Phaser mx1

Pulsed Microwelder

Instructions for assembly, installation and performance welding in the dental laboratory

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Dear Customer,

Thank you for buying a Phaser mx1 pulsed micro welder. To get off to a perfect start, please read and follow these recommended "step-by-step" instructions for assembly, equipment installation and effective application of dental welding techniques:

1. **Unpack the equipment, the parts for the microscope or optical unit and all peripheral products. Lay them out in front of you and arrange them appropriately. Check the parts delivered against the invoice or the delivery slip to make sure that the delivery is complete.**

2. **Assemble and install your Phaser mx1 as described in the assembly and installation instructions (page 3 to 9). But DO NOT connect the Phaser mx1 and the power supply for the microscope (or the optical unit) to the outlet with earthing contact (230V or 110V depending on the country).**

3. **It is your responsibility to read all the safety rules and instructions carefully (page 10 to 12) and make sure that all users are protected against all hazards and personal injury!! You must take all precautionary measures required before you startup operation of your Phaser mx1 for the first time.**

4. **Connect the Phaser mx1 and the power supply for the microscope (or the optical unit) to an outlet with earthing contact (230V or 110V), but DO NOT turn it on. Follow the instructions starting on page 13 (Introduction, Initial startup and Dental welding techniques using the Phaser mx1).**

Table of contents

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The precious metal alloys described and depicted in this Instruction Manual were manufactured by Wieland, C. Hafner and anaxdent

How to connect the Phaser mx1 control unit

1. **Installation requirement:** Always place the Phaser mx1 on a stable, level, highly flame retardant and insulating surface (e.g. a laboratory bench).

2. Connect the handpiece by plugging it into the appropriately sized socket located front right.

3. Make sure that the guides in the plug of the handpiece match the grooves in the socket.

4. Carefully hand-tighten the cap nut of the plug by turning it to the right.

5. Insert one of the two connecting clamps supplied ("alligator clip"“) into one of the small sockets intended for this purpose.

6. View of rear panel with power receptacle (socket), fuse holder, argon gas connection and plug sleeve for the shutter.

7. Plug the power cord into the power receptacle (socket). **Attention:** Do not plug the power plug into the power outlet until you have completed installation.

8. Remove the protective cap on the quick-connect plug for connecting the argon gas hose.

9. Plug the argon gas hose (supplied with the gas connection set) into the quick-connect plug.

10. To release the argon gas hose, you must press the blue ring while pulling on the hose at the same time.

How to assemble the Phaser mx1 microscope (1)

11. Start assembling the parts of the microscope. First, mount the stand for the handpiece to the microscope stand.

12. To do so screw on the arm for the handpiece to the designated black base.

13. Disassemble the silver-colored base plate by unscrewing the middle Allen screw.

14. Place the black base on the microscope stand, bring the silver-colored bottom plate up into position, then...

15. ... screw the base onto the bottom plate with Allen screw. It is enough to hand-tighten the screw. The easiest way to connect the base and bottom plate ...

16. ... together is to secure the screw at the top while turning the bottom plate. Position the hand rests to the left and right of the base.

17. Install the microscope holder with the lighting unit attached on the microscope stand and secure the holder by ...

18. .. locking the screw at the back. You must also slide the ring on the post of the microscope stand under the holder and lock it.

19. Plug the cord for the lighting unit into the designated socket on the cap of the post.

20. Now, the microscope holder is properly attached to the microscope stand.

How to assemble the Phaser mx1 microscope (2)

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

26. ... carefully screw it on (without damaging the threads) and hang the shutter cord on the designated hook.

22. ...and, at the same time, attach the light shield between microscope and ring of the holder.

27. Place the rubber eye-cups on the microscope oculars, in such way that the higher side ...

23. Secure the microscope by tightening the fastening screws located on the microscope ring.

28. ... is turned outward to prevent incident light from the sides.

24. The microscope is correctly mounted on the microscope holder.

To install the electronic shutter ...

29. Plug the cord of the lighting unit power supply into the designated socket on the bottom rear side of the post.

25. ...first unscrew the black protective ring to expose the threads. Bring the shutter into position, ...

30. The microscope lighting unit has a separate on/off switch on its power cord. This allows you to use the microscope alone, without the primotec Phaser

How to assemble the Phaser mx1 optical unit

31. Equipment supplied: magnifying glass with integrated LCD shutter, swivel arm, 9W-light bulb, transformer with AC adapter and vice clamp.

36. Connect the LCD shutter by plugging the cable connecting plug into the female socket labeled "Filter" on the rear panel of the control unit and tighten it securely by hand.

32. Unpack all parts and check to make sure that everything is complete. Install the light bulb in the socket on the underside of the magnifying glass.

37. Loosen the thumbscrew located on the upper part of the optical unit. Now you can adjust the magnifying glass infinitely...

33. Fasten the vice clamp ideally on the back side of the table or bench and screw on the vice clamp tightly by hand.

38. ... moving it up and ...

34. Insert the swivel arm of the magnifying glass down into the corresponding hole of the vice clamp. The arm should now swivel freely to either side.

39. ... down.

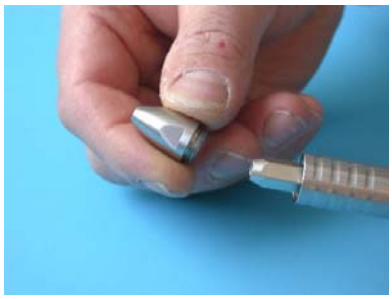
Plug the AC adapter into the power outlet.

35. Once you have assembled and installed everything correctly, your optical unit should be set up like in the photo to the left.

40. Turn the lighting on the optical unit ON/OFF with the switch located on the upper right. The light also works when Phaser mx1 is switched off.

How to assemble the Phaser mx1 handpiece – how to connect the shutter

41. The primotec Phaser mx1 comes equipped with 10 special tungsten electrodes, each of them having a service life of at least 1500 impulses.



42. Screw the nozzle off the handpiece.

43. Loosen the clamping chuck and insert an electrode into the collet chuck.

44. Close the clamping chuck, tightening by hand. Do not use a wrench.

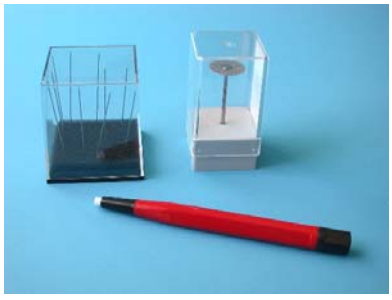
45. The electrode should extend 7-10mm past the handpiece nozzle. Both ends of the electrode can be used before regrinding is necessary.

46. In general, the handpiece can be held in your hand or operated stationary on its stand. For stationary use, mount the handpiece …

47. … in the holder on the stand and secure it in place with the wing screw located on the right side of the hand-piece holder.

48. Next, connect the electronic shutter to the control unit by inserting the cable plug into the socket on the rear panel of the unit labeled "Filter".

49. Screw the plug in tightly by hand. It may be some-what difficult to screw-in because of its grid threads.



50. The electrodes can be reground with the diamond disc included in the package. The glass brush can be used for quick cleaning of the welding area.

How to adjust the Phaser mx1 microscope

51. For the best view of the workpiece to be welded through the microscope, you must first set the eye distance.
To do so, ...

52. ... first turn the two ocular holders outwards and then slowly move them in until you see a round image through the micro-scope.

53. The eye-cups prevent incident light entering from the sides.

54. Users who wear eyeglasses can fold the cups down if necessary.

55. The silver line on each eyepiece represents the zero position for the diopter setting.

56. Turn the eyepieces away from the silver line to increase the diopters (+).

57. Turn the eyepieces down below the silver line to reduce the diopters (-).

58. The magni-fication factor can be set infinitely from 1–4 by turning the knobs on both sides of the micro-scope. This corre-sponds to a 4–20x magnification.

59. Turn the knob on the microscope holder to bring the workpiece into focus. If you cannot achieve a sharp focus, adjust the height of the holder.

60. Finally, you have to connect the primotec Phaser mx1 control unit to a gas tank contain-ing **argon 4.5 (this equals a purity of 99,995%)**

How to connect and adjust the Phaser mx1 pressure regulator

61. Before connecting the pressure regulator to the gas tank, read carefully the enclosed "Operating Instructions for Cylinder Pressure Control Valves".

65. Insert the free end of the argon gas hose already connected to the control unit into the quick-connect valve of the pressure regulator.

62. Furthermore, always observe all pertinent regulations for the safe use of gas tanks in the dental lab.

66. Open the valve on the argon gas bottle. Make sure that there are no leaks in the line.

63. First, the gas bottle must be secured so that it cannot fall over. Always comply with current regulations. Then screw off the protective valve cap.

67. Open the valve on the right side of the pressure regulator.

64. Install the pressure regulator as described in the enclosed "Operating Instructions for Cylinder Pressure Control Valves".

68. You can regulate the gas flow rate with the valve on the bottom of the pressure regulator. Set four liters per minute (reading is shown on the right gauge).

Attention: The Phaser mx1 features an auto-stop function, i.e. when there is no more inert gas or the flow rate is set too low, the red LEDs above the “Select” key of “Gas Preflow Time” (bottom right) will blink, the device will go into wait mode (“Wait” red LED top left) and you will not be able to trigger an impulse. If this happens, check to make sure that the argon gas has been connected properly and the flow rate set correctly.

If the flow rate is set too high (> 7 l/min.), air turbulence can occur, causing the welding spots to oxidize more readily. This can lead to much poorer welding results overall!!!

General safety regulations

1. **The Phaser mx1 is standard equipped to operate with line voltage of 230V~**.

   Yellow-green lead = ground wire (PE). The other leads L1 and N are connected to the phase and neutral leads of the power plug. Since the standard IEC 38 was introduced in May 1987, 230 V has been defined as the international standard value for public low voltage networks.

   The welder is set to 230V ex works!

   That means that, because of a tolerance range of +/-15%, the Phaser mx1 can also be used with 220V~ V line voltage. **Products with line voltages other than 230V will include specific labeling.**

2. If the equipment is constructed for other voltages **(for example USA or Japan 100V - 110V)**, the technical specifications on the rating plate apply! Power plugs must match the line voltage and power consumption of the welder (please refer to the technical specifications!). AC power line fuse protection must correspond to the power consumption of the welder!

3. **Only use the power cord supplied with the equipment**!

4. Always use original feeder clamps with sufficiently long cords and make sure that the clamp is properly fastened to the workpiece.

5. By law, only qualified electricians are allowed to work on parts that are connected to the line voltage. This does not apply to operating the power plug or the main power switch.

6. Both the mains current and the welding current can pose hazards.

7. Open-circuit voltage is the highest and thereby the most dangerous voltage in the welding current circuit. The maximum permissible open-circuit voltages are stipulated in national and international regulations and directives according to type of welding current, power source design and the electrical hazard rating of the workplace.

8. If it is anticipated that safe operation is no longer possible, the equipment must be made unoperational and protected against unintended operation. Safe operation is not possible when
   - The equipment exhibits visible damage or
   - The equipment no longer functions.

9. Observe the relevant safety precautions for handling gas tanks.

The Phaser mx1 may only be opened by trained specialists! If your company employs such specialists (e.g. works electricians), they must observe the following:

1. Before you open the Phaser mx1, disconnect the power plug from the line voltage and make sure that it is cut-off from the electrical supply. Discharge all components that may store an electrical charge.

