thread of the pressure reducer.

51. Also adhere to all the relevant safety regulations relating to argon gas bottles in the dental laboratory.

55. Open the valve of the argon gas bottle. Ensure that there is no leakage from any part of the gas connection.

52. After securing the argon gas bottles according to current regulations (tilt protection), unscrew the valve cap.

56. Open the valve on the right side of the pressure reducer.

53. Fit the pressure reducer as described in the instructions for use for the bottle pressure reducer.

57. The gas flow rate can be regulated with the valve on the bottom of the pressure reducer. Set the flow at four litres per minute (displayed on the right dial). The maximum operating pressure is 4 bar.

**Caution:** The OrthoPhaser® is fitted with an automatic cut-out function, i.e. if there is no shrouding gas or the flow rate has been set too low, the red LEDs flash above the “Select” button of “Gas Preflow Time” on the front panel of the OrthoPhaser® (see Page17, Fig. bottom right), the unit switches to wait mode (“Wait”, red LED top left) and no pulses can be emitted. If this happens, ensure that the argon gas is connected properly and the flow rate has been correctly set.

If the flow rate has been set too high (> 7 l/min.), it causes air turbulence, i.e. the welding spot oxidizes more readily and produces an overall poorer weld.
General safety regulations

1. The OrthoPhaser® should be operated with a mains voltage of 230V~.

   Yellow-green wire = earth (PE). The other wires L1 and N are connected to the phase and neutral terminals of the mains plug. Since the introduction of the European Standard IEC 38 (valid from May 1987) mains voltage throughout Europe has been standardised at 230V.

   The welding unit has been factory set at 230V~!

   The tolerance range of +/-15% also allows the OrthoPhaser® to be operated with a 220V~ mains supply. Units set to a voltage other than 230V are specially labelled.

2. If a unit is designed for a specific voltage, the technical data on the unit rating plate applies! Mains plugs should have the same mains voltage and current consumption as the welding unit (see technical data!). The fuse of the mains supply should correspond with the current consumption of the welding unit!

3. Use only the mains cable supplied!

4. Always use original crocodile clips with sufficient cable and ensure the clips are properly connected to the workpiece.

5. It is illegal for anyone other than a qualified electrician to carry out any work on components connected to the mains voltage. This does not include the plug or mains ON/OFF switch.

6. The mains current and the welding current are both sources of risk.

7. The highest and therefore most dangerous voltage in the welding current circuit is the open-circuit voltage. The highest permissible open-circuit voltages are set in national and international regulations according to the type of welding current, design of the power source and varying degree of electrical risk at the workplace.

8. If there is reason to believe that the unit cannot be operated without risk, it should be taken out of service and safeguarded against inadvertent operation. It should be assumed that the unit can no longer be operated without risk if
   - the unit has visible signs of damage or
   - the unit no longer functions.
   In this case contact our customer services (see Page13).

9. Adhere to the relevant precautions for handling gas bottles.
Repair and maintenance

⚠️ Caution:

The unit should only be opened by qualified personnel! If your company has the relevant qualified personnel (e.g. works electrician), the following points should be noted:

1. Remove the mains plug before opening the unit and ensure that there is no electric charge in the unit. Discharge any components in the unit that store electrical charges.

2. The unit should be disconnected from the mains supply during any repair or maintenance work on the power source. If further work on the unit is required and you have to leave it unattended, even for a short time, it is essential to remove the plug from the socket!

3. Always use original replacement parts in all repair, maintenance or overhaul work. If in doubt, always contact our customer services, which can provide specially trained personnel, suitable materials and equipment.

4. If you have any questions or problems, contact Dentaurum customer services on these numbers:

   Tel: +49 (0)7231 - 803 - 211
   Fax: +49 (0)7231 - 803 - 357
Personal safety and risks

1. **⚠️** Do not look into the light arc without eye protection; only use the microscopes and/or optical units with an electronic anti-glare device (shutter) specifically designed for the OrthoPhaser®.

2. Always ensure that the electronic anti-glare device (shutter) has been correctly attached to the microscope and that the shutter is properly connected to the OrthoPhaser® control unit and functions correctly.

