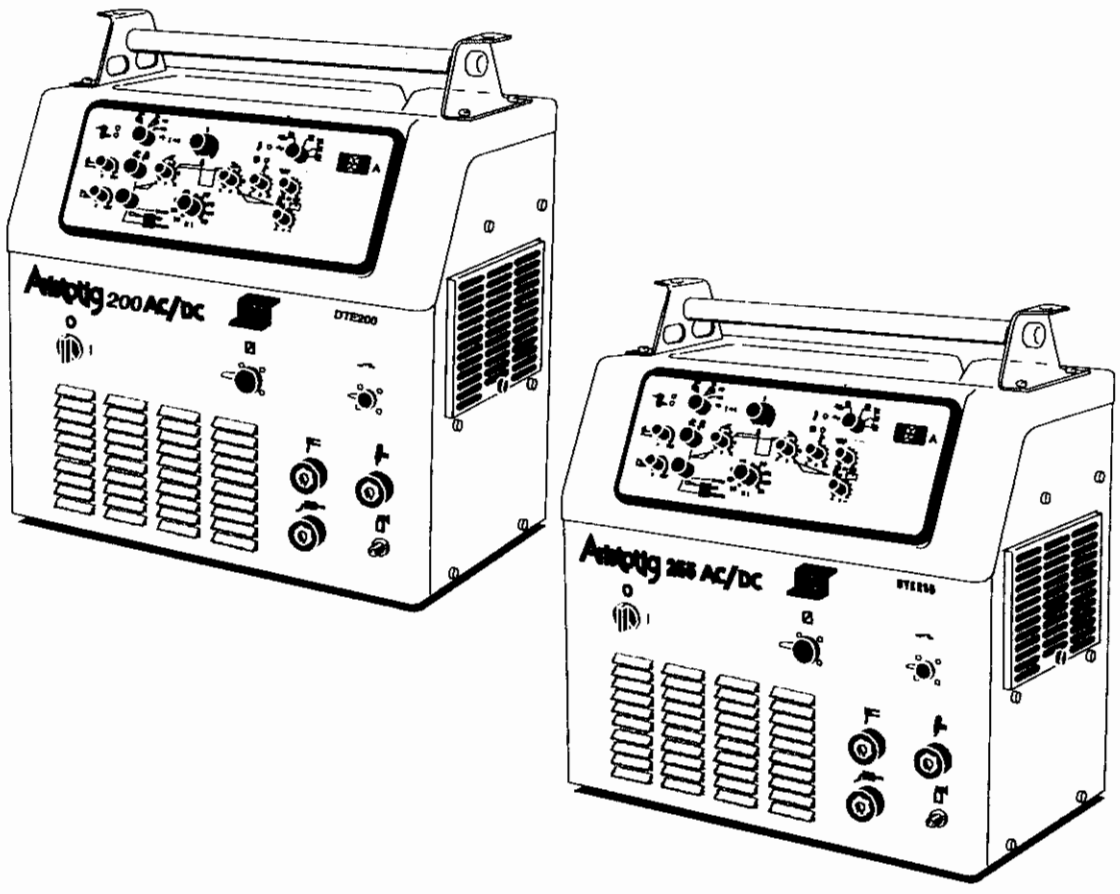
DTE 255



Service manual

0740 800 128 040621

Valid for serial no. 810-xxx-xxxx to 246-xxx-xxxx

LIST OF CONTENTS

READ THIS FIRST

Maintenance and repair work should be performed by an experienced person, and electrical work only by a trained electrician. Use only recommended replacement parts.

This service manual is intended for use by technicians with electrical/electronic training for help in connection with fault-tracing and repair.

The circuit boards are divided into numbered blocks, which are described individually in more detail in the description of operation. All component names in the wiring diagram are listed in the component description.

This manual contains details of all design changes that have been made up to and including June 2004.

The manual is valid for: DTE 200 with serial no. 914-xxx-xxxx, 246-xxx-xxxx and DTE 255 with serial no. 810-xxx-xxxx, 844-xxx-xxxx, 934-xxx-xxxx, 948-xxx-xxxx, 246-xxx-xxxx.

The DTE 200 and DTE 255 are designed and tested in accordance with international and European standard IEC/EN 60974-1 and EN 50199.
On completion of service or repair work, it is the responsibility of the person(s) etc. performing the work to ensure that the product does not depart from the requirements of the above standard.

WARNING

Many parts of the power source are at mains voltage.

WARNING

ARC WELDING AND CUTTING CAN BE INJURIOUS TO YOURSELF AND OTHERS. TAKE PRECAUTIONS WHEN WELDING. ASK FOR YOUR EMPLOYER'S SAFETY PRACTICES WHICH SHOULD BE BASED ON MANUFACTURERS' HAZARD DATA.

ELECTRIC SHOCK - Can kill
- Install and earth the welding unit in accordance with applicable standards.
- Do not touch live electrical parts or electrodes with bare skin, wet gloves or wet clothing.
- Insulate yourself from earth and the workpiece.
- Ensure your working stance is safe.