2. Whenever there are any problems, please always contact a specialist. Do not hesitate to consult our customer service department at any time. They will be happy to support you with specially trained experts, proper materials and equipment.

3. When performing any maintenance or servicing work on the power source, always separate the equipment from the mains current. During work that extends beyond a few minor handling steps, but require that you leave the workplace, even for a short time, you must additionally block the power outlet in an obvious way.

4. When performing any maintenance, servicing or overhauling work, always use original replacement parts. Our customer service will be glad to assist you.

5. Kuss Dental service numbers for questions and troubleshooting:

Phone :+34 91 736 23 17

Fax: + 34 91 736 23 18

E-mail : info@kuss-dental.com

Personal protection and hazards

1. **Never look at the welding arc with the naked eye; only use the microscopes and/or optical units with electronic shutter specially designed for the Phaser mx1.**

2. Always make sure that the electronic shutter has been installed correctly on the microscope and that the microscope shutter and/or the optical unit are properly connected to the Phaser mx1 control unit and in functioning order.

3. The arc radiates heat, light and even UV radiation that can cause glare and burns. If insufficient or no eye protection is worn, this invisible ultra-violet radiation can cause very painful conjunctivitis that will not be noticed only several hours later.

4. Persons or assistants in the vicinity of the welding arc must be instructed about the hazards and wear the necessary protective gear; if appropriate, raise a protective wall.

5. As a preventive measure, wear insulated gloves on both hands during welding. Gloves will protect against electrical shocks (open circuit voltage of the welding current circuit), against hazardous radiation (heat and UV radiation), and any flying incandescent metal and slag sparks.

6. Wear well-insulated footwear; the user's shoes should also be insulated against moisture. Low shoes are not suitable because dripping molten metal can cause burns.

7. Choose suitable clothing; don’t wear synthetics.

8. Welding can produce smoke and harmful gases. When welding, especially in enclosed spaces, always make sure that there is a sufficient supply of fresh air.

9. Never carry out welding on containers that contain or were used to store gases, fuels, mineral oils or similar materials, even if they were emptied a long time ago. There is a danger of explosion from the materials and residues.

10. When used in rooms with a high fire hazard or explosion hazard rating, special regulations apply.

Introduction

The Phaser mx1 was developed to provide laser-quality welding to a broad spectrum of users in the field of dental technology at affordable investment costs. An intelligent marriage between high-power electronics and extremely reliable precision mechanics has produced a high-quality pulsed electric-arc microwelder that is distinguished by its small dimensions, low weight and low power requirements among other superior features. Outstanding ignition and welding properties open up a wide range of applications in dental technology for both new fabrications and repair work.

Intended use and areas of application for the Phaser mx1

The Phaser mx1 is a device designed for use in welding and joining work in the field of dental technology.

The Phaser mx1 is suitable for new fabrications as well as for repairing metallic dental prostheses.

The Phaser mx1 can be used to weld all contemporary dental alloys and mono metals (e.g. titanium).

Any other applications besides those described in these instructions and defined as intended use are not permissible.

Only use the Phaser mx1 in dry rooms. The equipment may not be operated in the out-of-doors.

The manufacturer is not liable for the welding spot stability. We recommend that you always check your welding points and, in the case of doubt, use them in combination with other joining techniques.

Technical equipment and properties

1. Reliable high-power electronics.
2. Power and pulse duration and thereby welding spot diameter are freely adjustable.
3. Pulse output with a very low heat-affected zone (like a laser).
4. Preset with five basic programs for gold (Au), cobalt-chrome (Co-Cr), hybrid welding (e.g. "gold to Co-Cr"), titanium (Ti) and orthodontics (Ortho) which are, however, adjustable freely.
5. When the Phaser mx1 is switched on or if it has not been used for five minutes, the power and pulse duration settings jump automatically to the "Ortho" program values to prevent inadvertent welding at incorrect settings, i.e. too high energy parameters.
6. Maximum pulse frequency 2 Hz
7. Acoustic signal announces the welding process
8. Gas preflow time can set between von 0.5 – 1.5 seconds
9. Very low gas consumption, maximum 4 l/min
10. Compact dimensions, low weight
11. No audible noise during operation (no ventilator or pump)
12. Maintenance-free
13. Zoom stereomicroscope with 4x to 20x magnification (optical unit with 3x magnification optionally available)
14. Shadow-free and glare-free illumination
15. Electronic shutter
16. Handpiece stand, swivelable
17. Easy and safe inert gas guard. The inert gas (Argon 4.6) is delivered through the handpiece, directly to the site to be welded.
18. The handpiece can be used on the stand or freely movable and features an IDB (immediate-draw-back) function

General notes before starting up operation

The Phaser mx1 may only be started up by trained personnel, and only in applications that are defined as intended use. The manufacturer/supplier accepts no liability whatsoever for damage caused by improper use or operation. Before starting up operation, be sure to read the sections: "General safety regulations" and "Personal protection".

When welding with the Phaser mx1, the welding pads and any connected clamps or pliers will be live when the main power switch is ON. Make sure that these parts cannot touch any electrically conductive or earthed components such as housings, etc.

Description and function of the operating controls

The red LED "Wait" lights up as long as the primotec Phaser mx1 is not operational, for example, right after it has been turned on and is running the self-test.

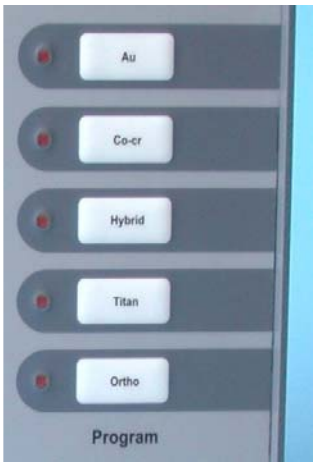
When the green LED "Ready" lights up, the primotec Phaser mx1 is ready for operation.

Use the "Power" and "Time" (impulse duration) keys to change these welding parameter individually.

Use the UP arrow keys to increase Power and/or Time.

Use the DOWN arrow keys to decrease Power and/or Time.

Each selected setting is optically displayed by red or yellow LED bars.



Your Phaser mx1 is factory equipped with five standard programs. To activate one of these programs, simply press the key labeled with the program you would like to run.

You can tell which program is currently running when the red LED is lit up next to its program button. The red LED goes out when this standard program is modified by the operator

The handpiece is connected to the right female socket (which should have been done already, if you followed these instructions in chrono-logical order).
The alligator clip and/or other optional accessories (e.g. welding table, tweezers or pliers) can be connected to the middle and left female sockets.

The "Select" button is used to set the gas preflow time as desired. The red LEDs show which preflow setting – 0.5, 1.0 or 1.5 sec – has been selected.

Rule of thumb: Select a longer gas preflow time for single spot-welds and a shorter preflow time for seam-welds.

Initial startup

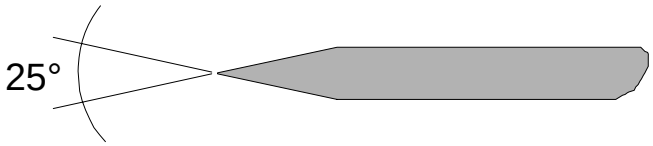
1. Open the valve on the gas bottle and check the flow rate setting (approx. 3-4 l/min). 10 bar is the maximum operating pressure!
2. Turn the Phaser mx1 on using the main power switch (located on the left side panel).
3. The Phaser mx1 carries out a self-test, the red "Wait" LED lights up.
4. Once the self-test is successfully completed, the green "Ready" LED lights up and the device automatically selects the standard program "Ortho", i.e. the red LED next to the "Ortho" key lights up. The "Power" LEDs indicate 20% and the "Time" LEDs indicate 6 ms. The gas preflow time is automatically set to 1.5 sec, i.e. the corresponding red LED lights up.
5. Connect one of the two parts to be welded with the connecting clamp (alligator clip) which, of course, has already been connected to the corresponding socket on the Phaser mx1.
6. Press the key to select the standard program you want to use to weld your workpiece (e.g. Gold = Au).
7. Select the desired gas preflow time. Individual spot-welds should be welded with a 1.0 to 1.5 second preflow: seam-welds should be welded with a 0.5 to 1.0 second preflow.
8. Look through the microscope (or the optical unit) and position your workpiece. It should be clearly visible! If it is not, adjust the microscope for your eyes (Page 8 of these instructions).
9. You should always put your hands on the hand rests during welding and keep them still. Avoid "free-hand" welding, since shaky hands can interfere with the parameter settings.
10. Next, take your workpiece and touch the place you want to weld to the tungsten electrode on the handpiece. **Do not exert any pressure on the electrode tip**. Maintain contact until the welding procedure is completed.
11. The welding procedure itself runs automatically. When contact is made with the electrode tip, the inert gas begins to flow to the spot-weld. An audible signal announces the electric arc, the arc is triggered, and the flow of inert gas stops.
12. Until you hear the signal, you can cancel the process at any time by pulling the workpiece away from the electrode tip, i.e. interrupting contact to the electrode tip.
13. If you have proceeded correctly and step-by-step up to this point, you have now successfully placed your first Phaser mx1 spot-weld!

Basic rules for successful welding with the Phaser mx1

1. Take some time to familiarize yourself with the equipment and perform the welding exercises described starting from Page 18 onwards.
2. As a general rule, all alloys and metals that have physical properties that make them basically suitable for welding can be easily welded with the Phaser mx1.
3. Every alloy and metal responds differently to welding. Material properties such as thermal conductivity, melting interval (or melting point) or any highly volatile alloy components it contains can all have a significant effect on the welding results.
4. Make sure that the workpiece is always in **optimum electrical contact** with the clip during welding.
5. Touch the area to be welded on your workpiece to the electrode tip as precisely as possible.
6. Once you have gained some practice, you will notice that the angle at which you touch the workpiece to the electrode tip influences the "flow direction" of the spot-weld.
7. A contact angle of 90° (electrode tip to the workpiece) produces the deepest spot-weld.
8. For deep-lying spot-welds, allow the electrode tip to extend farther out of the collet chuck and, if necessary, increase the gas flow rate slightly (5-7 l/min).
9. If there are problems with ignition, it is helpful to pull the electrode tip **lightly sideward**, as if you wanted to scratch over the workpiece. You can also use this technique to steer the spot-weld in a certain direction.

How to grind the special tungsten electrodes

19. Always make sure you are working with a **pointed electrode**. If the electrode tip is burnt off or broken off, you must grind it or exchange it for a new one. This is more often necessary with unskilled users.
20. If all possible, the electrode tip should be ground, with a fine- or medium-grain diamond disc. The angle should be approx. 25°.



Welding materials

1. For high gold content and reduced alloys, always use the same kind of welding material, which you can either obtain from your alloy supplier in the form of machined wire, or cast it yourself.
2. For cobalt-chromium alloys, you **always need machined, carbon-free welding wire**, which you can obtain from your alloy supplier.
3. For titanium, always use wire machined of pure titanium which is available from your titanium supplier.
4. The most common wire thicknesses range between 0.35 to 0.50 mm and are the most suitable wires for welding.
5. To melt the welding wire, you must hold it between the electrode tip and workpiece.

