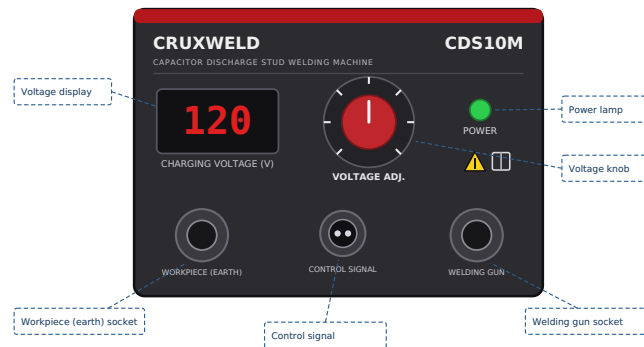


Capacitor Energy Stored Stud Welding Machine

CDS10M

Capacitor discharge (CD) stud welder for M3 – M10 studs

Operation Manual



Please read this manual carefully before installation, operation and maintenance.

Preface

Thank you for choosing this Cruxweld stud welding machine.

When the equipment is received, please check carefully whether it has been damaged in transit and whether it agrees with the packing list. If there is a problem, please contact us in good time.

This manual provides the user with the installation, technical parameters, fault diagnosis, troubleshooting and daily maintenance of the equipment. Please read it carefully before installing, using and maintaining the machine.

This equipment should be maintained by professional service personnel. Other personnel must not dismantle the machine.

Please let us know if anything in this manual is unclear or missing. We welcome your suggestions, so that we can serve you better.

This manual is subject to change without prior notice.

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1. Operation Cautions

The end user is responsible for the safe use of the welder. The contents of this manual are essential information for safe operation. The operator must be able to read the instructions and must be able to consult them at any time.

If the equipment is sold or transferred, please pass this manual on to the new user. Before installing the equipment, read the manual carefully and observe the safety instructions strictly, to protect yourself and others.

1. Electrical

Only qualified personnel may open the welding controller (power source). Dismantling is strictly prohibited before the power has been cut off. Disconnect the mains plug from the socket first —

danger!

Attention!

The energy-storage equipment contains a sealed power module working on the high-frequency inverter principle. The module carries potentially fatal voltage; do not dismantle it without authorisation. It can be safely removed and replaced through Cruxweld service.

Attention!

The capacitor bank stores electrical energy. The residual charge must be checked before any internal maintenance is started. Never use any liquid to clean electrical components, because it will penetrate the electrical system.

2. Fire protection

During welding, very hot metal particles are thrown out. Make sure that no flammable material can be ignited by them.

3. Personal safety

The arc can burn the eyes and the skin, and the noise may damage hearing. Operators and people nearby must take appropriate measures to protect their eyes, ears and body.

Smoke and fume are harmful. Use the equipment in a well-ventilated place; where ventilation is poor, fume extraction equipment is required.

Hot metal sparks can cause fire and burns. Wear protective clothing; flammable clothing must not be worn. A fire extinguisher must be nearby and the operator must know how to use it.

Strong magnetic fields from the welding current can affect cardiac pacemakers and other electrically controlled medical devices. Warn people before they enter the welding area.

4. Maintenance

All cables must be inspected regularly for ageing and for damage to the insulation or to the circuit connections. The cables to the welding gun are the most vulnerable. Damaged cables may overheat or arc and start a fire.

5. Training

This equipment may only be used by authorised personnel who have been trained, and who have read and understood these instructions. The manual must be available to the operator at all times. Take appropriate measures to prevent unauthorised personnel from using the equipment.

6. Installation

Make sure that the place where the equipment stands can carry its weight, so that it cannot fall over or become dangerous during use. Do not hang cables over sharp edges, and do not install the machine near a heat source or in a traffic route, where the cables could be damaged by people or vehicles passing over them.

7. Interference

Strong magnetic and electric fields are unavoidably generated during welding, and these may interfere with other sensitive electrical equipment. Everyone wearing a cardiac pacemaker or other medical device must stay well away from the welding area.

The welding equipment should be installed at least

5 metres

away from computer equipment to minimise mutual interference. Signal cables running between electrical installations may also be disturbed, and should likewise be kept more than 5 metres away.

8. Disposal

At the end of its life the equipment, in whole or in part, is treated as industrial waste or handed to a waste contractor. The materials used in this equipment are not toxic, carcinogenic or harmful to the body.