FUMES AND GASES - Can be dangerous to health
- Keep your head out of the fumes.
- Use ventilation, extraction at the arc, or both, to keep fumes and gases from your breathing zone and the general area.

ARC RAYS - Can injure eyes and burn skin.
- Protect your eyes and body. Use the correct welding screen and filter lens and wear protective clothing.
- Protect bystanders with suitable screens or curtains.

FIRE HAZARD
- Sparks (spatter) can cause fire. Make sure therefore that there are no inflammable materials nearby.

NOISE - Excessive noise can damage hearing
- Protect your ears. Use ear defenders or other hearing protection.
- Warn bystanders of the risk.

MALFUNCTION - Call for expert assistance in the event of malfunction.

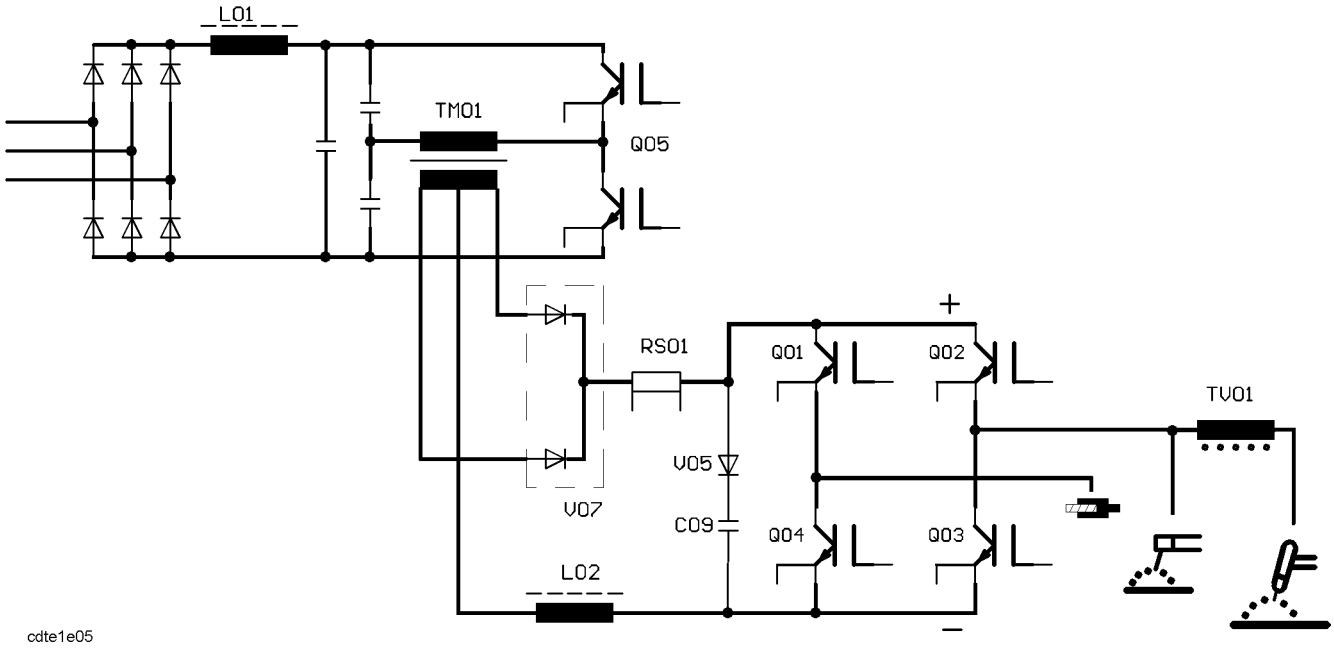
READ AND UNDERSTAND THE INSTRUCTION MANUAL BEFORE INSTALLING OR OPERATING.

PROTECT YOURSELF AND OTHERS!

INTRODUCTION

On the DC side, this generation of ESAB inverters for AC/DC welding is based on fast-switching IGBTs (Insulated Gate Bipolar Transistors). IGBT module Q05 is a half-wave bridge with integral freewheel diodes.

Low saturation voltage IGBTs are fitted in the AC converter. Q01 - Q04 are single switch modules with integral freewheel diodes.



Schematic circuit diagram for the DTE 255

The principle for the DC part is a “Half bridge push pull flow converter”. The nominal 400V three phase mains supply is rectified and filtered and then centre-tapped.
The AC current through the primary winding of transformer TM01 is controlled by IGBT module Q05. The output current is controlled by the duration of the On state of the IGBTs. (Pulse Width Modulation, PWM)

The frequency is 20 kHz. Only one IGBT is on at the time. The minimum time gap between On and Off state is 4µs.

The centre tap of the secondary side of transformer TM01 is the negative pole. Inductor L02 smooths the current and stores switching energy. Each end of the secondary winding is connected to a fast recovery diode module V07. The following shunt RS01 provides the actual current signal for control purpose.