Summary of the most important points

1. **In general, weld at a maximum gas flow rate of 4 liters/min.**

2. **Try to avoid welding "free-hand", i.e. always put both hands on the hand rests. Shaky hands interfere with the parameter settings.**

3. **Make sure that the workpiece is always in perfect electrical contact with the clip during welding.**

4. **Always work with a sharp, i.e. well-ground electrode.**

5. **Do not exert any pressure on the electrode tip during welding. Only make light contact with it.**

6. **If, during welding, a larger amount of welding smoke is produced due to impurities or grease on the surface of the workpiece, use the glass brush to remove any smoke residue or, even better, sandblast the surface before you continue welding.**

Recommended welding exercises

1. Use an uncast, sandblasted gold-alloy ingot, select the Gold (Au) program and place a few spot-welds on the ingot.

2. Vary the power setting on the welder (from 20% up to 100%) and observe the differences in the spot-weld and penetration depth.

3. Return to the standard program Gold and, as in number 2, change the impulse duration (from 3ms to 30ms). This will give you an idea of how the spot-welds change with varying power and time settings.

4. Weld together two of the above-mentioned gold ingots (on both sides) and try to break the ingots apart. If you have welded correctly, you should not be able to break the ingots apart by bending them with your bare hands.

5. First try welding some sprues together aligning them and butt-weld them to form a hollow seam. Then try beveling them "from inside out", this time using welding material. Clamp the welded sprues down in a vice and bend them 90° with a pair of pliers.

6. Weld two 0.5 mm-thick alloy wires together parallel to each other without damaging the "rounded edges" of the wires.

7. Butt-weld two alloy wires together (at the ends).

8. Build up a cusp on an alloy ingot.

9. Drill holes in an old crown and close them up again using the Phaser mx1. Use welding wire.

10. Practice welding your Co-Cr alloy on old cast partials.

Dental welding techniques using the Phaser mx1

There are a couple of things you should know before you start welding your first real dental prosthesis:

1. The thermal conductivity of an alloy.

   For Phaser welding, the power needed to melt the alloy (between 10% and 100%) depends primarily on the alloys thermal conductivity – and less on its melting interval.

   For instance, because of its high thermal conductivity, a high gold content alloy will absorb the energy generated faster and therefore requires greater energy input (power x impulse duration) than, say, cobalt-chrome or titanium, even though the melting interval of the Co-Cr alloy (and/or the melting point of titanium) is much higher than that of high gold content alloys.

2. Special notes on cobalt-chrome alloys

   - You should only use low-carbon Co-Cr alloys (if possible, "suitable for laser" alloys) for casting.
   - The welding wire used must be machined carbon-free, cobalt-chrome wire.
   - Co-Cr alloys must always be welded with a higher impulse duration (eutectic alloy = very narrow melting interval) since, otherwise, cracks can form in the welding spot.
   - Co-Cr alloys should be welded "more slowly" (with sufficient pauses between the individual impulses) to prevent heat build-up that can lead to distortion.

3. Never weld on old soldering spots, i.e. always grind off the old solder first before making repairs.

4. Never use solders as welding material. Solders contain components with a low melting point which will burn during welding.

5. When welding seams, you must always overlap the individual spot welds rather than place them one next to the other.

If you follow this information, you will be able to work successfully with the Phaser mx1.

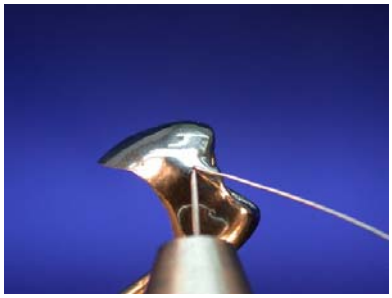
How to weld proximal and occlusal contacts

To carry out this welding task, you need welding material that is of the same type and compatible with the alloy you are using. It is best to use wire with a thickness of 0.35 – 0.5 mm.

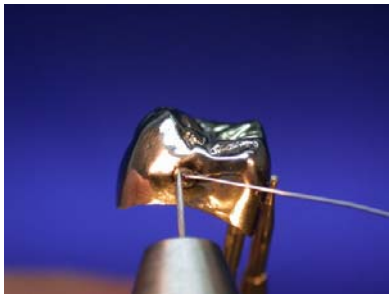
Connect the alligator clip to the object to be welded.

Select the standard program setting for the alloy you are using and the desired gas pre-flow time (in this case 1.5 sec).

Proceed according to the steps described in the pictures:

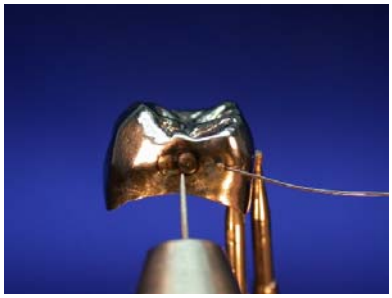


1. To achieve a spherical contact, start applying the material at the equatorial level towards buccal-proximal. Be sure to hold the welding wire ...

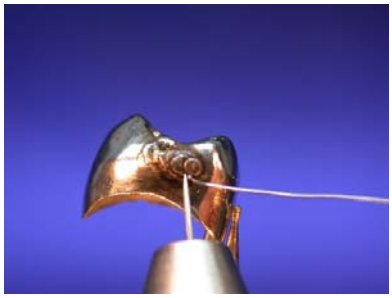


2. ... between the electrode tip and crown.

The first pulse melts the welding wire material onto the crown.

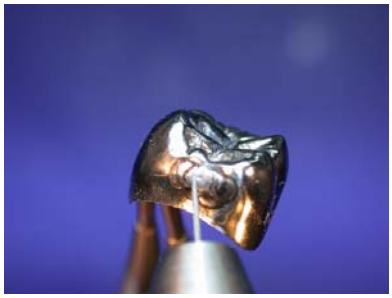


3. Now you can weld additional welding material spot-by-spot onto the proximal surface.



4. If necessary, you can easily weld several layers of welding material on top of each other.

5. To smoothen the welded-on material, turn up the impulse duration (Time) and reduce the power accordingly.



6. Now you have finished welding the contact and can start adjusting and polishing it.

Note: The level to which you increase the impulse duration (Time) and lower the power during smoothening will depend on the alloy you are welding. If you are using a high-gold content alloy, for example, increase the impulse duration by two to four levels, but only lower the power input by one to two levels.

You can also achieve a flatter, more widespread and smoother spot weld by changing the angle between object and electrode tip. Instead of holding the object at a 90° angle, reduce the angle to between about 40°-50°.

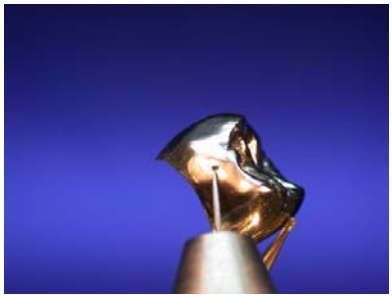
How to close porosities and/or holes in crowns

To carry out this welding task, you need welding material that is of the same type and compatible with the alloy you are using. The most suitable wire thickness is 0.35 – 0.5 mm.

Connect the alligator clip to the object to be welded.

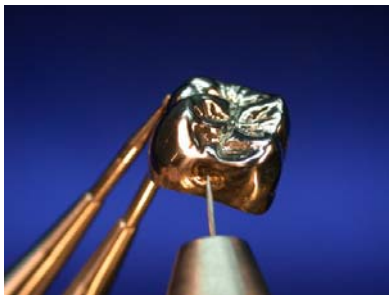
Select the standard program setting for the alloy you are using and the desired gas pre-flow time (in this case 1.5 sec).

Proceed according to the steps described in the pictures:

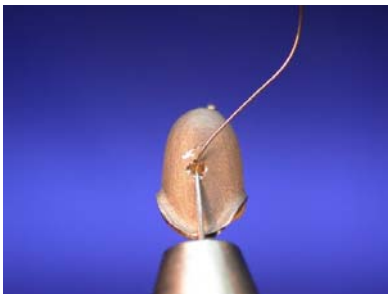


1. Porosities usually develop from investment material residue or from not enough molten alloy. Since you can't always tell “from outside” how deep the porosity is ...

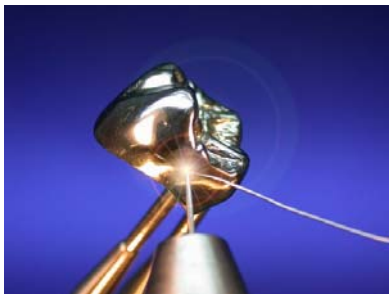
1. Widen the hole in the crown to achieve an approx. equal surrounding thickness of at least 0.2 to 0-3 mm.



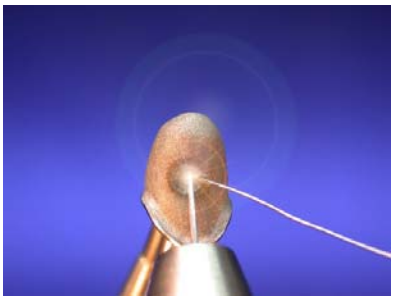
2. ... start by sending several impulses to expand the porosity without adding any welding material. This creates a "crater-like" hole.



2. Place the welding wire approx. 0.5mm inside the defect. Aim the electrode tip exactly at the welding wire.



3. Now fill up the "crater" you have created with the welding material "spot-by-spot".



3. Usually, you only need to send one targeted pulse to close the hole by melting the wire into it.

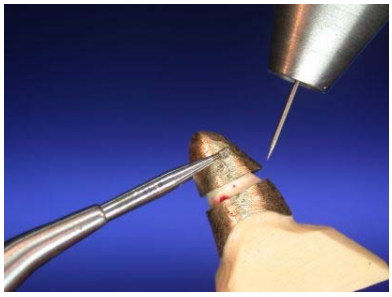
4. For finishing, you can also use the Phaser mx1 to smoothen the spot weld (see page 21), adjust the contact and polish to a finish.

4. In case the wall of the crown in the surrounding area of the hole is too thin, weld on a thin sheet of the same alloy over a wider area.

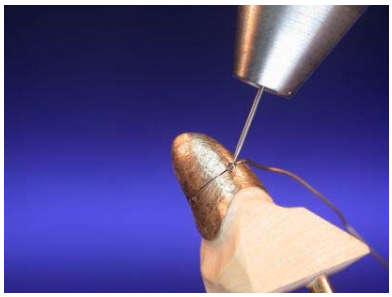
How to restore or extend crown margins

As a basic rule, it is always preferable to restore crown margins than to try to extend them. This is because it is very difficult to weld very fine wire onto a thin crown margin that is already insufficient and the results are usually unsatisfactory.
As with the previous welding tasks described above, always start by selecting a suitable welding material. Connect the alligator clip to the object to be welded and select the standard program that corresponds to the alloy you will be working with. The gas preflow time is 1.5 sec for each individual spot weld; for welding the seam, the preflow time can be reduced to 0.5 to 1.0 sec.

