



OPERATING MANUAL

Temperature controlled
welding iron kit

for

PLASTIC REPAIR

Prototyping and
modelling

Keep this user's manual for handy reference.

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The information provided represents our current expertise and is provided as practical guidelines; however our suggestions cannot replace hands-on practical knowledge and experience. All the information we have supplied is subject to revisions according to newer developments and results.

Orbi-Tech GmbH does not grant warranty, liability and responsibility for the results of any experiments or work carried out related to this information. The contents of this welding set are the result of the demands of our customers. This publication does not constitute or imply any licenses and does not intend the violation of any eventual intellectual property rights of third parties.

Our general terms and conditions apply to all services and supply provided.



Congratulations...

... on purchasing your new plastic repair system. The new welding procedure introduces new possibilities in repair techniques; Especially for PE and PP parts that are hard or even impossible to fix using adhesives. In a lot of cases, there is no need to dismantle the part for repair. This reduces your expenditures and helps you offer your client attractive prices. Our technique uses plastic fillers of the same type as the item to be repaired.

Naturally, only thermoplastics can be welded.

Please read the following operating instructions carefully before starting your work.

1. Set Contents

Description		Quantity
Carryingcase		1 piece
Welding iron 230 V		1 piece
Welding tip		1 piece
Welding rod	ABS (Acrylnitril Butadien Styrol)	1 package
	ABS/PC (Mixed polymer ABS and PC)	1 package
	PC (Polycarbonat)	1 package
	PE (Polyethylen)	1 package
	PP (Polypropylen)	1 package
	PP-EPDM (Polypropylen soft)	1 package
	PS (Polystyrol)	1 package
Reinforcement grid		1 piece
Cleaning rod		1 piece
Brass brush		1 piece
Heat transfer powder		1 piece



2. Safety advice

Keep this operating manual with the appliance at all times for reference. With its accurate temperature control, one can apply heat only where necessary. Thereby reducing collateral damage to the parts; Hence it is possible to obtain professional results with this kit, however it is advised to allow only experienced and trained workers to use it. Do not repair parts from which danger could occur! Keep away from children.

Attention: Fire and burns hazard

The area between the handle and the welding tip heats up to high temperature! The welding tip may exceed 500°C which is dangerous for your skin and all body parts. High temperatures can also cause fires.

Before connecting the mains plug make sure that:

- The appliance rests on the accompanying welding stand on an un-inflammable surface.
- The welding tip is inserted as far in as possible in the appliance. The voltage rating of the appliance and the power source have to be equal.

Always disconnect the mains plug:

- When leaving the appliance unattended
- When the welding tip loosens
- When changing the welding tip (Wait until tip has cooled down)
- When cleaning appliance and tip. Only dry-clean the appliance. Clean hot welding tip with cotton cloth or dense tissue. Remove obstinate coating from hot tip with the brass wire brush.

Allow the iron to cool down before storage.

Attention: Danger of electric shock

Store and use in a dry place. Keep away from humidity. Preferably use a socket outlet within easy reach for your safety and convenience. Do not use when taken apart or partly assembled. Leave the iron to cool off naturally on its stand. The appliance should only be dismantled by authorised dealers.

Unplug and stop using and take back to your dealer immediately in case of:

- T-80 not functioning properly
- Missing or damaged parts, especially exposed wires
- Blown fuse or main fuse
- Do not attempt to repair the welding iron yourself!



Danger: health hazards

Do not breathe fumes while working. Only work in well ventilated places. Do not work in a flammable or explosive atmosphere. Always wear gloves and safety glasses. Follow the accident prevention regulations. Do not weld parts that may contain dangerous compounds. Use only original spare parts and accessories.

Safety regulations for use and maintenance of electric appliances have to be adhered to. Always wear safety glasses when welding plastics. Never leave the hot welding iron unattended (Fire and Burns hazard). Only use the welding iron if the welding tip is fitted properly, otherwise the heating unit might be damaged. Unplug from mains after finishing work. Keep the hot welding iron has on its stand.