The AC converter has four single-module IGBTs. If no control signal is applied, all IGBTs are turned off. No output current is possible.
During normal operation there are control signals in either forward polarity (two IGBTs are on and two are off) or in reverse polarity.

Just before changing the polarity the set value of the output current is decreased (or increased), by the process board AP04, to a certain value from which the polarity is changed. The change of polarity is so fast that the arc does not extinguish, even without using HF ignition.

TECHNICAL DATA

	DTE 200	DTE 255
Permissible load at		
25% duty cycle, MMA		250 A / 30 V
35% duty cycle, MMA	170 A / 27 V	
60% duty cycle, MMA	130 A / 25 V	200 A / 28 V
100% duty cycle, MMA	100 A / 24 V	165 A / 26 V
35% duty cycle, TIG	200A / 18V	
50% duty cycle, TIG		250A / 20V
60% duty cycle, TIG	150 A / 16 V	225 A / 19 V
100% duty cycle, TIG	120 A / 15 V	170 A / 17 V
Setting range TIG	5 - 200 A DC	5 - 250 A DC
	5***** - 200 A AC	5***** - 200 A AC
Setting range MMA	5 - 200 A	5 - 250 A
Slope up	0 - 10 seconds	0 - 10 seconds
Slope down	0 - 10 seconds	0 - 10 seconds
Gas preflow, adjustable on the circuit board	0 - 5 seconds	0 - 5 seconds
Gas postflow	3 - 30 seconds	3 - 30 seconds
Open circuit voltage	70 - 90 V DC	70 - 90 V DC
No-load power, MMA	115 W	120 W
No-load power, TIG	60 W	60 W
Useful power, P (at max. current MMA)	6.2 kW	10 kW
Apparent power, S (at max. current MMA)	6.4 kVA	10.6 kVA
Power factor at max. current, MMA	0.95	0.93
Efficiency at max. current, MMA	73%	73%
Mains voltage	400V +/- 10% 3 ~	400V +/- 10% 3 ~
Mains frequency	50 - 60 Hz	50 - 60 Hz
Welding cable, cross-sectional area	35 mm^2	35 mm^2
Fuse, slow-acting	10 A	16 A
Mains cable, cross-sectional area	4 x 2.5 mm^2	4 x 2.5 mm^2
Dimensions l x w x h	510 x 310 x 555 mm	510 x 310 x 555 mm
Weight	45 kg	45 kg
Application class	S	S
Enclosure class	IP23	IP 23

These welding power sources fulfil the requirements of IEC 60974-1

***)** *The minimum current during AC welding depends on the alloy used for the aluminium plates and their surface cleanliness.*

Duty cycle

The duty cycle refers to the time in per cent of a ten-minute period that you can weld at a certain load without overloading the welding power source.

Enclosure class

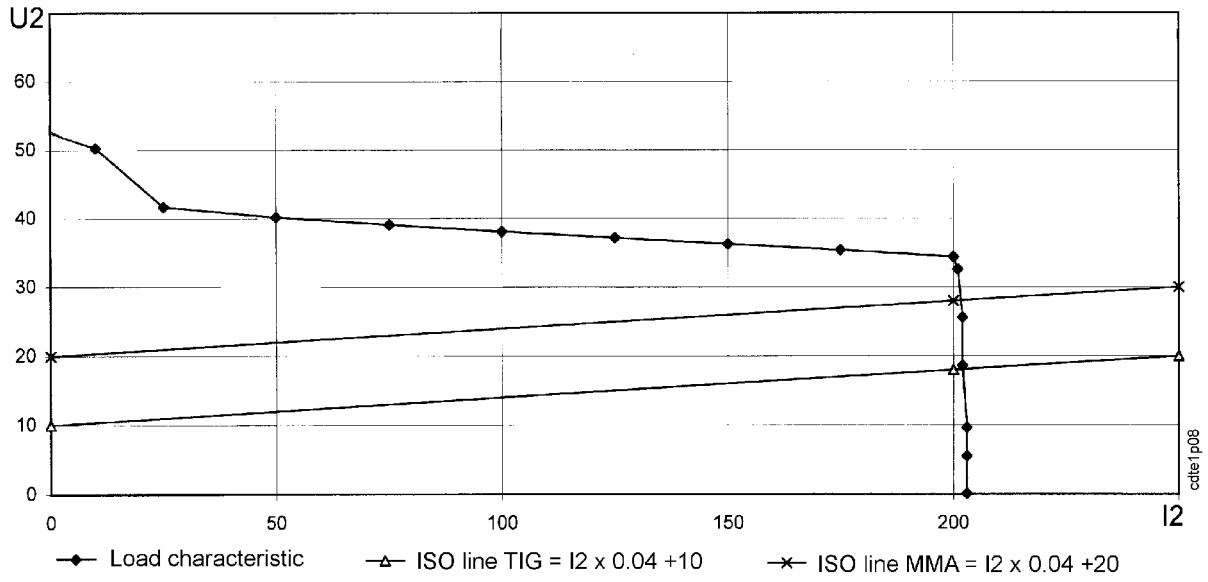
The **IP** code indicates the enclosure class, i. e. the degree of protection against penetration by solid objects or water. Equipment marked **IP 23** is designed for indoor and outdoor use.