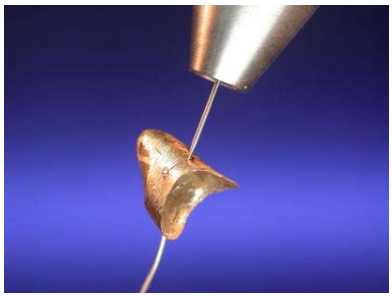
Proceed according to the steps described in the pictures:



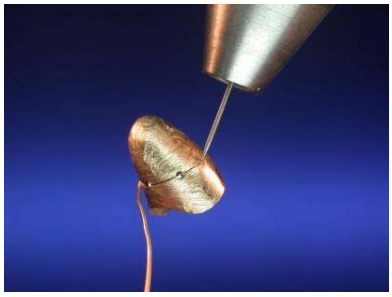
1. Cut off the insufficient crown margin at 360° and then wax up a perfectly new crown margin, invest and cast it.



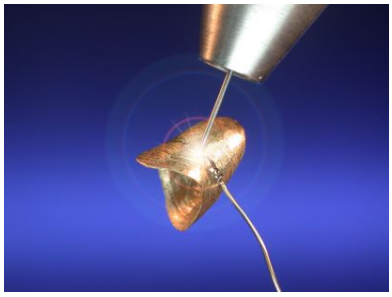
2. Place the new margin and "residual crown" on the die and give it the first joining shot. Depending on how large the gap is between crown and...



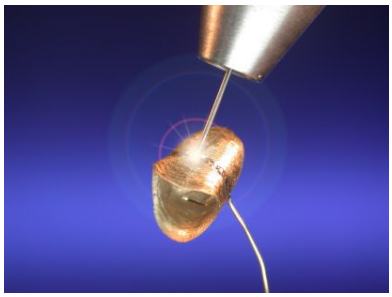
3. ... new margin, you may have to start working with welding material right away. Place several spot welds 360° around the margin to join it securely. Then...



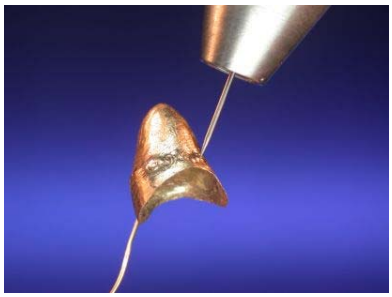
4. ... remove the crown from the die and start to draw seams between the individual spot welds.



5. For this working step, you can now reduce the gas preflow time (as described above).



6. Pulse-by-pulse a 360° weld is created. **As a rule of thumb:** Where the parts to be welded parts touch each other, it is possible...



7. ... to work without welding material. Whenever a gap exists, material must be added. **Always remember to aim at the wire!!!**

8. The finished crown margin after welding and sand-blasting. Counter-welding from the inside of the crown could be done, but is normally not needed.

How to weld cast bridge elements to galvano copings

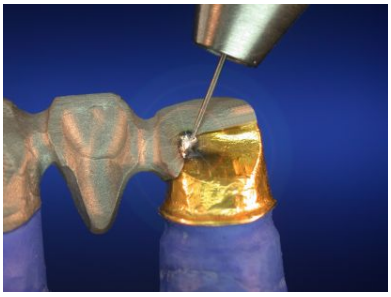
If you want to weld a bridge element to a galvano coping, most of the time you don't need any welding material, because the cast components usually fit accurately on the crowns.

Attach the alligator clip to the **cast bridge element.**

Select the standard program for the **cast alloy** and set the desired gas preflow time (in this case 1.0 sec).

Follow the procedure illustrated below and observe the information given in the notes.

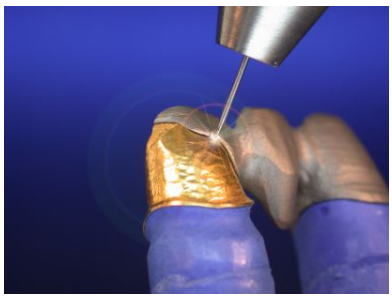
1. Place the finished galvano coping on the die and the die on the model.



4. Always aim at the casting alloy, never at the galvano coping or into the gap. For more details, see "Note".

2. Place the cast bridge element on the galvano coping.

5. Once bridge element and coping are fused together, place the seam welds. If the gap between the elements turns out to be too large in isolated areas...



3. Always send your first tacking impulse to the area where the gap between coping and bridge element is the smallest.

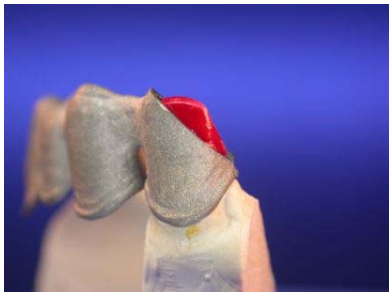
6. ... continue working with the cast alloy welding wire. As mentioned, always aim at the wire.

Note: In general, the cast alloy is always aimed at because its melting interval is always higher than the melting point of the galvano **gold** coping. The molten cast alloy will melt the galvano gold, thereby causing the two components to fuse. In practical terms, when working in the transition zone between bridge element and coping, you must always aim at the cast alloy. **If you aim at the gap between bridge element and coping or at the coping itself, you will shoot a hole through your galvano crown!!!**

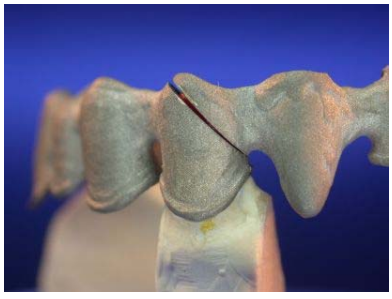
How to separate bridges and weld them back together again (1)

There are various different methods and techniques for separating bridges and welding them back together again. Here we will use only a few of the simplest and most efficient methods for illustration purposes.

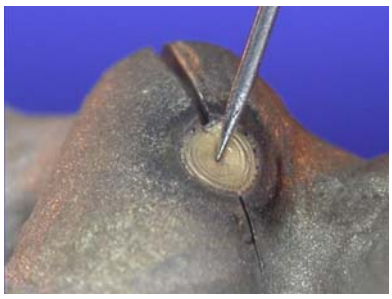
In general, we distinguish between "hollow seams" and massively welded joints in which the components to be joined are beveled and then built back up with welding wire made of the same type of metal (for example the classical interdental cut). For more information, read the Note below and on the next page.



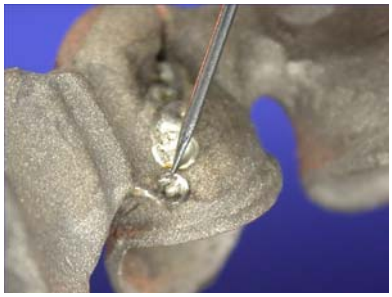
1. If a rocking bridge has to be separated, it is more efficient to separate "through the crown" than to separate inter-dentally, because...



2. ... this technique lets you work with thinner crown wall thicknesses. By contrast, the interdental cut has to be beveled and fully rebuilt.



3. Always place your first joining impulse at the site where the gap between the two bridge elements is smallest.



4. Once you have reliably secured the bridge with the first impulses, you can lift the workpiece off the model and weld a circular seam, ...

5. ... as described in the section on restoring crown margins (page 23). During seam welding, repeatedly check for an accurate fit of...

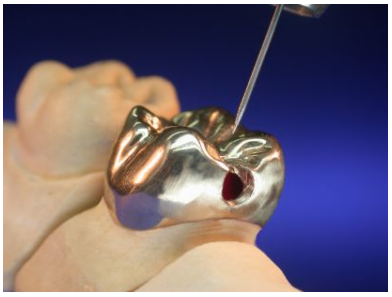
6. .... the bridge on the model. Wher-ever the gaps between the bridge elements are too wide, always be sure to fill with welding material!!!

Note: It is basically possible to separate pieces of work that have already been veneered and weld them back together. Beware: this is not a task for the novice. Much experience is required to weld the pieces back together without damaging the veneer, while preventing deformation. That's why you should gain practice and experience before tackling sophisticated welding tasks.

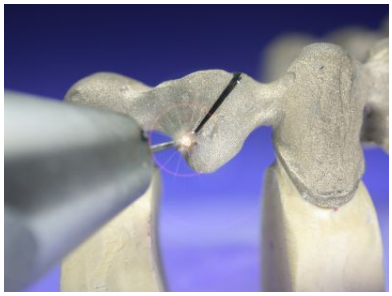
How to separate bridges and weld them back together again (2)

As we will illustrate in the following example, the so-called "penetration depth" is extremely important when welding a hollow seam. Select the appropriate standard program for the alloy and turn up the power high enough to achieve penetration depth of 0.5mm to 0.6mm. Always be very careful to prevent spattering or metal ejection. Violent spattering is a clear indication that you are overheating and thereby damaging the alloy.
The statics of a hollow seam are comparable to those of a full weld, particularly in cases where the welded bridge is later intended for full-ceramic veneering.

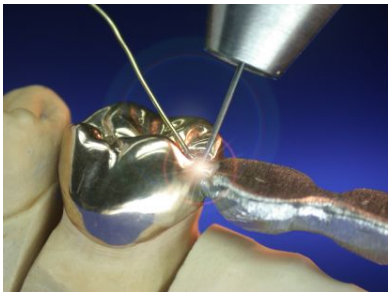
1. A diagonal cut through the bridge pontic is the easiest technique for separating bridges intended for ceramic veneering.



1. If you have to go back and weld a bridge element (pontic) onto a pre-existing crown, prepare the crown as shown on the left.

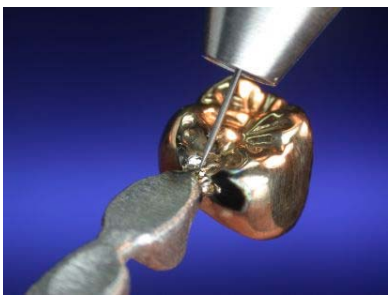


2. In these cases, you can place a hollow seam weld without worrying about the statics. Aim the first welding impulse at the site where the gap ...

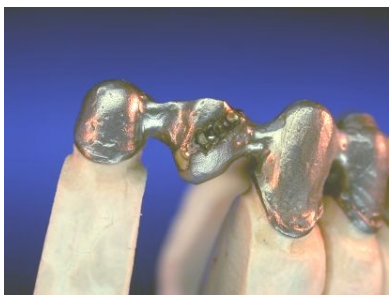


2. Wax-up and cast the bridge element so that the proximal peg projects into the crown like a "Lego block". Place the first joining welds...

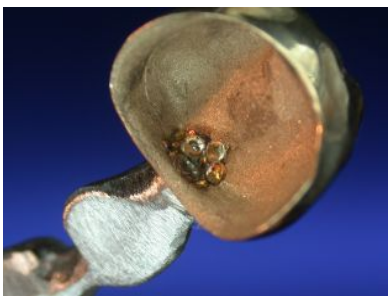
3. ... between the parts is the narrowest. Use compatible welding material where the gaps are wider. After placing the first joining welds, you can ...



3. ... then you can remove the bridge framework from the model and weld circularly. Whenever necessary, use the proper welding material.



4. ... remove the bridge framework from the model and weld the seam. Beginners: repeatedly check for an accurate fit on the model.