3. As well as emitting light and thermal rays, which can dazzle or burn, the light arc also emits UV rays. With inadequate eye protection these invisible ultra-violet rays cause very painful conjunctivitis, which only becomes apparent after a few hours.

4. Personnel or assistants in the vicinity of the light arc should also be informed of the risks and be provided with the required protective equipment; if necessary, erect protective walls.

5. Wear insulating gloves on both hands as a precaution when welding. These provide protection against electric shocks (open-circuit voltage of the welding electric circuit), harmful rays (thermal and UV rays) and splashes of hot metal and slag.

6. Wear sturdy, insulating footwear; shoes should also insulate when wet. Open-backed shoes are unsuitable, as falling drops of hot metal can cause burns.

7. Use protective clothing; do not wear synthetic clothing.

8. Ensure there is adequate ventilation when welding, particularly in small areas, as smoke and harmful gases are created. If necessary, use an extractor.

9. Never weld containers that have been used for storing gases, propellants, mineral oil or similar substances, even if they have been empty for a long time, as there is still a risk of explosion due to residue.

10. Special regulations apply in areas where there is a danger of fire or explosion.

11. Only use in dry areas. Outside use is not permitted.
OrthoPhaser® – Introduction

The OrthoPhaser® was developed to provide a wide range of users with a cost-effective option for arc welding in the orthodontic laboratory. High-performance electronics and reliable precision engineering have been coordinated to produce a micro-arc pulse welding unit that includes features such as compact design, minimum weight and low-energy consumption. Excellent ignition and welding properties ensure a wide range of applications for use with new orthodontic appliances as well as repairs.

OrthoPhaser® – Areas of application

The OrthoPhaser® unit is used for welding and tack welding orthodontic appliances.

The OrthoPhaser® welds all standard dental alloys and monometals (e.g. titanium).

Any use other than the correct use as described in these instructions is not permitted.

No liability is accepted for the durability of the weld. We recommend that the weld should always be checked and, if in doubt, combined with other welding techniques.

Fittings and features of the unit

1. The power and pulse duration and therefore the diameter of the welding spot are freely adjustable.
2. The welding energy is delivered to the workpiece as a pulse and therefore heats a smaller area.
3. Four basic programmes are preset, though these can be altered.
4. After switching on, or if the unit has been switched on but not used for five minutes, the power and pulse duration switch automatically to a lower setting to prevent inadvertent welding with the wrong power setting, i.e. too high a setting.
5. The maximum pulse frequency is 2 Hz.
6. An acoustic signal precedes the welding procedure.
7. The gas preflow time is variable from 0.5 – 1.5 seconds.
8. The unit has a low gas consumption of 4 l/min.
9. It has a compact and lightweight design.
10. It is quiet-running (no ventilator, no pump).
11. The unit is virtually maintenance-free.
12. Zoom stereomicroscope with 4 to 20x magnification.
13. The light does not produce shadows or glare.
14. The unit has an electronic anti-glare device (shutter).
15. The handpiece holder is adjustable.
16. The welding site is easily and reliably shrouded with inert gas, as the inert gas (argon 4.6) is delivered directly through the handpiece to the welding site.
17. The handpiece can be used in the holder or freehand and has an IDB (immediate draw back) function.
Important information on initial operation

Initial operation of the unit should only be carried out by qualified personnel for the purpose intended. The manufacturer/distributor does not accept any liability for damage caused by incorrect application or operation. It is essential to read the sections “General safety regulations” and “Personal safety” before initial operation of the unit.

When welding with the OrthoPhaser®, the welding base and any connected clamps or clips are live as soon as the mains supply is switched on. Ensure that these parts do not come into contact with electrically conducting or earthed components such as the housing etc.
Description and function of the control unit

The green LED “Ready” lights up if the unit is operational.

The red LED “Wait” lights up if the OrthoPhaser® is not operational, e.g. immediately after switching it on and for the duration of the self-test.

The “Power” and “Time” keys are used for adjusting the individual welding parameters.

Press the relevant top arrow key to increase the power or time.

Press the relevant bottom arrow key to decrease the power or time.

The selected setting is visually displayed on the red or yellow LED bar.

Four basic programmes P1–P4 are preset. To activate these programmes, simply press the relevant key for the required programme (see Page 18).