**Before every shift**

Check the gun cable, earth cable and control cable for damage, check that all plugs are fully seated, and confirm that the machine is properly earthed. Never operate the machine with a damaged cable.

2. Introduction to the Stud Welding Machine

The Cruxweld **CDS10M** capacitor discharge stud welding machine is a compact and portable stud welding unit. It is designed specially to weld small-diameter ferrous and non-ferrous studs onto thin, polished and pre-coated materials. In most cases there is almost no mark on the back of the welded part.

It can replace riveting, drilling and other fastening methods. The welding time is only **3 to 6 milliseconds**. Studs can be welded onto sheet as thin as **0.3 mm** without causing distortion, discolouration or burn-through, and without damaging paint or a coating on the reverse side.

The machine improves production efficiency, shortens the production chain and reduces production cost (material, labour and electricity). Weld strength is high, the workpiece is not distorted, welding is convenient in any position, and the machine is easy to operate and quick to learn.

It is widely used in locomotive and vehicle building, automobile manufacturing, the chemical and electrical industries, instrumentation, kitchen equipment, metal utensils, hardware and other industries, with high economic benefit.

It is used mainly for welding carbon steel, stainless steel, copper and copper alloy, aluminium and aluminium alloy, **without any flux or shielding gas**, while achieving the required strength and metallurgical structure.

Features

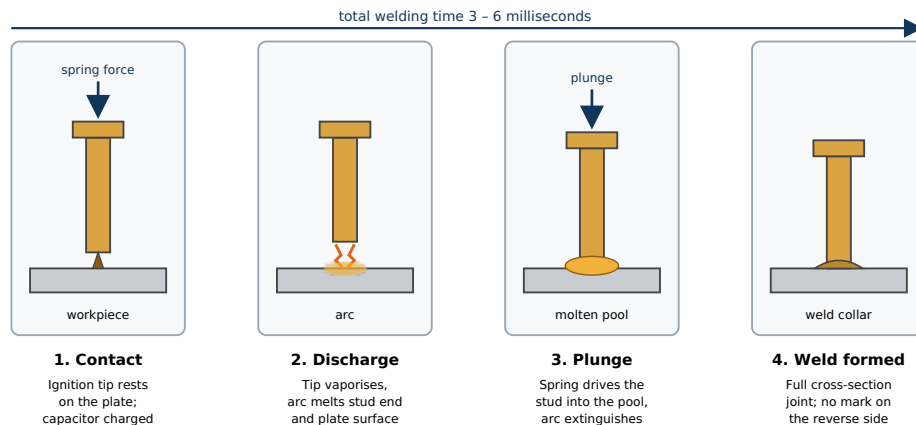
- Novel design, compact construction and reliable operation.
- Stepless adjustment of the charging voltage over a wide range; all parameters are easy to set.
- The welding gun is dual-purpose and covers a wide range of applications.
- No flux, no shielding gas and no ceramic ferrule required.
- Welding speed up to 40 studs per minute, depending on stud diameter.

2.1 How capacitor discharge stud welding works

Capacitor discharge stud welding takes its energy from a charged capacitor bank. When the two welding surfaces are brought close together, the stored energy is released across the gap between them. The resulting arc heats both surfaces and melts a thin layer of metal on each; the two molten surfaces are then pressed together to form the joint.

In contact welding, the stud is pressed against the plate by spring pressure. The arc gap between the two parts is set by the small **ignition tip** on the stud end. When the capacitor delivers its high-current pulse, the tip vaporises and an arc is drawn between the workpiece and the stud. While the spring in the welding gun drives the stud rapidly towards the workpiece, the energy of the arc melts the base of the stud and the surface area beneath it.

Within 3 to 4 milliseconds the stud reaches the workpiece and the arc disappears. The kinetic energy of the stud, together with the remaining spring pressure, fuses the molten zone and forms the weld.



The four stages of a capacitor discharge stud weld

2.2 Weldable material combinations

The combinations of the main materials are given in Table 1.

Stud \ Workpiece	Carbon steel	Stainless steel	Copper alloy	Aluminium alloy
Carbon steel	Excellent	Good	Weldable	—
Stainless steel	Good	Excellent	Weldable	—
Copper alloy	Weldable	Weldable	Excellent	—
Aluminium alloy	—	—	—	Excellent

Table 1

Note: low-carbon steel studs require a copper-plated surface so that they conduct properly. The workpiece must be free of rust, scale, paint and oil at the welding position; dirt trapped in the weld reduces the joint strength.