Heating plastics might create fumes that cause adverse health effects: Many plastics decompose when heated beyond their melting point. Long molecular chains break down to smaller molecules that can be harmful to your health. Thus make sure your workplace is well ventilated. Do not breathe the resulting fumes. In case of distinct increase of fumes, interrupt your workflow and try to continue using less heat. For this very reason, PVC (Polyvinylchloride) must not be overheated at all.

Parts that may contain dangerous materials or unknown materials are not to be welded. Always refer to the user's manual provided by the manufacturer.

3. Technical details

The T-80 is equipped with a temperature regulator, keeping the temperature of the welding tip constant.

For technical details please refer to the enclosed spec sheets.

Safety advice has to be observed at all times. Do not use your T-80 in explosive or corrosive places and keep away from humidity.



4. Terms of Guarantee

All T-80's are sold guaranteed free from defects in material and manufacture, according to legal obligations. This guarantee is limited to replacement and exchange of defective parts only. Damage of fragile parts is excluded from the guarantee. Claims arising from damages to material other than the T-80 are excluded.

Improper handling, misuse and application of excess force, as well as modifications caused by non-authorized dealers and personnel lead to termination of guarantee.

Guarantee does not cover consumer goods. The heating element and the welding tip are expendable parts.

In the case of a guarantee claim, the appliance has to be sent, (carriage cost carried by the sender), in the original packing to an authorized dealer or the manufacturer (copy of invoice) and it has to be picked up after it has been repaired.

Use original parts and accessories only !

5. Identifying plastic types

Successful welds can only be obtained if welding sticks and parts are matched chemically.

It is difficult to distinguish plastics by sight alone. Plastics can be dyed any colour and textures vary. Identifying plastics is essential and requires some experience. Look for the ISO-Code on the inner side of the parts (e.g. PC for Polycarbonate) or make a test weld as described below.

Some plastic types are commonly used for particular applications, for instance, (for your information only and without responsibility):

Modelling: airplanes, cars, buildings	PS
Trucks and tractors, fender, air ventilation duct	PE
Trailer-fender	PE
Boats, if not GFK: Canadian canoes, Kayaks, paddling boats	ABS, PE, PP
Water tanks	PE, PP
Vacuum cleaner bodies	PE
Lawn mowers	PP
Mobile phones	ABS/PC



Ski running surface

PE

Automobiles:

Bumpers of European and Japanese make

PP, PP-EPDM

Ford bumpers

PC

Bumpers of US American makes

PUR

Body parts, Dashboards

PUR or PP

Fender, Grate, Grill

ABS

Water tank

PE

Door gasket

TPE

Motorcycles:

Fuel tanks, mud-guards on trail bikes

PE

Fairings on road bikes

PA6, ABS

Cowlings and instrument facia

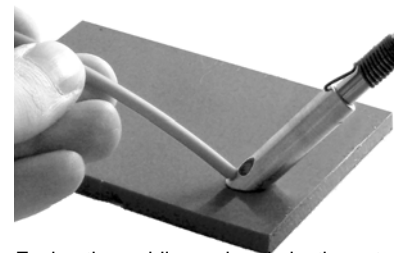
ASA, ABS

Testing of plastic type:

Since plastics can only be heat bonded with similar materials, make a quick test weld when in doubt about the type.

Procedure:

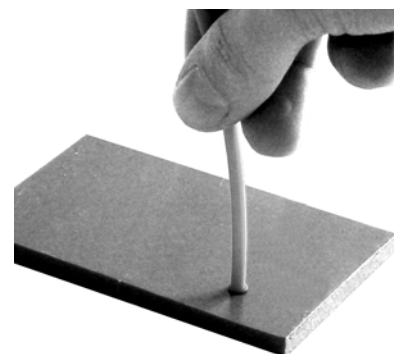
Hold the tip of the welding iron to the plastic part to be welded and melt the plastic (do not use too much pressure to avoid deforming the melted plastic).



Fusing the welding rod and plastic part together with heat and gentle pressure

Simultaneously melt the end of the welding rod on the upper part of the welding tip. Using only little pressure is important: Do not squeeze out molten plastic because molten plastic is needed for the bond.