4. Finally, weld the peg of the bridge element that extends into the interior of the crown from the inside.

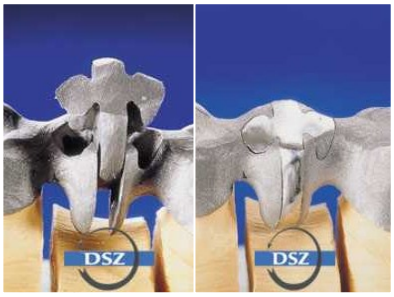
How to separate bridges and weld them back together again (3)

As we already mentioned, there are numerous ways to efficiently separate bridges and weld them back together again to create an accurate and passive fit. In the following, we would like to give you some helpful examples, suggestions and tips on how to do so.
As a rule, starting with the standard program for the alloy to be welded, you should adjust the parameters so that the material does not spatter during welding. Spattering is a clear indication that you are overheating and thereby damaging the alloy.

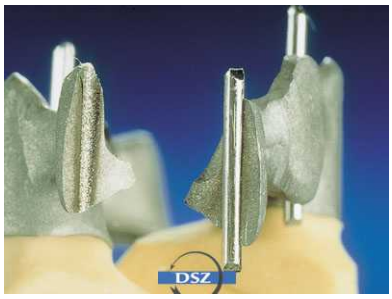
1. If you have to make an interdental cut through a bridge or if the dentist has separated the bridge interdentally in his practice, you can either...

1. If you encounter a large cavity in the pontic, for example, due to incorrect spruing, there's no need to throw the bridge away. All you have to do is separate the...

2. ... chamfer the interfaces and reshape the joint bit-by-bit, or place the two bridge elements in situ and drill a 1-mm hole with the milling machine.

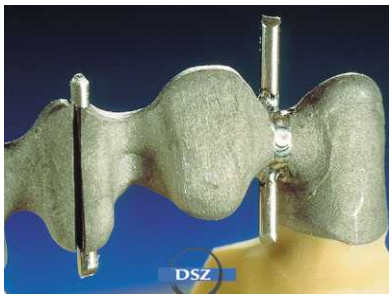


2. ... bridge element, grind it down to create a slightly retentive geometry and cast a fitted piece which can now be easily seam-welded together.

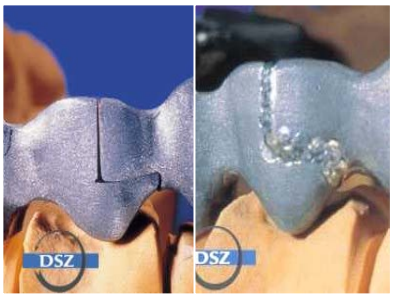


3. In this hole, you then insert an alloy wire of the same diameter. Now, you no longer need to weld deep which could cause the alloy to overheat...

1. Another simple and efficient method for separating poorly fitting bridges and welding them back together is the "staggered cut". Here, too, ..



4. ... depending on the circumstances, but you just draw welding seams and separate off the wire extentions afterwards.



2. ... you do not need to weld all the way through because this cut will optimally accommodate masticatory forces, especially after the framework is veneered.

How to weld secondary crowns or attachments to a cast partial

To carry out this welding task, you will usually work with cobalt-chrome welding material. The most suitable wire thickness is 0.35 – 0.5 mm.

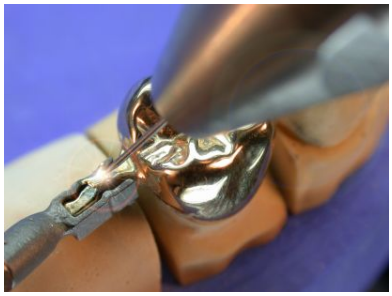
Connect the alligator clip to the object to be welded.

Select the standard program that corresponds to the alloy (hybrid, in this case) and the desired gas preflow time (1.5 sec).

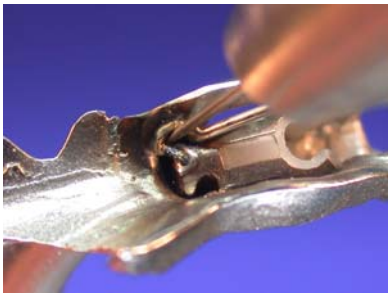
Proceed according to the steps described in the pictures:

1. Produce a suitable (laser) connecting element on the secondary crown and on the cast partial. Such connecting elements are ideal for achieving ...

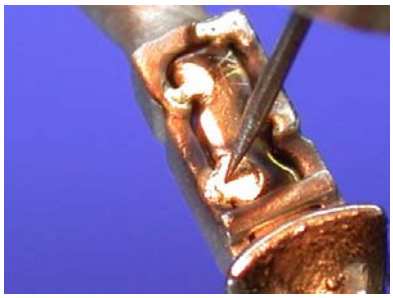
1. Achieve an optimum fit of the attachment (here an SG attachment) on the cast partial.



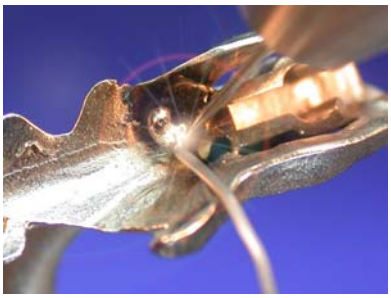
2. ... a power grip for power transmission. Place the first joining spot from the occlusal "half way across" this connecting element.



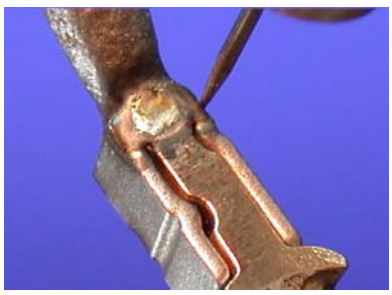
2. Place your first spot weld at the site where you have the smallest distance between attachment and cast partial. Check the fit...



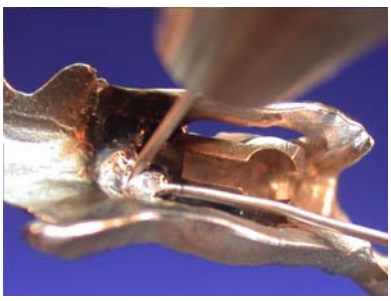
3. Place additional occlusal joining spots diagonally across the first. Then weld the corresponding spots from the basal.



3. ... before you continue welding. Once the attachment has been cleanly joined, you can remove the acrylic inserts.



4. Finally, weld the seams. If the task is to attach several secondary crowns on a cast partial, weld them on, one after another.



4. Use welding wire to fill any gaps between attachment and cast partial. Always aim the electrode tip at the wire.

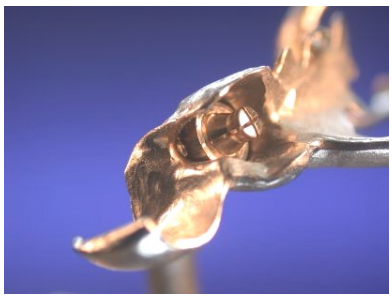
How to weld anchor or Bona-type ball attachments to a cast partial

To carry out this welding task, again use welding material that is of the same type and compatible with the alloy you are using. It is best to use wire with a thickness of 0.35 – 0.5 mm.

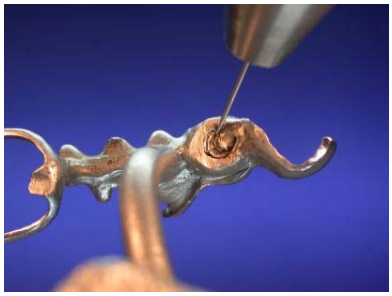
Connect the alligator clip to the object to be welded.

Select the standard program setting for the alloy you are using (in the case of HSL anchor attachments use “Hybrid”) and the desired gas preflow time.

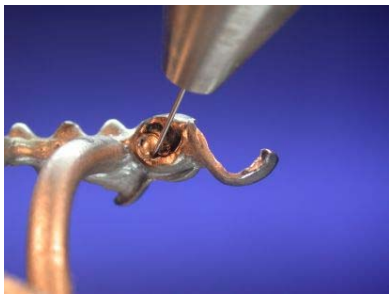
Proceed according to the steps described in the pictures:



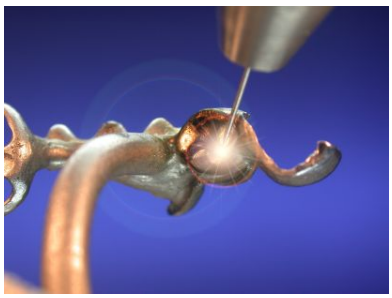
1. To be able to weld an HSL anchor onto the cast partial, you must expose it on the occlusal side. With the workpiece on the model,..



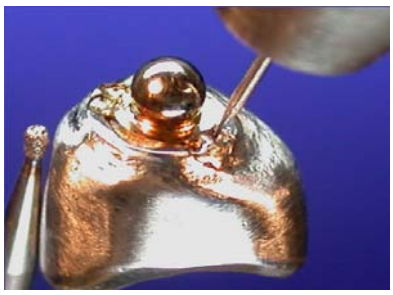
2. ... place the first spot welds. Then you can remove the workpiece from the model and finish welding.



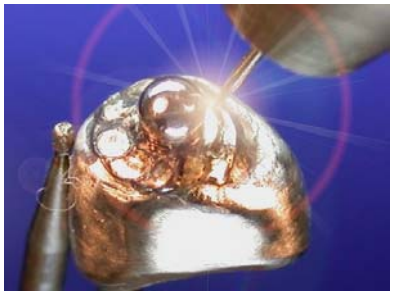
3.Always make sure to weld criss-cross (tighten the wheel nuts) to prevent distortion ...



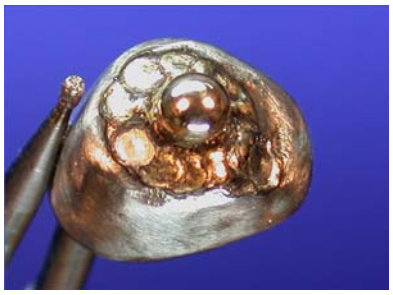
4. ... and use the proper welding material if the gap is still too large. Remember to always aim the electrode tip at the welding wire.



1. In this example, Bona-type ball attachments are to be welded as retention elements to root canal posts made of a non-precious alloy.



2. After joining, place a circular seam. Since the Bona-type ball attachments have been somewhat integrated into the root canal post, ...



3. ... you can usually work without any welding material.

4. Now that you have finished welding on the Bona-type ball attachments, you only have to rubber-wheel and polish the seam weld.

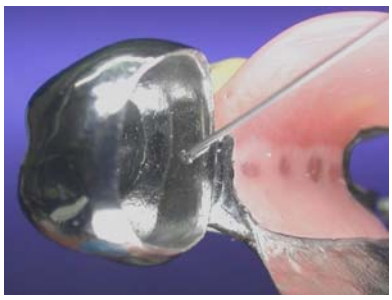
How to increase friction in secondary crowns

To carry out this welding task, you need welding material that is of the same type and compatible with the alloy you are using. It is best to use wire with a thickness of 0.35 – 0.5 mm.

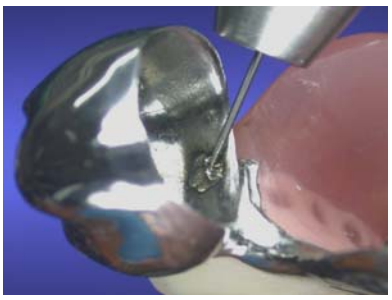
Connect the alligator clip to the object to be welded.

Select the standard program setting for the alloy you are using and the desired gas pre-flow time (in this case 1.0 sec).