Typical applications

Control cabinets and enclosures, switchgear, lift and elevator panels, bus and rail vehicle bodies, kitchen equipment and stainless-steel furniture, ducting and insulation pins, signage, white goods and general sheet-metal fabrication — wherever a threaded or plain fastener has to be attached to thin sheet without marking the visible face.

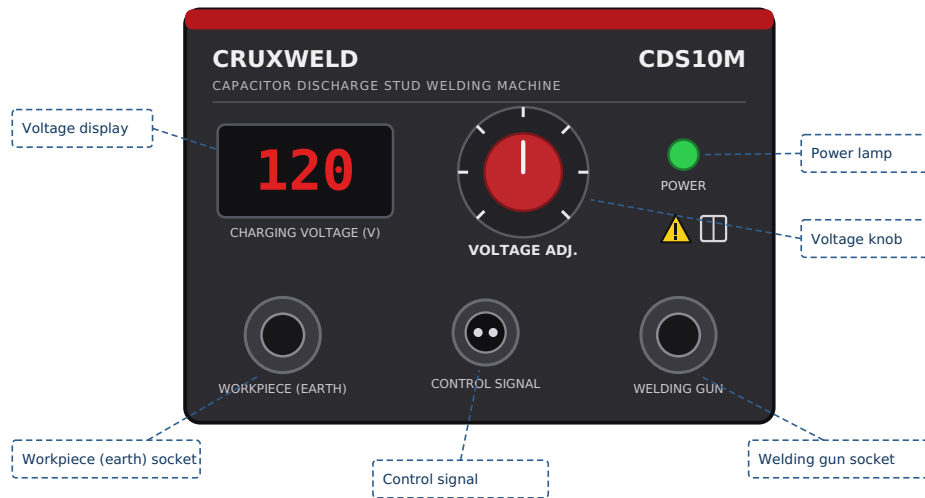
3. Specification

Item	Data
Model	Cruxweld CDS10M
Type	Capacitor discharge (energy stored) stud welding machine
Input voltage / frequency	AC 220 V, 50 / 60 Hz
Input rated fuse	10 A
Energy store	Electrolytic capacitor bank
Charging capacitance	108 000 μ F
Charging / output voltage	35 – 200 V DC, steplessly adjustable
Welding time	0.001 – 0.003 s
Welding speed	Max. 40 studs / min (depending on stud diameter)
Stud diameter range	M3 – M10
Stud length range	Up to 35 mm
Workpiece thickness — low carbon steel	2 – 8 mm
Workpiece thickness — stainless steel	2 – 8 mm
Workpiece thickness — aluminium alloy	2 – 8 mm
Workpiece thickness — zinc	2 – 8 mm
Input power	500 W
Enclosure	Steel
Protection grade	IP21S
Net weight	18 kg
Dimensions (L x W x H)	403 x 402 x 204 mm

The specifications and technical content of this product are subject to change without notice.

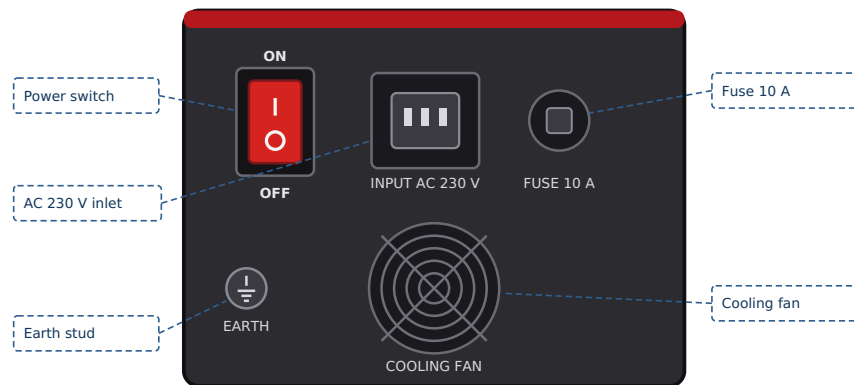
4. Front and Rear Panel

4.1 Front panel



Item	Function
Voltage display	Shows the charging voltage of the capacitor bank in volts.
Voltage adjustment knob	Sets the charging voltage steplessly from 35 to 200 V. Turn clockwise to increase, anticlockwise to decrease.
Power lamp	Lights when the machine is switched on and the control supply is present.
Workpiece (earth) socket	Quick connector for the earth cable and clamp that connects to the workpiece.
Control signal socket	Two-pin connector for the trigger (switch) lead of the welding gun.
Welding gun socket	Quick connector for the main welding cable of the gun.