The red LED next to the selected programme key lights up to display which programme is currently active. If the basic programme is altered, the red programme LED goes out.

The handpiece is connected to the socket on the right (the handpiece should already be connected if the instructions have been carried out in the correct sequence, see also Page 6).

The required gas preflow time is set with the “Select” key. A red LED indicates whether a 0.5, 1.0 or 1.5 seconds preflow has been selected.

Basically a longer preflow time should be selected for single welding spots. A shorter preflow time should be used for weld seams.
Initial operation of the OrthoPhaser©

1. Open the valve of the gas bottle and check the flow rate setting (approx. 3-4 l/min). The maximum operating pressure is 4 bar!
2. Switch the control unit on at the mains switch (on the left side wall).
3. The unit carries out a self-test and the red LED “Wait” lights up.
4. Once the self-test is complete, the green LED “Ready” lights up and the unit automatically selects a low power setting. The “Power” LEDs are at 20% and the “Time” LEDs at 6 ms. The “Gas Preflow Time” is automatically set at 1.5 seconds, i.e. the relevant red LED lights up.
5. Connect one of the sections of the workpiece to be welded to the crocodile clip, which should already be connected to the relevant unit socket.
6. Select the required basic programme for welding the workpiece by pressing the relevant key P1 – P4.
   The following basic programmes are stored:
   
<table>
<thead>
<tr>
<th>Programme</th>
<th>Power</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>20%</td>
<td>9 ms</td>
</tr>
<tr>
<td>P2</td>
<td>40%</td>
<td>13 ms</td>
</tr>
<tr>
<td>P3</td>
<td>60%</td>
<td>18 ms</td>
</tr>
<tr>
<td>P4</td>
<td>80%</td>
<td>21 ms</td>
</tr>
</tbody>
</table>

7. Select the required gas preflow time. Single welding spots are welded with 1.0 to 1.5 seconds preflow time and for welding seams a preflow time of 1.5 to 1.0 seconds is used.
8. Look through the microscope and move the workpiece into position. It should be sharp and clear! If not, adjust the microscope to suit your eyes (see Page10).
9. Always place your hands on the handrests and keep them steady when welding. Avoid freehand welding, as the set parameters can be distorted if your hands shake.
10. Then place the area of the workpiece to be welded in contact the tungsten electrode of handpiece **without applying pressure to the electrode tip**. Keep in contact until welding is complete.
11. The welding procedure is automatic. As soon as there is contact with the electrode tip, the shrouding gas begins to flood the welding site. An acoustic signal precedes the electric arc, the electric arc is triggered and the shrouding gas supply ceases.
12. The procedure can be interrupted at any time before the acoustic signal by removing the workpiece from the electrode tip, i.e. breaking contact with the electrode tip.
13. Provided that the procedure has been carried out correctly and in sequence, your first welding spot should now have been completed successfully.
Basic principles for successful welding with the OrthoPhaser

1. Take some time to familiarize yourself with the unit and complete the practice welding described on Page 22.
2. As a rule all alloys and metals with suitable physical properties for welding can also be welded without any problem using the OrthoPhaser.
3. Different alloys and metals react very differently during welding. Material properties, such as thermal conductivity, melting range (or melting point) and possible volatile alloy components, can considerably affect the quality of the weld.
4. Ensure that there is always optimum electrical contact between the workpiece and the crocodile clip during welding.
5. The area of the workpiece to be welded should be in direct contact with the tip of the electrode.
6. With a little experience you will find that the “flow direction” of the welding spot is affected by the angle at which the workpiece is held when in contact with the electrode tip.
7. A 90° angle of contact (electrode tip to workpiece) produces a deep weld.
8. For deep welding spots lengthen the electrode tip to suit and slightly increase the flow rate (5-7 l/min) if required.
9. If there is a problem with ignition, apply light lateral pressure to the electrode tip, as if scratching the workpiece. This technique also allows you to guide the welding spot in a certain direction.