Hold the melted welding stick on to the melted part of the plastic part (again use very little pressure to avoid squeezing the molten mass) and leave to cool down. Do not move or shake!



Hold plastic rod until joint is cool and test for proper adhesion.

Test the strength of the bond after it has completely cooled down. Only same types of plastic give bond with each other.

Start with the lowest temperature (250°C) and the most common types of plastic, being PE and PP. In time and with practical experience you'll identify the types with ease.



Use the following table as reference to help you identifying most common plastics used in automobiles and motorbikes (for your casual information only):

	Grill	Bumper	Outter parts	Inner parts
Alfa Romeo		PP, PUR		
Audi		PP		
BMW		PP		
Cadillac		PC	PC	
Chevrolet	ABS		PA, PC	
Chrysler	ABS			
Citroen		PP		
Daihatsu		PP		
Fiat		PP		
Ford	ABS	PP, PC		
Honda	ABS	PP, PC	ABS, PC	ABS
Hyundai		PP, PC		
Jeep				
Lancia		PP		
Landrover		PC		
Lexus	ABS	PP	ABS, PC	ABS
Mazda	ABS	PP	ABS, PC	ABS
Mercedes		PP, PC		
Mitsubishi		PP		
Nissan	ABS	PP	ABS, PA	ABS
Opel		PP, PC		
Peugeot		PP		
Pontiac			PC	
Renault		PP		
Rover		PP, PC		
Seat		PP		
Skoda		PP		PP
Subaru		PP		
Toyota	ABS	PP, PUR	ABS, PC	ABS
Volvo		PP		
VW	ASA	PP		PP
Motorcycles		PC, ABS	ABS	

You might also consider if it is possible to cut off a small piece of the part you intend to repair, from where it does not show, and use this as a welding rod:

However, beware of unknown plastics: Potential Fire and Intoxication hazards!



6. Welding techniques

Always check if the T-80 is in good working condition before connecting it to the mains. Observe safety instructions. Then choose the desired temperature and plug in the mains plug.

Overview of some plastic types and their maximum working temperature

Short description	Material	max. Working temperature
ABS	Acronitryl Butadien Styren	265°C
ABS/PC	(Mixpolymer ABS + PC)	280 °C
PC	Polycarbonate	290 °C
PE	Polyethylen	275 °C
PP	Polypropylen	275 °C
PP-EPDM	Polypropylen flexible	270 °C
PS	Polystyrene	265 °C
TPE	thermoplastic Elastomer	270 °C

Other materials on request.

Health hazard at too high temperatures: If a lot of fumes are created, interrupt your work flow and use lower temperatures. **Only work in well ventilated areas. Do not breathe fumes!**

Working with plastics requires patience. Parts have to be heated slowly, not using temperatures that are too high. High temperatures destroy the molecules of the plastics causing discoloration and decrease of durability. Unlike thermosetting plastics, (like two-part epoxy and polyester priming and filling kits) when working with thermoplastic welding, you are not limited by a specific setting or hardening time. As a general rule thermoplastic materials can be melted repeatedly many times with ease.

Always use a scrap piece or a not so visible area to try out the welding technique before starting to work on the piece you actually want to weld.