4.2 Rear panel



Item	Function
Power switch	Rocker switch that connects and disconnects the mains supply to the machine.
AC 230 V inlet	Mains input connector for the supply lead.
Fuse	10 A input fuse. Replace only with a fuse of the same type and rating.
Cooling fan	Cools the charging circuit. Keep the grille clear of dust and do not block the air flow.
Earth stud	Protective earth connection of the machine. It must be connected reliably to earth.

Note on the power supply

This equipment is a low-frequency machine. Do not share the supply socket with a TIG welding machine or other high-frequency equipment, and keep the machine away from such equipment.

5. Welding Process Guidance

1. The stud may have any of the usual practical shapes. For standard straight studs (with or without a thread), the diameter range is **M3 to M10**. Besides threaded fasteners, internally threaded round bosses can also be used, most of which have a flange.
2. Stud materials are given in Table 1. Low-carbon steel studs require a copper-plated surface so that they conduct properly.
3. The workpiece must be weldable and its surface must not be rusty. Clean it properly, otherwise dirt will be trapped in the weld and the joint strength will suffer.
4. The workpiece thickness is between **0.5 mm and 3 mm** for normal work.
5. Reference values for the charging voltage required by the various stud sizes are given in Table 2.

Stud diameter	Charging voltage (V)	Remark
M3	55 – 65	Adjust the parameters according to the strength actually required.
M4	65 – 75	
M5	70 – 85	
M6	90 – 120	
M8	130 – 160	
M10	160 – 180	

Table 2

The values above apply to steel and stainless steel. For welding aluminium, or onto a zinc-coated transfer plate, increase the voltage by about **10 V**. The exact working parameters are set according to the strength actually required.

6. Operating Procedure and Precautions

6.1 Preparation before welding

1. Insert the welding gun cable, the control lead and the earth cable quick connectors into the corresponding ports on the control panel of the machine.
2. Insert the supply lead into the power input of the machine and switch on the power control switch.
Note: this equipment is a low-frequency machine. Do not share the power socket with a TIG welding machine or other high-frequency equipment, and keep the machine at a distance from such equipment.
3. Check that all indicator lamps are lit.
4. Turn the voltage adjustment knob and check that the working voltage charges and discharges normally.
5. Set the charging voltage.

Before switching on the supply, turn the charging-voltage knob down to a low value, then connect the supply. Turn the knob slowly clockwise and watch the voltage display until the required working voltage is reached. Once the working voltage has been set, the machine charges automatically to that value after every weld.

6.2 Welding gun adjustment

Select the stud collet that matches the diameter of the studs being welded and fit it to the welding gun. Set the welding pressure to suit the stud diameter: turning the sleeve clockwise increases the spring pressure, turning it the other way reduces it.

Place the three legs of the welding gun flat on the workpiece, apply slight extra pressure and press the trigger. The stud is welded to the workpiece in an instant (3 to 6 milliseconds).

6.3 Important notes

- Keep the contact resistance in the welding circuit as low as possible, so that the full welding energy reaches the joint. Clean the contact faces of the earth clamp and the workpiece.
- The clamping bore of the stud collet must not be too large. Replace the collet in good time when it becomes worn.
- Tighten the lock nut when the stud collet is replaced.
- Each time a stud is loaded it must be pushed in until it touches the positioning column, so that the weld quality is consistent.
- The three legs of the gun must sit flat on the workpiece before the trigger is pressed.
- Pull the gun away vertically after welding, so that the stud is not bent while the weld is still hot.



Attention

Always make trial welds on an offcut of the same material and thickness before welding production parts, and test the joints as described in section 8. Repeat the trial whenever the stud type, the plate material or the collet is changed.

Never point the gun at anyone and never press the trigger while the gun is not seated on the workpiece.