Application class

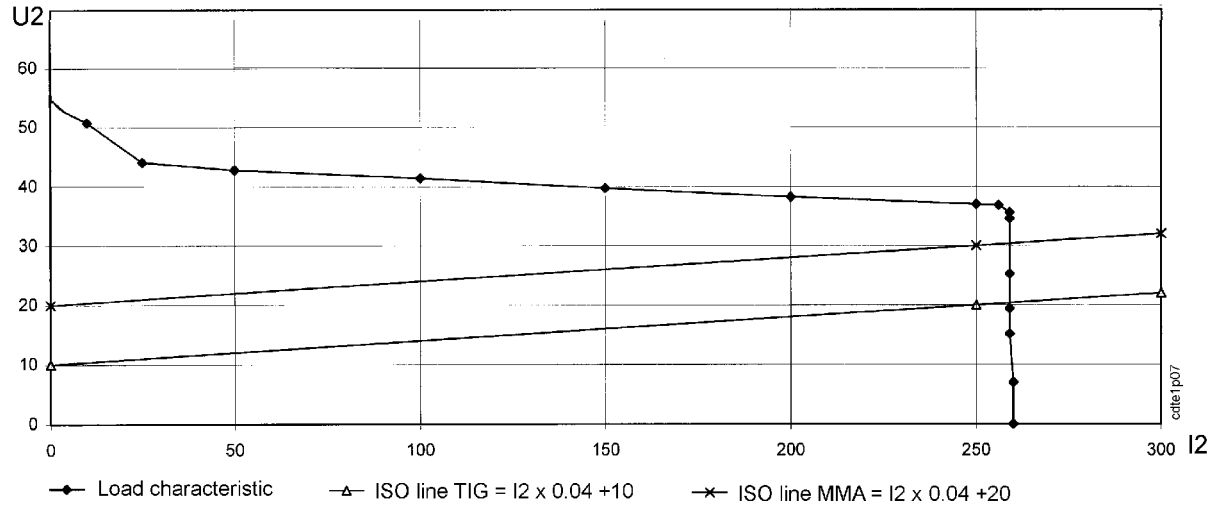
The symbol S indicates that the power source is designed for use in areas with increased electrical hazard.

LOAD CHARACTERISTICS

DTE 200



DTE 255



COMPONENT DESCRIPTION

WARNING !

STATIC ELECTRICITY can damage circuit boards and electronic components.

- **Observe precautions for handling electrostatic sensitive devices.**
- **Use proper static-proof bags and boxes.**

This component description refers to the diagram for the DTE 255 on page 12 and for the DTE 200 on page 14. Data for components not mentioned here may be found in the spare parts list.

AP01 DC control circuit board. See the description on page 16.

AP02 IGBT board. See the description on page 27.

AP03 Mains rectifier circuit board. Only for DTE 255. See the diagram on page 29.

AP04 Circuit board. (Processor board). See the description on page 30.

AP05 Front panel circuit board. See the description on page 33.

AP06 Remote control connection circuit board. See the description on page 42.

AP07 AC control circuit board. See the function description on page 44.

AP08 Circuit board, suppression (EMC). See circuit diagram on page 52.

AP09 Circuit board (Snubber A). Only for DTE 255, see diagram on page 53.
AP09 Snubber circuit board for DTE 200, see diagram on page 56.

AP10 Circuit board (Snubber B). Only for DTE 255, see diagram on page 54.

AP11, AP12 Safety circuit boards. See circuit diagram on page 55.

AP13 HF unit, output voltage: 550V peak.

C01 Capacitor 0.1µF 1000V, transient voltage protection.

C04, C05 Filter capacitors, 10µF. Together with L01, they form a low-pass filter.

C06, C07 Filter capacitors.

C09 Capacitor, see V05.

C10, C11 Filter capacitors.

EV01 Cooling fan, DC unit (230V AC).

EV02, EV03 **DTE 255:** Cooling fans, AC unit (230V AC).
To check if the fans are electrically sound: disconnect the supply to the fans and measure their resistance with an ohmmeter across terminal XT23. The resistance must be 315Ω ±15Ω for the two fans in parallel.

DTE 200: Supplied with only one fan (EV02) for the AC unit.

L01 Primary inductor.

L02 Secondary inductor.

L03 4 ferrite ring cores, included in TM01. Reduces transients to/from transformer TM01.

L04 2 ferrite ring cores. Reduces transients to/from the mains.

L05 1 ferrite ring core. Reduces transients from the shunt.