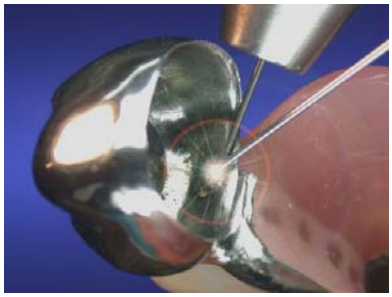
Proceed according to the steps described in the pictures:



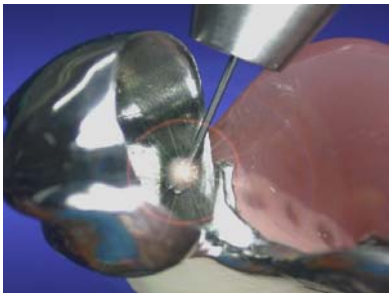
1. Place the welding wire in the desired position on the inside of the secondary telescope.



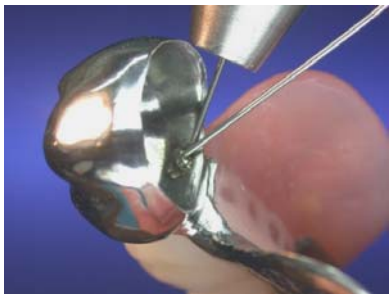
4. If necessary, you can simply weld several layers of welding material over each other.



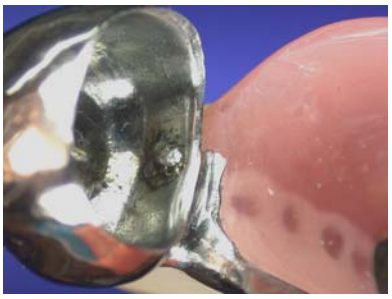
2. Aim the electrode tip at the welding wire and wait until the pulse is triggered.



5. To smoothen the welded-on welding material, turn up the impulse duration and reduce the power input accordingly.



3. Repeat the procedure until you have applied enough material.



6. Finally, you just have to adjust and polish the applied welding material to restore the friction.

Note: The level to which you increase the impulse duration and lower the power during smoothening will depend on the alloy you are welding. With a high-gold content alloy, for example, increase the impulse duration by two to four levels, but only lower the power by one to two levels.

Basically, this type of repair work does not really create true friction, but rather a sort of "clamp fit". Nevertheless, such repair procedures are efficient and also more affordable for the patient.

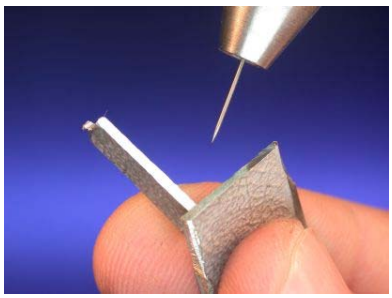
How to weld a cast partial framework (example)

To successfully weld cobalt-chrome alloys, use machined, carbon-free wire, most suitably with a thickness of 0.35 – 0.5 mm.

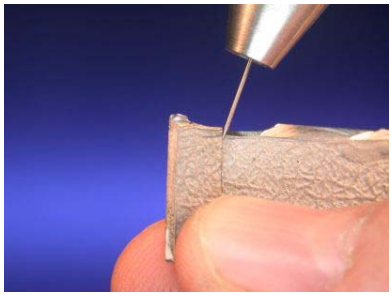
Connect the alligator clip to the object to be welded.

Select the cobalt-chrome (Co-Cr) standard program and the desired gas preflow time (for isolated spot welds 1.5 sec, for seams 0.5 to 1.0 sec).

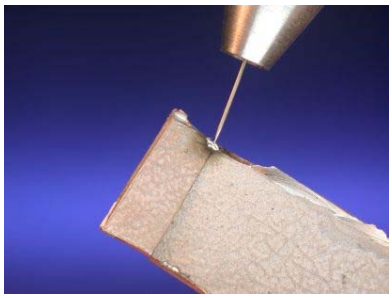
Proceed according to the steps described in the pictures:



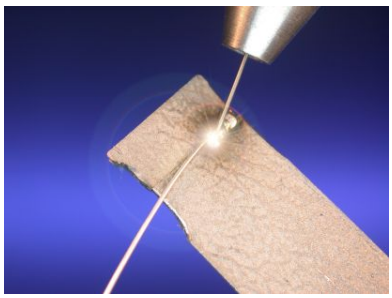
1. In this practical example we illustrate how you can extend a transversal belt. The first thing you have to do is to cleanly adapt...



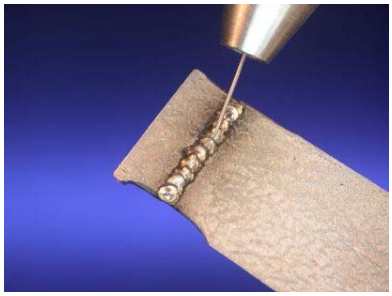
2. ... the new cast extension to fit the existing transversal belt. Allow no gap at all or only a small gap between the parts to be welded.



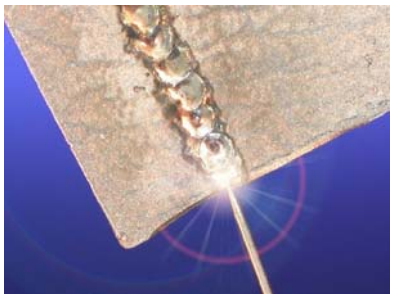
3. With the first spot welds, join the two partial frame-works parts together.



4. Now start by welding from the palatal. Use welding material if nec-essary. As mentioned before, weld slowly, with short pauses...



5. ... between the individual impulses. This kind of work should always be welded also from the basal. Since you will usually require welding wire, ...



6. ... create the necessary space in the basal region beforehand. This way you will avoid unnecessary correction work.

Note: Please always observe the fundamentals of cobalt-chrome welding. When fabricating new constructions, cast the carbon-free alloys (for example laser-compatible Co-Cr material). Only ever weld with carbon-free wire. Also, you must always counter weld. One-sided welding will not endure. Never ignore cracks you may notice in the spot weld, but increase the impulse duration and work with Co-Cr welding material. It is also important that the spot welds always overlap each other.

How to eliminate tension in a newly fabricated cast partial framework

The same basic rules apply here as to every welding task. Use machined, carbon-free Co-Cr wire, most suitably with a thickness of 0.35 – 0.5 mm. Attach the alligator clip to the object to be welded.

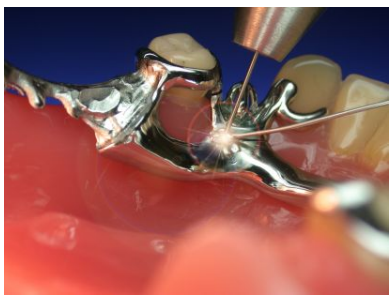
Select the cobalt-chrome (Co-Cr) standard program for the alloy, or adapt the program setting as needed, and select the desired gas preflow time (1.5 sec, for seams, 0.5 to 1.0 sec for isolated spot welds).

Proceed according to the steps described in the pictures below:

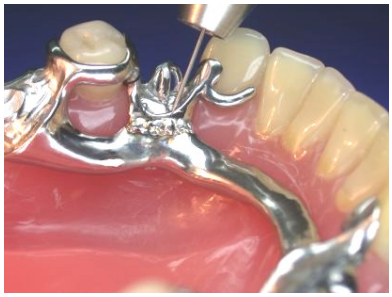
1. The situation: you have finished a partial framework. Unfortunately, it does not show a passive fit. When you separate the clasp and saddle element...

2. ... this element fits perfectly on its own. The same applies to the sublingual bar.

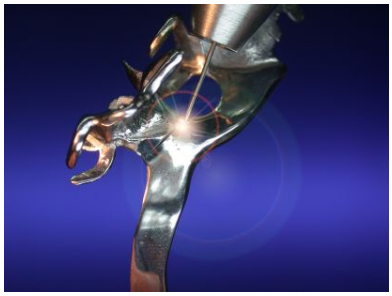
3. A gap was created by separating with a grinding disc, which, of course, has to be filled with welding wire.



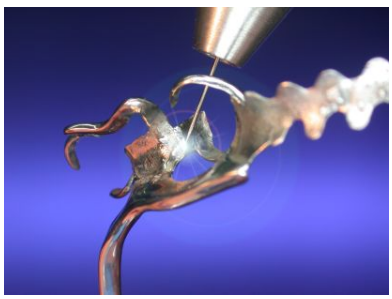
4. Use welding wire for your very first joining impulses. Always remember to aim the electrode tip at the wire.



5. Check the fit at regular intervals, especially if you are not yet that experienced in the technique and ...



6. ... then weld the basal side. Ideally, the separating gap was as wide as the wire, i.e. you were able to fit the wire into the gap.



7. In this case, you do not need to use any additional welding wire for the basal side. Don't forget that Co-Cr has to be welded slowly.

8. Normally, all you have to do now is rubber-wheel and polish as usual.

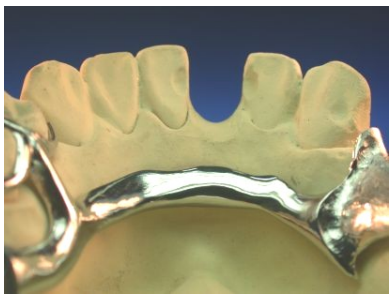
How to weld cast and/or bent retentions

To carry out this welding task, again use welding material that is of the same type as the alloy you are using. It is best to use wire with a thickness of 0.35 – 0.5 mm.

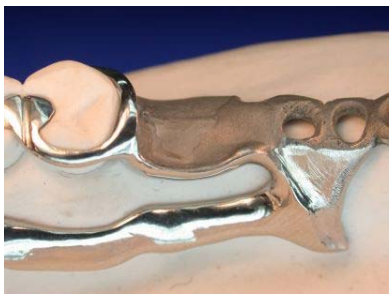
Attach the alligator clip to the object to be welded.

Select the standard program for the alloy (Co-Cr) and the desired gas preflow time.

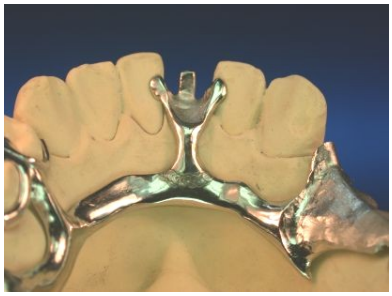
Proceed according to the steps described in the pictures below:



1. One common welding task is to extend a cast partial frame by attaching a cast or bent retention.

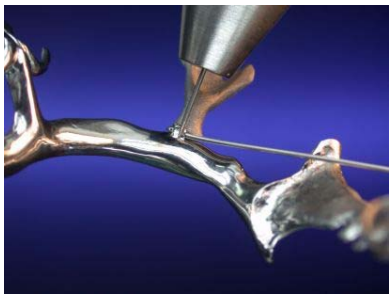


1. For a bent retention, you can use Wiptam wire, for example. As usual, grind a small groove in the cast partial frame.

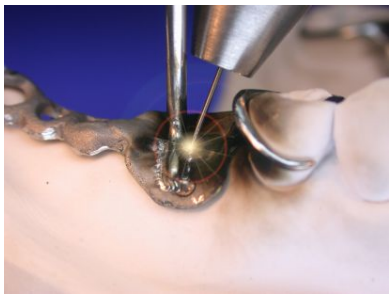


2. After casting and finishing the retention, start by setting the first welding spots. Once the retention is cleanly adapted to the bar ...