Charging voltage, in short: a larger stud needs more energy, and therefore a higher charging voltage. Start at the lower end of the range in Table 2, make a trial weld, and raise the voltage in small steps until the weld collar is even all round and the bend test is passed.

7. Step-by-Step Welding Tutorial

1. Tighten the earth cable and the main cable of the welding gun with an Allen key.



2. Insert the switch lead of the welding gun into the control-signal socket and tighten the lock nut.



3. Adjust the pin of the stud collet to the correct position.



4. After the pin has been adjusted, the flange of the stud must stand 1 - 2 mm clear of the stud collet.



5. When the adjustment is complete, tighten the retaining nut at the end of the clamping head.



6. Insert the stud collet that matches the stud to be welded.



7. With the collet seated in the core, the tip of the stud must stand 2 – 3 mm above the face of the three legs.



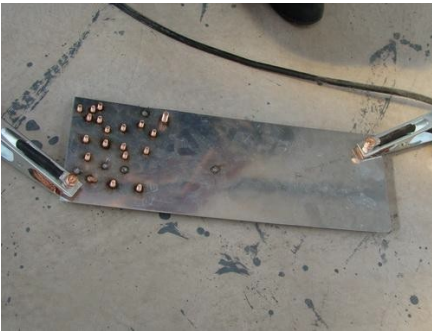
8. After loading the stud collet, turn the sleeve clockwise to lock it.



9. Turn the pressure regulator at the tail of the gun to a moderate pressure and lock it.



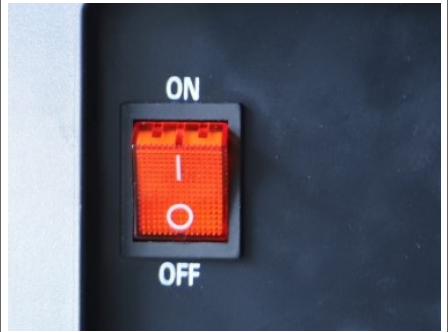
10. Clamp the earth clamp to the plate diagonally opposite the welding position, so that the arc stays balanced.



11. Plug in the supply lead at the AC 230 V inlet.



12. Check everything once more, then switch on the rocker switch on the rear panel; the machine is now powered.



13. Turn the voltage adjustment knob clockwise and set the reference voltage from Table 2.



14. Hold the gun firmly and press it down vertically, so that all three legs bear evenly on the plate.



15. Press the gun trigger lightly to weld. Pull the gun away vertically afterwards.



16. Welding complete — inspect the weld visually, then bend the stud to about 30° with a hammer.



17. Carry out a destructive check on the welded stud.



8. Welding Quality Evaluation

8.1 Visual inspection

The result of a visual inspection depends on the inspector's judgement of the weld collar around the base of the stud. A high-quality weld has the stud perpendicular to the workpiece, little spatter around the base of the weld, and a shallow, smooth fillet all the way round.

8.2 Mechanical testing

Mechanical testing is carried out in two ways: a static tensile test and a bending test.

(a) Static tensile test

Select the stud normally used and a plate of the corresponding thickness, make a standard sample, set the machine to the appropriate parameters and weld. The sample is then fitted into a special fixture and pulled on a tensile testing machine.

In practice the stud cannot be taken to its yield point and a safety factor must be allowed. It is generally recommended that the welded joint reaches **60 % of the tensile strength of the stud**; a joint whose tensile strength is greater than 60 % of the stud strength is acceptable. For example, an M6 low-carbon steel stud has a tensile load of 8.04 kN (coarse thread, grade 4.6), so the weld strength only has to be greater than 4.8 kN.

(b) Bending test

The bending test is a practical and effective method for checking on site. The stud under test is bent with a bending tool. If the stud can be bent 10° to 30° from its axis before the weld or the parent metal is damaged, the joint is acceptable.

Acceptance rule of thumb
Weld a test stud at the start of every shift and after every parameter change. Bend it to 30°. If the stud bends without the weld breaking, the setting is good; if the weld shears off, raise the charging voltage one step and repeat.

8.3 Welding test results

When the stud and the workpiece have been decided, choose the appropriate welding energy — that is, the charging voltage — and weld. The following are the results of welding tests.