Q01 - Q02 **DTE 200:** IGBT modules, AC unit.
See Test and Fitting Instructions on page 63.

Q01 - Q04 **DTE 255:** IGBT modules, AC unit.
See Test and Fitting Instructions on page 62.

Q05 IGBT module, DC unit. See Test and Fitting Instructions on page 61.

QF01 Main power supply switch.

R03 Current limiting resistor for C09.

R05 Resistor. With capacitor on AP09, forms a snubber circuit from positive to negative.

RS01 Shunt. 250A/60mV

ST01, ST03 Thermal sensors (PTC). Sensing the temperature at Q5 (ST01) and in TM01 (ST03). When the temperature exceeds 50°C the fans run at high speed. When it exceeds 75-80°C, welding is stopped until the temperature drops.
When the temperature is below 30°C, the. resistance of the PTC resistor is between 50 and 150Ω..

ST02 Thermal switch (PTC). Sensing the temperature of the AC heat sink. When it exceeds 75-80°C, welding is stopped until the temperature drops.
When the temperature is below 30°C, the resistance of the PTC resistor is between 50 and 150Ω..

TC01 Control transformer. Fuses included, see the circuit diagram.

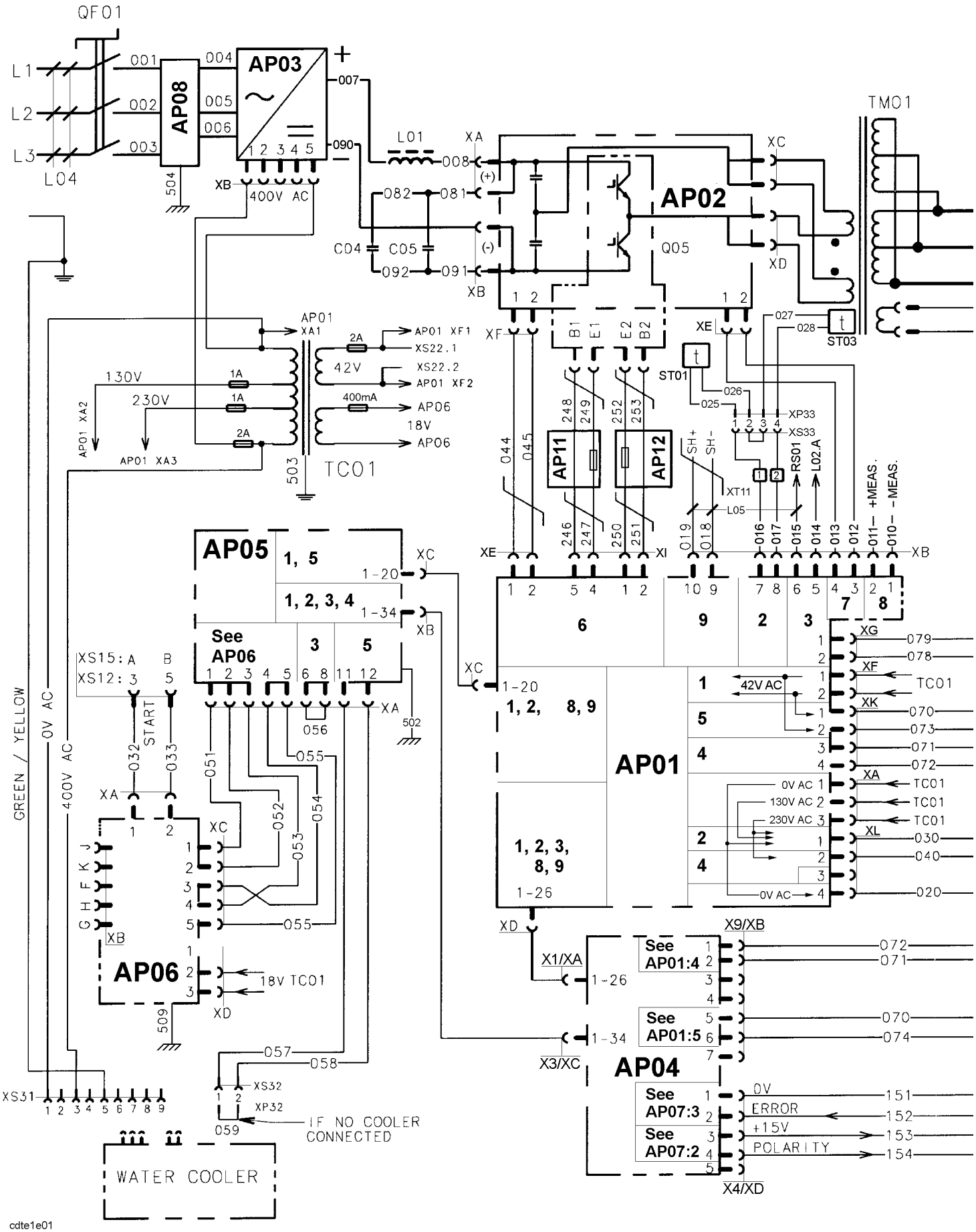
TM01 Main transformer. Supplies the main current circuit. Has an additional winding for HF start voltage.