Sharpening the special tungsten electrodes

18. Always ensure that a sharp electrode is used for welding. If the electrode tip is burnt or broken off, it should always be sharpened or replaced. This tends to happen more frequently with less experienced operators.
19. The electrode tip should be sharpened with a fine or medium grit size diamond disc if possible at an angle of approx. 25°.
Filler material

1. remanium® ligature wire (0.25-0.5 mm diameter) is recommended as a filler material when welding stainless steel components.
2. For chromium cobalt alloys always use drawn, carbon-free filler wire, which can be ordered from Dentaurum (REF 528-210-00, 528-200-50).
3. For high-gold-content alloys and semi-precious alloys always use a filler material of the same alloy type, which can be obtained either from the alloy manufacturer as drawn wire or cast in the laboratory.
4. For titanium always use drawn pure titanium wire, which can be ordered from Dentaurum (REF 528-039-50).
5. The most commonly used and most suitable thickness of wire for a filler material is 0.35 mm to 0.50 mm.
6. To melt the filler wire, hold it between the electrode tip and the workpiece.

Summary of the most important points for successful welding

1. As a rule weld with a gas flow of 3 - 4 l/min.
2. Never weld freehand if possible, i.e. always place both hands on the handrests. If the hands shake, the welding result is distorted.
3. Ensure that there is always optimum electrical contact between the workpiece and the crocodile clip when welding.
4. Always weld with a pointed, i.e. well-sharpened electrode.
5. Do not apply any pressure to the electrode tip when welding. There should only be light contact.
6. If a lot of black welding smoke is caused by dirt or grease on the surface of the workpiece, remove the contamination with the glass fibre brush or preferably by sandblasting before continuing with welding.
Recommended practice welding

1. Weld two 0.5 mm thick alloy wires parallel to one another without damaging their outer circumference.
2. Weld two alloy wires together end to end.
3. Build up a cusp on an alloy ingot.

Dental welding technique – Welding with the OrthoPhaser®

The following points should be noted before welding any orthodontic appliances:

1. Thermal conductivity of the alloy

   The power range (between 10% and 100%), which is used for welding an alloy, depends mainly on the thermal conductivity of the alloy rather than on the melting range when welding with the OrthoPhaser®.

   High-gold-content alloys, which absorb the energy produced more quickly due to their high thermal conductivity, therefore require more energy (power x pulse duration) than a CrCo alloy or titanium for example, though the melting range of the CrCo alloy (or the melting point of titanium) is much higher than that of a high-gold-content alloy.

2. Points to note with CrCo alloys

   - Carbon-free CrCo wire should be used as the filler material with remaloy® weld joints
   - Only low carbon CrCo alloys (or alloys suitable for laser welding) should be welded using carbon-free CrCo wire as the filler material.
   - CrCo alloys should always be welded using a high pulse duration (very short melting interval), as cracks could otherwise form in the welding spot.
   - CrCo alloys should be welded “more slowly” (adequate intervals between individual pulses) to prevent heat build-up, as this causes distortion.

3. Never weld on old solder joints, i.e. with repairs always grind the old solder off completely beforehand.

4. Never use solder as a filler material. Solders have low-fusing components that burn during welding.

5. When welding a seam, always overlap individual welding spots and do not simply weld them together.
Example of an orthodontic appliance: Crozat appliance

Filler material is not normally required for completing this welding exercise.

Connect the crocodile clip with the object to be welded.

Select the required gas preflow time (in this case 1.0 to 1.5 seconds).

Proceed as shown in the following illustrations:

1. As a rule never weld bent wires end to end. They should be welded in short seams so that the bent ...

5. When welding a thick wire with a thin wire, connect the crocodile clip to the thicker wire.

2. ... wires overlap a little. After the first tack welding pulse, weld the seam so that the welding spots always overlap by 50%.

6. When welding from the inside, also ensure contact with the raised occlusal wire to fuse the edge optimally.

3. Five to six pulses should produce a continuous, welded, durable seam that can be easily prepared, rubber prepolished and polished ...

7. Finish welding all the seams as described above. At this stage areas already welded can be overlaid (as when smoothing weld seams).

4. ... with rotary instruments. If required, the inside can also be welded.