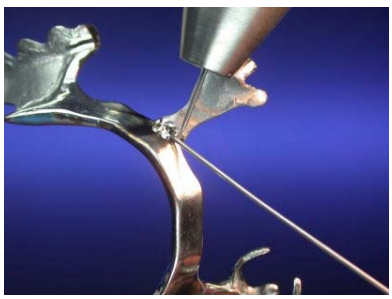
2. Join the retention with a few spot welds, and then weld the seam (if necessary, reduce the gas preflow time to save argon).



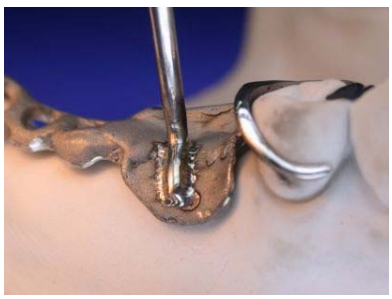
3. ... you can secure it in place without any welding material. If you are working with welding wire, you should bevel the edges.



3. To prevent cracks from forming at the weld spots, it is advisable to anneal the Wiptam wire before welding it on.



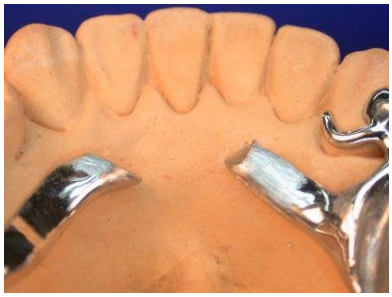
4. Then, weld the retention from the basal. If you are working with welding material, always aim the electrode tip at the welding wire.



4. If necessary, work with carbon-free Co-Cr welding wire.

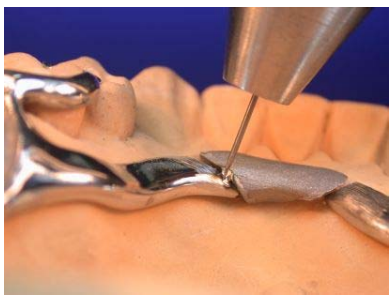
How to weld a broken sublingual bar

The most important aspect of this welding task is to first find out what caused the bar to break. If you repair the bar without eliminating the cause beforehand (for example, if the saddles were not rebased in time), then your efforts will fail, i.e. the piece will break again after just a short time. Furthermore, the structure of the metal exhibits micro-fissures on either side of the break and is thus useless anyway. So, it would not make sense to just align the two halves and weld them back together again. If you were to do so nevertheless, the bar would soon break again, probably right next to the welded spot. What would make sense is to weld in a new piece.

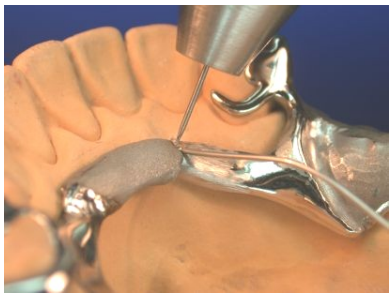


1. Remove approx. 5 mm from the bar left and right of the break. Cut at a slant to facilitate adaptation of the joining element.

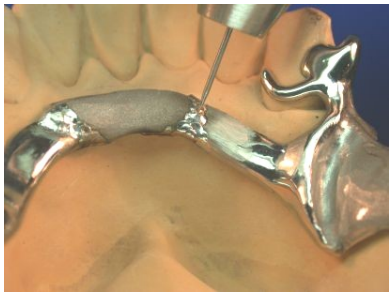
2. You can either fabricate a new joining element or cut one out of an "old" sublingual bar. The smaller the gap is ...



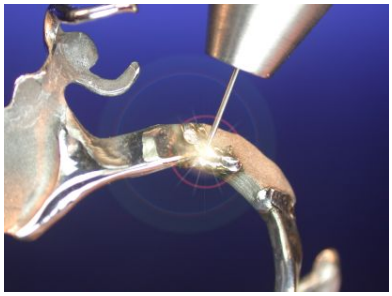
3. ... between the bar halves and the joining element, the less welding material you need. Always complete the weld on one side first, ...



4. ... i.e. also from the basal before you start working on the other side. Make sure to check the fit repeatedly during your work.



5. On this side, if necessary, always weld alternately from the lingual and basal. Make sure not to create any hollow seams on the bar, ...



6. ... but weld massive seams "from the inside out". This work is tedious and will take several minutes, but compared to soldering, ...

7. ... is still more efficient than having to remove the saddles. After the actual welding is complete, increase the impulse duration and ...

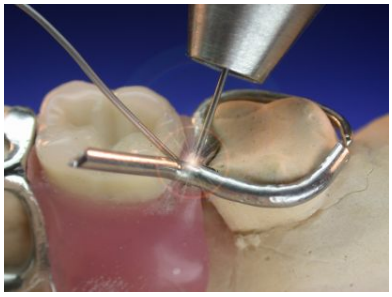
8. ... adjust the power accordingly to smoothen the weld. As an alternative, you can also rubber-wheel and polish right away without smoothening.

How to repair a broken clasp

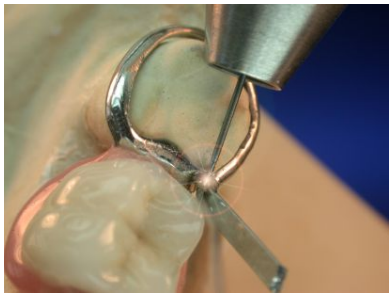
For this welding task, you must again first find out what caused the clasp to break. If you were to just weld the broken clasp piece back on without eliminating the cause (e.g. constant overextension due to incorrect surveying), then your efforts will fail, i.e. the clasp will break again after just a short time. Furthermore, the structure of the metal exhibits micro-fissures on either side of the break and is thus useless anyway. To permanently repair the broken clasp, it is advisable to fabricate a new clasp (bent or cast) and then to weld the new clasp on.

1. Repair work is needed on # 31 after the lingual clasp arm was "overactivated".

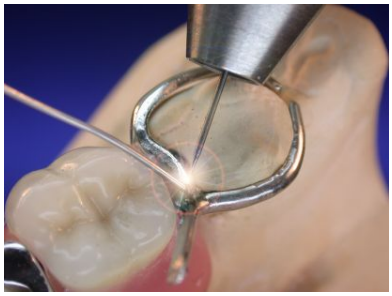
2. As with the broken bar, keep grinding off the defective structure until clean cast material is exposed.



3. Bend a one-arm clasp out of a half-round wire and set your first joining welds. Work with welding material since in this case ...

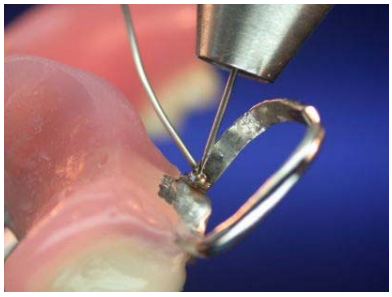


4. ... as well, you should create massive welding seams "from the inside out" (without creating any hollow seams).



5. As with a modeling instrument, you can now apply material "spot-by-spot" with the electrode tip and welding wire.

6. Lift the prosthesis off the model and weld the inside of the clasp.



7. At this time, you should separate off the protruding part of the bent clasp arm (the holder).

8. You can now finish and polish the clasp. The composite has not been damaged by the welding procedure.

How to repair secondary crowns broken off a cast partial frame

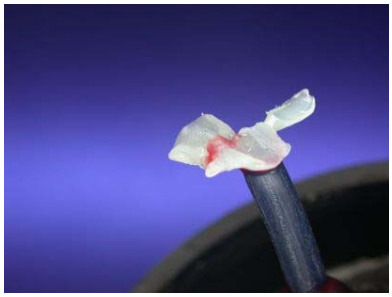
In general, you do not need any welding wire to perform these welding tasks since the cast joining element should already show a proper fit on the crowns and the cast partial frame. However, it is very important that you remove all soldering residues from the fracture areas.

Select the standard program for the alloy (hybrid and/or Co-Cr), or adapt the program setting as needed, and select the desired gas preflow time.

Proceed according to the steps described in the pictures below:

1. Once you have removed all soldering residues, grind a retaining guide in the secondary crowns and in the ascending branch of the cast partial frame.

2. Ideally, you should shape the joining element (base) out of light-cured wax (Metacon, Kuss Dental) and polymerize the wax-up.



3. Polymerization turns this wax into acrylic. Now carry out try-in and finishing, if necessary. Then sprue and cast (rapid firing invest-ment material).

4. This is how the finished cast joining element should be fitted on and prepared for welding.

5. First, select the Co-Cr program and weld the "arm extension" to the cast partial frame in the area of the natural tooth.

6. Next, select the hybrid program and weld the joining element to the secondary crowns.

7. After you have welded the joining element to the secondary crowns and cast frame with a circular seam (also in the area of the ascending branch) ...

8. ...you just need to metal-finish, rubber-wheel and polish. Now you have completed the repair work without damaging veneer or composite.

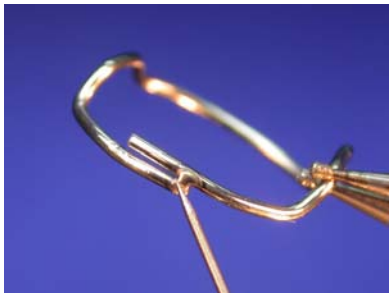
Orthodontic example: How to fabricate a Crozat appliance

You generally do not need any welding material to complete this welding task.

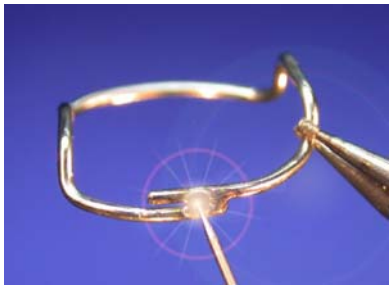
Attach the alligator clip to the object to be welded.

Select the standard program for the alloy and the desired gas preflow time (in this case 1.0 to 1.5 seconds).

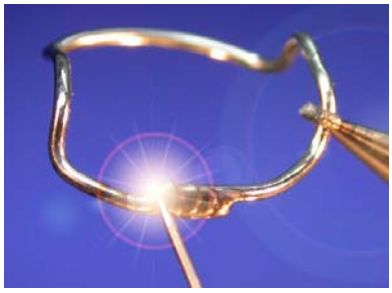
Proceed according to the steps described in the pictures below:



1. In general, you should never butt weld the wire elements end-to-end. Instead use short seams so that the bent ...



2. ... elements overlap a bit. After the first joining impulse, weld the seam so that the weld spots always overlap by 50%.

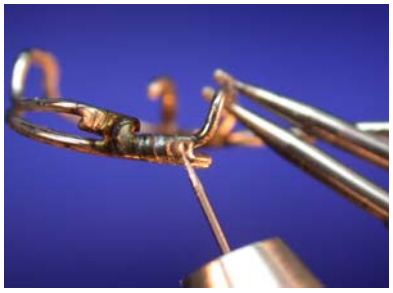


3. Five to six impulses should be sufficient to achieve a solid, permanent seam. Then you can easily use rotary instruments...