6.1. Weld preparation

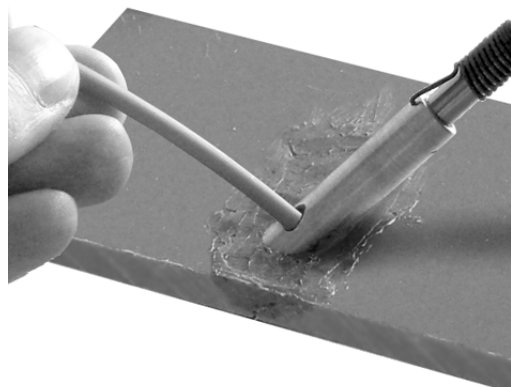
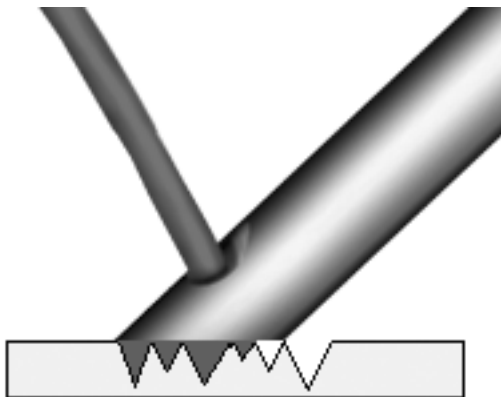
The part that has to be repaired does not have to be necessarily dismantled, the whole repair technique can be done from the outside. The start of cracks does not have to be drilled.



Clean the part to be repaired thoroughly, degrease if necessary. Remove paint from varnished parts (bumpers etc.) mechanically (sanding) to uncover the actual plastic surface. If the broken part is deformed, gently heat the deformed part (heat gun max 280 °C or infra- red heater) and mould back to its original shape using a piece of wood or Teflon. Leave the part cool down. Choose the matching plastic rod type. A lot of parts have a manufacturing stamp placed on them indicating the plastic type used. In case you still have doubts about the plastic type, make a test weld: Weld a piece of plastic to the broken plastic part on a non-noticeable part next to the broken patch (see above). Make sure that the surface and welding rod are sufficiently heated up (beginning to melt) before pushing the rod further through the hole in the welding tip. Do not squeeze out molten plastic of both parts. You need the molten plastic for a good bound. The basic principle of plastic welding is: Put molten plastic together with molten plastic and press molten plastics together. A good bound you only get between molten plastics of molten surfaces of plastics.

6.2. Scratch repair

Set the temperature to the melting temperature of the plastic type. As soon as the temperature of the welding iron has reached the set temperature (blinking of the regulation lamp), smoothen the surface slowly, holding the welding tip flat on the surface. Hold the welding iron like a pencil. Use only very light pressure. Using a lot of force might damage the T-80 and does not do the job: the material has to be sufficiently heated to melt. Insert welding rod, wait until it has melted. Then continuously insert the welding rod through the hole in the welding iron without lifting from the surface (picture 1). It is vital that the fresh material is applied on a melted surface for the welding effect to happen. If the surface is too cold (hard), the two pieces will not merge. You have to join melted rod onto melted plastic surface. Continue working until enough material has mixed. The repaired patch has to be higher than the actual surface (allow for shrinking after cooling off). Then, roughly smooth out the surface without adding any more plastic with the hot iron tip and leave to cool down naturally.



Picture 1:
1. Hold welding iron like a pencil
2. Use minimum pressure
3. Heat base material with the T-80 tip and melt



4. Insert welding rod and melt. Attention: Welding rod gets hot
5. Remove remaining plastic in hole with supplied cleaning stick

Naturally, the repaired part has to be finish sanded. For further processing of bare plastics: see corresponding chapter. Painting can be done after welding (according to the plastic type (where necessary, after primer treatment). Spray-on textured or matt finishes can be used to simulate the original surface and colour.

6.3. Crack and hole repair

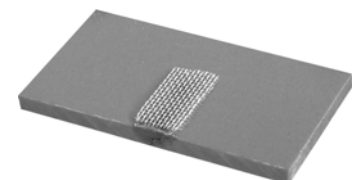
If the part has a crack, first you tack weld the two parts. You can do this by spot welding with the welding tip with 2-5mm spacing (like stitching), Next make sure penetration is adequate and smooth the seam. If it is possible to weld from both sides the bond will be strong even with this fairly simple method. If you can only weld from one side, the bond is not as strong but is enough to will keep the parts from moving during the welding process. To make the bond even stronger, the reinforcing grid can be used. Cut a piece of the grid with the scissors and put it on top of the crack. The grid should extend at least 7 mm longer than the crack on either side. Fix grid on the surface by using the flat part of the welding tip to tack the grid bit by bit. Start on one side in the middle of the grid.