8. The result is an orthodontic appliance that is completely solder-free and fabricated from a single material.
# Troubleshooting

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<th>PROBLEM</th>
<th>CAUSE</th>
<th>REMEDY</th>
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<tr>
<td>1. No weld current</td>
<td>Interruption of the mains supply</td>
<td>Check mains supply and mains voltage</td>
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<tr>
<td>2. No weld current</td>
<td>No weld cable connection</td>
<td>Check plug connection</td>
</tr>
<tr>
<td></td>
<td>Poor or no connection to the workpiece</td>
<td>Ensure connection with the workpiece, connect contact clips directly to the workpiece</td>
</tr>
<tr>
<td>3. No weld current</td>
<td>Automatic cut-out function active because there is no shrouding gas. Problem caused by faulty current</td>
<td>Connect shrouding gas, check flow rate. Switch the unit off, then on again. If the problem recurs, contact customer services</td>
</tr>
<tr>
<td>4. Poor ignition</td>
<td>Poor contact with the workpiece</td>
<td>Ensure connection with the workpiece</td>
</tr>
<tr>
<td></td>
<td>Dirt on the electrode</td>
<td>Sharpen the electrode</td>
</tr>
<tr>
<td></td>
<td>Electrode tip burnt off</td>
<td>Sharpen the electrode</td>
</tr>
<tr>
<td>5. Mains fuse or safety cut-out triggered</td>
<td>Mains fuse too low or incorrect safety cut-out</td>
<td>Use the correct fuse for the mains supply</td>
</tr>
<tr>
<td></td>
<td>Mains fuse triggers when idling</td>
<td>Contact customer services</td>
</tr>
<tr>
<td>6. Poor weld quality</td>
<td>Wrong shrouding gas</td>
<td>Use argon shrouding gas (argon 4.6)</td>
</tr>
<tr>
<td>7. Oxidation and carbon formation</td>
<td>Gas pressure too high</td>
<td>Reduce flow rate – approx. 3 to 4 l/min is adequate</td>
</tr>
<tr>
<td>8. Heavy oxidation of the welding spots</td>
<td>Wrong shrouding gas</td>
<td>Use argon shrouding gas (argon 4.6)</td>
</tr>
<tr>
<td>9. Tungsten inclusions in the base material</td>
<td>Excessive pressure of the electrode on the workpiece</td>
<td>Apply only sufficient pressure when contacting the workpiece to ensure ignition</td>
</tr>
<tr>
<td>10. Tungsten electrode sticks to the workpiece</td>
<td>Excessive pressure of the electrode on the workpiece</td>
<td>Apply only sufficient pressure when contacting the workpiece to ensure ignition</td>
</tr>
<tr>
<td>11. Tungsten electrode melts immediately</td>
<td>Tapered too sharply</td>
<td>Sharpen to the recommended angle (approx. 25°)</td>
</tr>
<tr>
<td>12. Static discharge over the unit surface</td>
<td>Specific ambient conditions</td>
<td>Use a special floor mat for the working area</td>
</tr>
</tbody>
</table>
FAQs

1. Which alloys and metals can be welded?
   - Stainless steel, chromium cobalt alloys and titanium
   - All gold, silver, platinum and palladium precious metal alloys

2. Do all alloys react in the same way during welding?
   - No – the quality of the weld depends on the melting range of the alloys and their thermal conductivity.
   - The lower the thermal conductivity of an alloy for example, the less energy (power x pulse duration) is required to melt it.

3. Can welding be carried out directly adjacent to resin or porcelain?
   - Yes – the heat build-up when welding with the OrthoPhaser® is comparable to the heat build-up when laser welding.

4. Can welding be carried out without shrouding gas?
   - No – welding without shrouding gas causes high oxidation and carbon formation on the welding site and is also impossible due to the cut-out function of the OrthoPhaser®.
   - The welding spots become porous and are not as strong.

5. Can shrouding gases other than argon 4.6 be used?
   - Generally, yes. We recommend argon 4.6, however, as the best results have been achieved with it.

6. How much gas is used during welding?
   - Approximately 0.3 to 0.4 litres of gas are used per welding spot.
   - A 10 litre (200 bar) bottle contains 2000 litres of gas. A full gas bottle provides approximately 5000 to 6600 weldings.

7. Can filler material be used?
   - Yes – we recommend filler wire made from the same material with a thickness of 0.25 to 0.50 mm.