4. ... to finish, rubber-wheel and polish. If necessary, of course, you can also counter-weld on the inside.

5. If you want to join thick and thin wires together, connect the alligator clip to the thicker wire.

6. Even if you are welding "from the inside", touch the electrode to the ascending occlusal bar to melt the edge on perfectly.



7. Finish all seams to be welded as described above. As with smoothening, you can also weld over the welded areas again, if necessary.

8. This method produces an orthodontic appliance which is made of one single material and completely solder-free.

Troubleshooting

PROBLEM	CAUSE	REMEDY
elding current The main power switch is on, but the green "Ready" LED is not lit up	Break in mains lead	Check mains lead und mains voltage
2. No welding current The main power switch is on and the green "Ready" LED is lit up	Break in welding cable connection Poor or no earthing	Check all plug connections Create connection to workpiece Fasten contact clip directly to workpiece
3. No welding current The main power switch is on, the charging LED stays permanently red, and/or "Select“ LEDs are blinking	No Argon gas, thereby act-ivating Auto-Stop function. Fault current causing malfunction	Connect shielding gas, check flow rate. Turn device off and on again If the error still occurs, have device serviced
4. Poor ignition	Poor contact to earth Electrode is dirty Electrode tip is burnt off	Create connection to workpiece Regrind electrode Regrind electrode
5. Main fuse blows or automatic circuit breaker triggers	Poor fuse protection or wrong **circuit breaker** Mains fuse triggers in open circuit	Ensure proper fuse protection Have device serviced
6. Poor welding properties	Wrong shielding gas	Use inert shielding gas (Argon 4.6)
7. Oxidation und soot formation	Gas pressure too high	Reduce gas flow rate: approx. 3 to 4 l/min is sufficient
7. Weld-spots show strong oxidation	Wrong shielding gas	Use inert shielding gas (Argon 4.6)
8. Tungsten inclusions in the basic material	Too much pressure is applied to touch the electrodes to the workpiece	Touch workpiece without pressure just enough to ensure reliable ignition
9. Tungsten electrode sticks to workpiece	Too much pressure is applied to touch the electrodes to the workpiece	Touch workpiece without pressure to ensure reliable ignition

10. Tungsten electrode melts off instantly	Tip ground too sharp	Grind electrode to recommended angle (approx. 25°)
11. Static discharges over surface of device	Special ambient conditions	Use a special foot mat in working area

Frequently Asked Questions – FAQs

1. Which alloys and metals can I use for welding?

- All precious metal alloys containing gold, silver, platinum and palladium.
- Cobalt-chrome alloys, titanium and stainless steel.
- And, with certain limitations (depending on the alloys), aluminum, tin and most brass alloys.

2. Do all alloys behave the same during welding?

- No – The welding result depends on the melting interval and the thermal conductivity of the alloy.
- For example, the lower an alloy's thermal conductivity, the less energy (power X impulse time) is required to melt it.

3. Can I weld right next to acrylic and ceramic?

- Yes – the heat-affected zone during welding with the Phaser mx1 is comparable to the heat that develops during laser welding.

4. Can I also weld without shielding gas?

- No – welding without shielding gas produces strong oxidation and soot formation at the welding site. Moreover, it is not possible on the Phaser mx1 because of its Auto-Stop function.
- The spot welds will become porous and loose their stability.

5. Can I use a different shielding gas besides Argon 4.5?

- In principle, yes. However, we recommend Argon 4.5, because we have obtained the best results with it.

6. How much gas is consumed during welding?

- Each spot weld consumes about 0.3 to 0.4 liters of gas. A 10-liter bottle contains 2000 liters of gas. That means 5,000 to 6,600 welds per filling.

7. Can I use welding wire?

- Yes – we recommend welding wire made of the same kind of material with a thickness of 0.35 mm to 0.50 mm.

8. Can I add solder?

- No – Solder tends to "scorch" because of its low-melting components.
- That is the reason why you should never weld on solder points.

9. How deep do spot welds penetrate into the material?

- The penetration depth depends on the power settings for welding (power X impulse time), the thermal conductivity of the material to be welded and the angle at which the electrode tip is held.
- That means that the higher the welding power and the lower the thermal conductivity, the deeper the penetration of the spot weld will be.

10. Can I weld different alloys together?

- Yes – You can even weld together alloys that have very different properties, such as gold with cobalt-chrome alloys.

11. Can the spot welds take up tungsten particles from the electrode tip?

- If the Phaser mx1 is not operated properly, it cannot be entirely ruled out that tungsten particles may end up in the spot weld.
- However, this is highly unlikely when the Phaser mx1 is operated properly.

12. How thin can the material to be welded be?

- Depending on the material, it should have a minimum layer thickness of 0.2 to 0.3 mm.

13. What kind of operating and maintenance costs can I reckon with?

- The welder is maintenance free.
- Under normal operating conditions, you only have to pay the low costs for Argon gas and for wear-and-tear of the electrodes.

14. How many spot welds are possible with one electrode?

- Since the tips of tungsten electrodes have to be sharpened, they get shorter over time. Electrode lifetimes range between about 500 and 1,000 spot welds.

Product list - electrodes, accessories, replacement parts

1. **Special tungsten electrodes** (pack of 10)

   Product number: mx0-0100

2. **Diamond disc** ∅ 19mm, shaft 2.3 mm for sharpening the tips of the special tungsten electrodes

   Product number: mx0-0150

3. **Glass brushes** for fast and easy cleaning of the welding area

   Product number: mx0-0160

4. **Connecting clamp ("alligator clip")** with 100 cm cable

   Product number: mx0-0200

5. **Solder cross tweezers** with connecting cable (70 cm)

   Product number: mx0-0250

6. **Flat pointed pliers** with connecting cable (70 cm)

   Product number: mx0-0300

7. **Welding table, high** for microscope complete with cable (50 cm)

   Product number: mx0-0350

8. **Welding table, low** for optical unit complete with cable (50 cm)

   Product number: mx0-0400

9. **Holder stand for tweezers** ("your third hand") basic design

   Product number: mx0-0450

10. **Holder stand for tweezers** ("your third hand ") ball design

    Product number: mx0-0460

11. **Hand rests** (pack of 2)

    Product number: mx0-0550

12. **Phaser mx1 Handpiece** complete with connecting cable

    Product number: mx0-0500

13. **Nozzle** for Phaser mx1 handpiece

    Product number: mx0-0510

14. **Collet chuck** for Phaser mx1 handpiece

    Product number: mx0-0520

15. **Tightening nut** for Phaser mx1 handpiece

    Product number: mx0-0530

16. **Adapter / double connector** for simultaneous operation of microscope and optical unit

    Product number: mx0-0950

Care and maintenance

Under normal operating conditions, the Phaser mx1 requires a minimum of care and maintenance. Nevertheless, compliance with the following instructions and notes is imperative to ensure that the equipment functions properly. This will keep your Phaser mx1 running perfectly for many years.

1. Check mains plug, mains cable and all connecting clamps for signs of damage at regular intervals.

2. Check all movable parts of the handpiece for easy mobility

3. Clean the collet chuck on the handpiece as required to ensure that there is always perfect contact to the electrode

4. **Attention!** If any fuses have to be replaced always use fuses of the same rating. You forfeit any rights to warranty claims for possible damages if you use fuses that are too strong!

5. Clean the Phaser mx1 and the microscope or optical unit regularly with a dry or slightly wet cloth (Do not use cleaning agents). Cover the microscope with the protective cover supplied when it is not in use.

Technical specifications

- Equipment is suitable for spot welding in dry rooms
- Temperature range 5-40C
- Altitude: not above 2000 m above sea level
- Humidity: max. 80% until 31ºC, max. 50% from 31-40ºC
- Mains voltage ~230 V (or 110 V) / 50-60 Hz +/-15%
- Line Current max. 4,5 A (230V) resp. 12A (115 V)
- Mains fusing T 6.3 A H (230 V) resp. T 10 A H (115 V)
- Power consumption 1400 VA
- On-time X: 80%
- Operating voltage 20 – 40 V
- Open circuit voltage 40 V
- Loading time, max. 2 sec
- Shielding gas: ARGON 99.996% (ARGON 4.6)
- Maximum gas pressure: 4 bar
- Protection class I
- Insulation class B
- Protection rating IP 21S
- Weight 6.05 kg

Manufacturer's label

1. Key to symbols on manufacturer's label:

A	Amperes	V	Volts
Hz	Hertz		Alternating Current
	Direct Current	 1 ~ 50-60Hz	Line Connection 1 Phase / Alternating Current / 50-60Hz
U_0	Rated No Load Voltage (Average)	U_1	Primary Voltage
U_2	Conventional Load Voltage	I_2	Rated Welding Current
I_{1max}	Rated Maximum Supply Current	I_{1eff}	Maximum Effective Supply Current
IP	Degree Of Protection		One phase transformer
	Gas Tungsten Arc Welding	X	On-time

Declaration of Conformity

1. The equipment manufactured and/or sold by Kuss Dental, S.L. 28050 Madrid conforms to CE requirements and VDE guidelines.

Important note

Always keep these operating instructions in a place that is accessible to all users.

The worded information and illustrations are in compliance with the technical state-of-the-art prevailing at the time of printing. Kuss Dental reserves the right to make changes at any time.

Warranty Terms

Except with respect to those component parts and uses which are herein described, primotec warrants the primotec phaser mx1 to be free from defects in material and workmanship for a period of 24 months from the date of delivery. primotec's liability, under warranty, is limited solely to the repairing or at primotec's option, replacing those products included under the warranty, which are returned to primotec within the applicable warranty period (with shipping charges prepaid), and which are determined by primotec to be defective. This warranty shall not apply to any product which has been subject to misuse; negligence, or accident or misapplied; or modified, or repaired by unauthorized persons, or improperly installed.

Inspection

The buyer shall inspect the product upon receipt. The buyer shall notify primotec in writing of any claims or defects in material and workmanship, within thirty days after the buyer discovers or should have discovered the facts upon which such a claim is based. Failure of the buyer to give written notice of such a claim within this time period shall be deemed to be a waiver of such claim.

Disclaimer

The provisions here-in stated are primotec's sole obligation and exclude all other remedies or warranties, expressed or implied, including those related to MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE.

Limitation of actions

The buyer must initiate any action with respect to Claims under the warranty described in the first paragraph within two years of the purchase.

DECLARATI0N OF CONFORMITY
TO EC DIRECTIVES

- Machinery	98/37/EC, Annex II A
- Low Voltage Electrical Equipment	73/23 EEC
- Electromagnetic Compatibility (EMC)	89/336 EEC

The Manufacturer

primotec®
Tannenwaldallee 4
DE-61348 Bad Homburg

declares that the product listed below

Phaser mx1
Pulsed Microwelder

complies with the regulations of the Council Directives listed above and includes all amendments valid at the time this Declaration was issued.

The following harmonized standards apply:

Power source for arch welding with limited operation:
DIN VDE 0543 (VDE 0543)

International protection rating of the housing (IP Code):
DIN EN 60529 (VDE 0470-1)

Electromagnetic tolerability (EMV): EN50199

Bad Homburg, the 3rd of June 2003

Signature of authorized signatory

primotec, Joachim Mosch

General Manager