Tacking plastic parts with stitching action



Alternating „stitching“ and smoothing



Reinforcing grid should overlap the crack to be repaired by at least 7mm

Afterwards start to sink the mesh into the plastic with the welding tip as gently as possible with minimum force. When the net sinks into the plastic through melting of the surface, pull back the foot about 2 to 3mm and repeat the procedure. Push the molten plastic on the hot part that you have just worked on, thus covering the mesh.



Sink in the metal mesh with heat and gentle pressure



Cover the mesh with melted plastic

(picture 2). Repeat this procedure until the mesh is fully below the surface. This requires patience. Plastic needs some time to melt. Do not use excessive force or pressure.



- Pictures:
1. Hold the welding iron like a pen
 2. Only light pressure, **Do not struggle!**
 3. Melting the net into the plastic

For a strong bond, try to position the mesh as near to the middle thickness of the material as possible. You may also use several layers of net. The mesh should not be visible after the repair. Make sure that the edges are sunk in properly in the plastic and not visible.

You can then use the welding filler rods to complete the repair (pictures above).

When repairing holes, the net has to be attached on top of the hole as described previously and covered with plastic material from both sides.

6.4 Surface finishing of unpainted items

With the tip of the T-80 you can finish slight scratches and repaired surfaces and left unpainted. Make sure you use a clean, smooth welding tip without scratches (see paragraph: Ending the repair session)

The procedures are:

1. Sand surface.
2. Set temperature that is just about enough to melt the surface within 20 seconds.
3. Apply a thin piece of plastic (same material as item under repair) of about 1mm thickness (if you do not have any, you can take some off a part of the broken part that does not show)
4. Slightly press the welding tip on the thin piece until both item and plastic part surfaces melt.
5. If necessary smooth out the surface.
6. Leave to fully cool off.
7. After cooling, scrape the surface smooth carefully with a scraper and fine sandpaper.

To obtain a shiny surface (Attention: Burns hazard!) shortly blow hot air from a hot air gun or gas flame on the surface so that any welding marks will blend. After cooling off the surface will be shiny, if necessary use some polish or silicon spray.

A textured surface can be obtained by pressing the rough side of sanding paper on a plastic surface that has been previously heated and softened by a hot air gun.

Doing this kind of work, patience and careful experimentation will give good results.

There are plastic welding virtuosos who obtain such brilliant results that it is very difficult to tell the difference between the repaired and the original parts.

6.5 Post welding



Unplug the mains lead. Clean hot welding iron with paper or cotton tissue. Clean tough dirt with wire brush. Remove remains of welding rod from the hole with the cleaning rod. Tidy up the cleaning rod.

Attention: Cleaning rod might get hot as well!

Leave the T-80 to cool off naturally on the supplied stand. Do not cool off with water!!! Put the appliance back in the case once it is cooled off completely.

Scratches on the bottom of the welding tip can be sanded with very fine sanding paper (e.g. 1000 Grit). Put the sandpaper on a flat surface and sand the welding tip (once cool) by moving the bottom backwards and forward on the sandpaper.

7. Permanent marking and labelling of plastic parts

Plastic parts can be marked permanently with the welding iron.

To do this, hold the welding tip – which is to be heated up according to the type of plastic – on the area where you want to mark using very slight pressure. A thin melted layer will rise since the heat flows from the welding tip into the plastic surface.

After you remove the welding tip you can mark the plastic permanently by slight pressure with letter or number punches.

For embossing special logos or signs directly on plastic, please contact us for a nonbinding quote.



8. A word from the directors

Dear Customers,

we wish you the best of luck and results with your plastic welding experiments and works with the T-80. We believe that this appliance opens up nearly unlimited new opportunities in processing and repairing plastic materials and products.

If you want to share your experience with other users, please send us your reports or pictures (by post, fax or e-mail) so that we can inform them. We would be glad to maintain an exchange of ideas and techniques. Ideas for improvement and innovation are particularly welcome for up to date development and improvements.

Thermoplastic regards

Orbi-Tech GmbH