8. Can solder be added?
   - No – solder tends to burn due to its low-fusing components.
   - Solder joints should also not be welded for this reason.

9. How deep do the welding spots penetrate the material?
   - The penetration depth depends on the welding energy setting (power x pulse duration), the thermal conductivity of the material to be welded and the angle at which the tip is held.
   - The higher the welding energy and the lower the thermal conductivity, the deeper the weld.
10. Can tungsten particles from the electrode tip get into the welding spot?
   - If the OrthoPhaser® is not used correctly, the inclusion of tungsten particles in the welding spot cannot be completely ruled out. This is highly unlikely if the unit is used properly.

11. What is the minimum thickness for the material to be welded?
   - The minimum thickness should be 0.2 to 0.3 mm depending on the material.

12. What are the anticipated operating and servicing costs?
   - The unit does not require servicing.
   - With normal operation there is only a minimum outlay for shrouding gas and worn electrodes.

13. How many welding spots can be welded with one electrode?
   - As the tungsten electrodes become shorter over time due to sharpening the tips, the service life is limited to approx. 1500 to 2000 welding spots per electrode.
List of equipment, accessories, replacement parts

OrthoPhaser® (1 unit, complete with connector cable) ...................................................... 090-400-00
10 special tungsten electrodes, 1 diamond disc,
1 glass fibre brush and 2 crocodile clips

Special tungsten electrodes, 10 electrodes ................................................................. 090-401-00

Diamond disc, 1 disc, Ø 19 mm, shank Ø 2.35 mm ........................................................... 137-856-00
for sharpening the special tungsten electrodes

Glass fibre brush, 1 brush, for cleaning the weld site .................................................... 090-402-00

Crocodile clip, 1 clip with 100 cm cable ................................................................. 090-403-00
Argon fitting set for connecting the OrthoPhaser® ...................................................... 090-404-00
to the argon bottle. Comprises fittings and pressure hose. Length of connector hose: 2 m

Handpiece nozzle, 1 nozzle ................................................................. 908-333-00

Handpiece chuck, 1 chuck .......................................................................................... 908-333-10

Handpiece tension nut, 1 nut ..................................................................................... 908-333-20

Care and maintenance

The OrthoPhaser® requires minimum care and maintenance under normal operating conditions. It is essential, however, to adhere to some points to ensure proper functioning and keep the OrthoPhaser® operational for years to come.

1. Regularly check the mains plug and cable as well as the crocodile clips for damage.
2. Check that the moveable parts of the handpiece move smoothly.
3. Clean the handpiece chuck when required to ensure full contact with the electrode.
4. Caution!
   Fuses should be replaced with the same strength of fuse. If too high a fuse is used and it causes damage, a claim under guarantee is no longer valid!
5. Clean the unit and microscope regularly with a dry or slightly damp cloth (do not use a cleaning agent). If the microscope is not in use, cover it with the protective cover supplied.
Technical data

- Unit suitable for arc-light welding in dry areas
- Mains voltage ~230 V / 50-60 Hz +/-15%
- Mains fuse M 6.3 A
- Power consumption 1400 VA
- Operating voltage 20 – 40 V
- Open-circuit voltage 40 V
- Maximum charge time 1.5 seconds
- Shrouding gas: ARGON 99.996% (ARGON 4.6)
- Maximum gas pressure 4 bar
- Safety Class I
- Insulation Class B
- Protective system IP 21S
- Duty cycle 80%
- Weight 6.2 kg

Rating plate

1. Description of the symbols on the rating plate:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="1" alt="Image" /></td>
<td>Single phase transformer</td>
</tr>
<tr>
<td><img src="2" alt="Image" /></td>
<td>Tungsten-Inert-Gas-Welding</td>
</tr>
<tr>
<td><img src="3" alt="Image" /></td>
<td>Direct current</td>
</tr>
<tr>
<td><img src="4" alt="Image" /></td>
<td>Mains input 1 phase / alternating current / 50-60Hz</td>
</tr>
</tbody>
</table>

Note:

Keep these instructions for use readily available for all operators.

Text and illustrations are technically correct at the time of printing. We reserve the right to make changes.