No.	Plate thickness (mm)	Stud diameter (mm)	Voltage (V)	Static tensile (kN)	Remark
1	1.2	6	95	4.7	Plate is worn through
2	3	6	125	8.85	
3	3	6	130	8.63	
4	2.5	6	115	7.93	
5	3	6	100	8.49	
6	2	6	110	12.5	
7	2.5	8	145	11.28	
8	2.5	8	165	13.65	
9	1.2	8	150	8.0	Plate is worn through

Table 3

The static tension figures above are the average of five welds each. Apart from the 1.2 mm plates, which were pulled through, 90 % of the samples broke in the stud and 10 % in the weld. From these results the average tensile load is **8.475 kN** for an M6 stud and **12.35 kN** for an M8 stud. The minimum tensile load laid down in the fastener standard is 6.63 kN for M6 and 8.04 kN for M8, so the test data meet the requirement comfortably.

Conclusion: using a capacitor bank as the energy-storage element achieves the object of welding studs very quickly. The strength of the stud weld meets production requirements, and the process saves energy and material, keeps labour intensity low and gives high efficiency.

9. Troubleshooting

Fault	Check	Action
Power indicator does not light	Is the supply switched on and is the power cord in good condition?	Switch on / replace the cord
	Is the fuse in the machine blown?	Change the fuse
	Is the power control switch damaged?	Change the switch
	Has the supply lead come loose?	Refit and tighten
The power source charges and discharges repeatedly	Is the two-way rectifier connected?	Replace
	Is the working voltage set too low?	Set it higher
	Is the fault occasional or periodic?	Restart the power source
Power indicator is on but the machine will not charge	Is the ripple diode in good condition?	Replace
	Is the main transformer in good condition?	Replace or overhaul
	Is the bridge rectifier damaged?	Replace
	Is the main control board faulty?	Replace or overhaul
The power source discharges by itself	Is the thyristor (SCR) short-circuited?	Replace
	Is the welding gun switch stuck closed?	Replace
	Is the main control board faulty?	Replace or overhaul

Fault	Check	Action
Charging is normal but the machine will not discharge	Has the main thyristor broken down or failed?	Replace
	Are the welding gun control switch and its cable normal?	Replace
	Are the main cable and the earth cable disconnected?	Replace
	Has the auxiliary control wire inside the gun barrel come off?	Reconnect or replace
	Does the workpiece have an insulating layer or corrosion?	Clean the surface
The working voltage cannot be reduced	Is the potentiometer in good condition?	Replace
	Are the relay and its wiring in good condition?	Replace and tighten
Weak weld	Is the working voltage too low?	Set it higher
	Is the welding gun pressure too high or too low?	Adjust the gun pressure
	Does the stud quality meet the standard?	Use standard studs
	Is the plate coated or corroded?	Clean the surface
	Is the plate within the weldable range?	Change the material
Welds are still weak after adjustment	Is there a fault on the control board?	Replace or overhaul
Working voltage lamp does not light	Is the auxiliary transformer in good condition?	Replace or overhaul
	Is the voltage indicator damaged?	Replace
Voltage lamp is off but the machine still welds	Is the voltage indicator damaged?	Replace

If a fault persists, or is not listed above, stop work and contact Cruxweld service at support@cruxweld.com or **+91 8800 882 983**, quoting the model **CDS10M**.

10. Maintenance and Storage

When	What	How
Before every shift	Gun cable, earth cable, control lead	Check for damage to the insulation and for loose connections; replace a damaged cable before use.
Before every shift	Stud collet	Check the clamping bore for wear and the contact faces for burning; replace a worn collet.
Before every shift	Earth clamp	Clean the jaws and the contact area on the workpiece so that the contact resistance stays low.
Daily, after work	Gun legs and front face	Remove spatter; check that the three legs sit flat.
Weekly	Cooling fan grille	Remove dust so that the air flow is not obstructed.
Periodically	Plugs, sockets and earth stud	Check that all connections are tight and that the earth connection is sound.
Periodically	Interior of the machine	Only by qualified service personnel, with the supply isolated and the capacitor bank discharged.

Danger — stored energy

The capacitor bank holds a charge even after the machine has been switched off and unplugged. The residual charge must be checked and discharged by a qualified person before any internal work. Never use liquid to clean electrical components.

Storage

- Switch off and unplug the machine when work is finished.
- Store the machine in a dry, clean place, away from damp and corrosive fumes.
- Coil the cables loosely; do not hang them over sharp edges.



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