TV01	HF coil. When replacing the coil it is important that the winding is correctly connected. The connection is polarity sensitive. Input voltage: about 550V; Output voltage: about 9kV.
V01, V02	Mains rectifiers for DTE 200. **Warning:** Do not mix up wires 007 and 090, when connecting them to the rectifiers. **Wire 007 must be connected to the positive (+) pole of V02.**
V05	Diode, used with C09 and R3 to limit the voltage between plus and minus on the IGBTs (Q01 - Q04). Only for DTE 255.
V07	Diode module. When measured with a diode tester the forward voltage drop is about 0.2 - 0.3V. When replacing the diode module, follow the fitting instructions for the IGBTs on page 62.
X	The pin connectors on the circuit boards are marked with XA, XB and so on. This is repeated on each circuit board. The connectors on circuit board AP04 are marked X1, X2 and so on.
XP	Pin connectors.
XS	Sleeve connectors.
XS12	Central connector for TIG. OKC connector for TIG on machines without central connector.
XS13	OKC connector for MMA
XS14	OKC connector for return welding current cable.
XS15	Connection for TIG start. Only machines with OKC connector for TIG.
XT	Terminal block.
YV01	Solenoid valve.

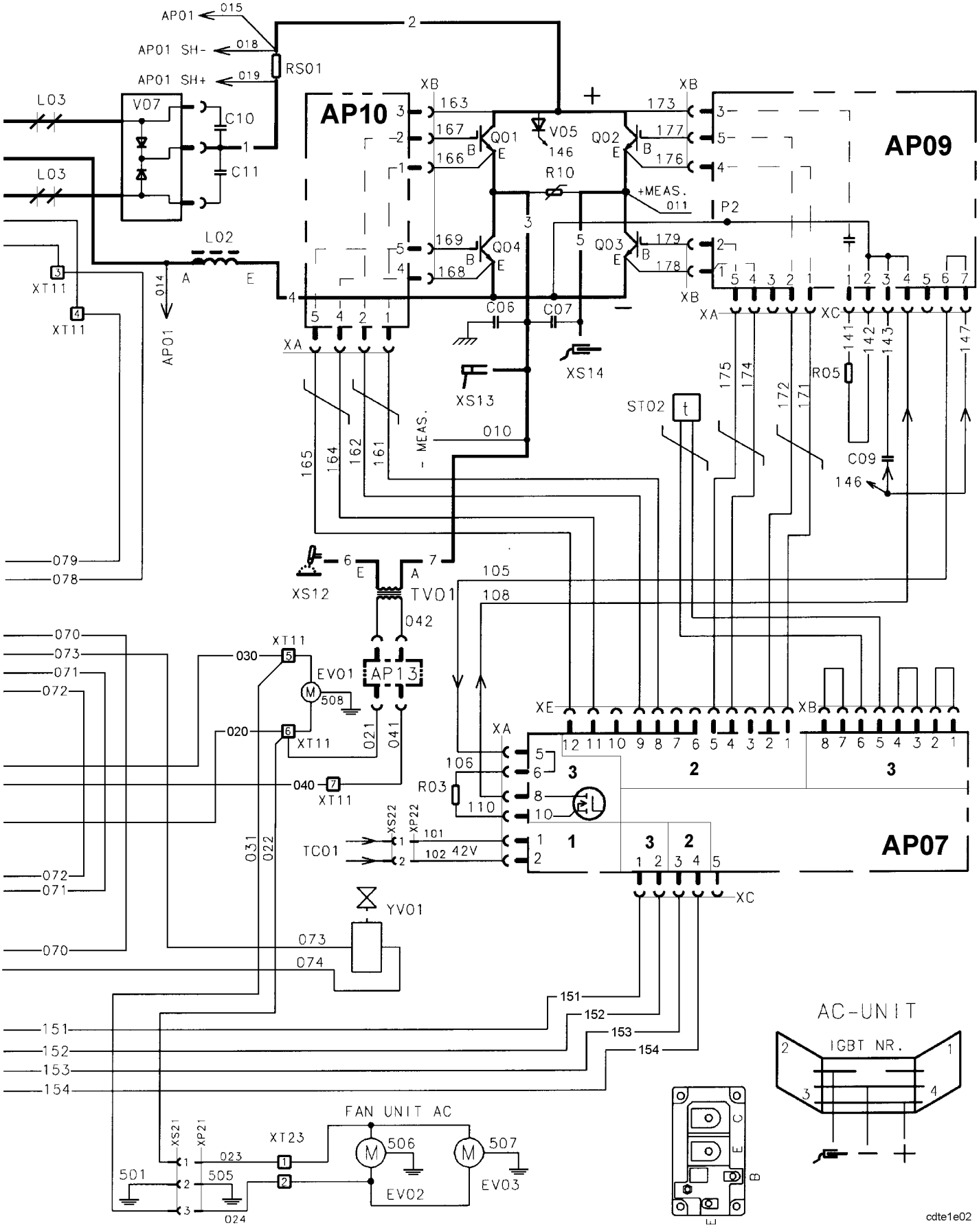
Introduction to the wiring diagram

Some of the circuit boards are divided into function blocks which are described in the descriptions of operation. The blocks are listed in the list of contents.

DTE 255 WIRING DIAGRAM

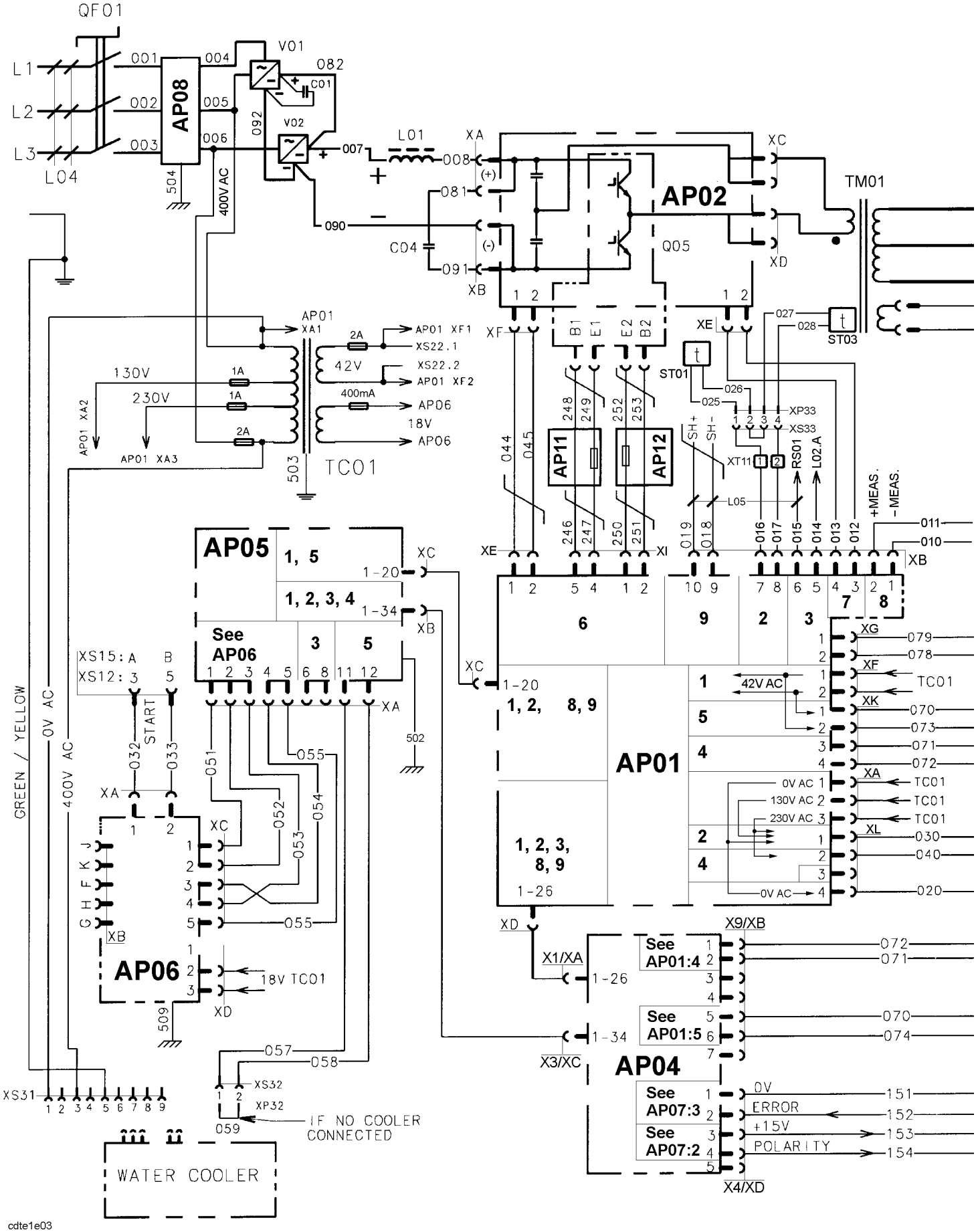


cdte1e01

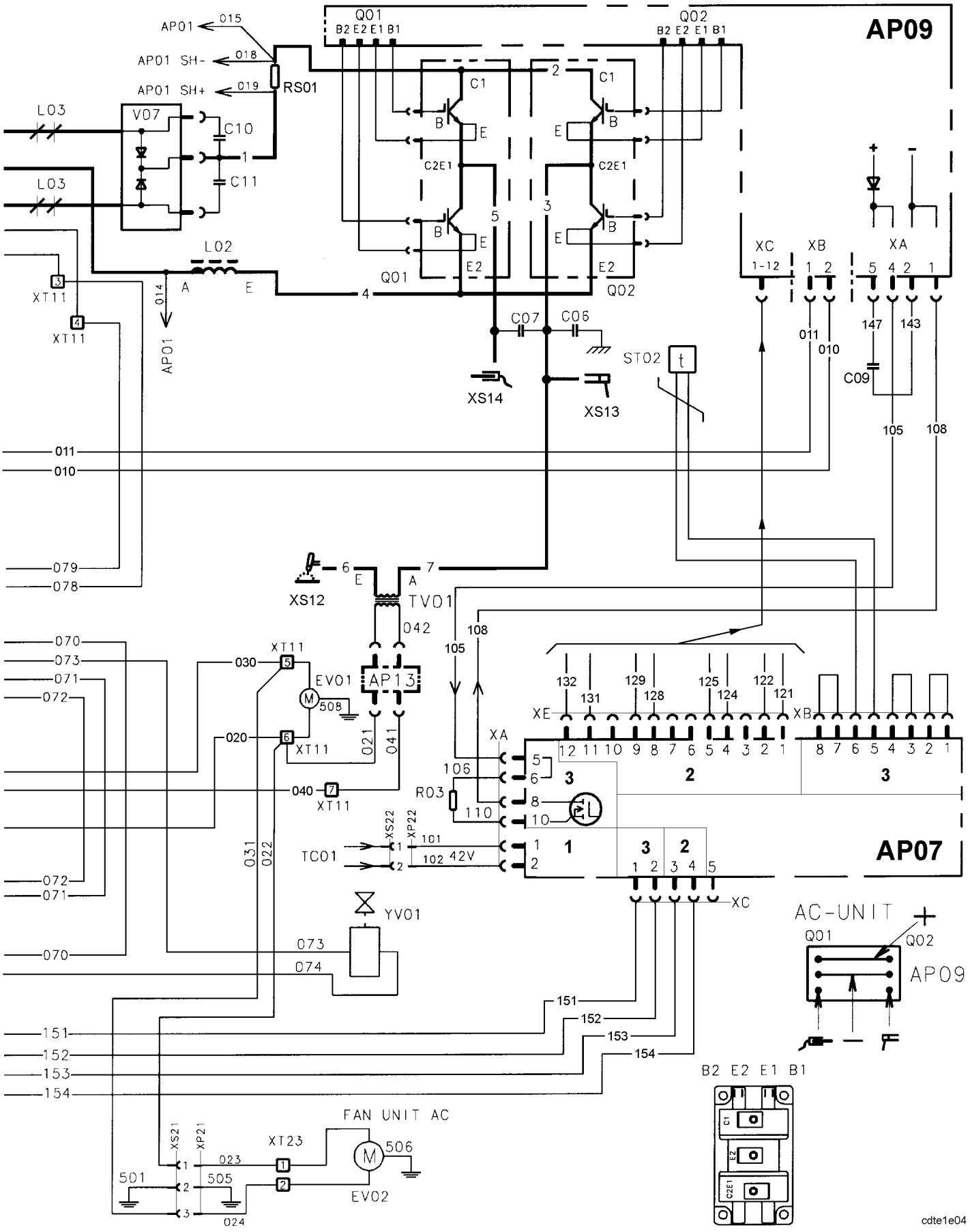

AP01
015
AP01 SH-
018
AP01 SH+
019
RS01
2
AP10
AP09
AP07
XB
XA
XC
XE
V07
C10
C11
L03
L02
XT11
AP01
014
A
E
Q01
Q02
Q03
Q04
V05
146
R10
+MEAS.
011
P2
C06
C07
XS13
XS14
- MEAS.
010
ST02
R05
C09
XS12
TV01
042
105
108
EV01
AP13
508
030
020
040
021
041
R03
106
110
TC01
XS22
XP22
101
102 42V
031
022
YV01
073
074
070
071
072
079
078
151
152
153
154
AC-UNIT
IGBT NR.
FAN UNIT AC
XT23
XS21
XP21
023
024
501
505
506
507
EV02
EV03

cdte1e02

DTE 200 WIRING DIAGRAM



cdte1e03


AP09
AP07
Q01
Q02
B2 E2 E1 B1
AP01 015
AP01 SH- 018
AP01 SH+ 019
RS01
V07
C10
C11
L03
L02
XT11
AP01
014
C1
C2E1
B
E
E2
XC
XB
XA
1-12
1 2
5 4 2 1
147
143
C09
011
010
105
108
C07
C06
ST02
XS14
XS13
XS12
TV01
042
EV01
AP13
508
030
020
040
021
041
XE
132 131 129 128 125 124 122 121
12 11 10 9 8 7 6 5 4 3 2 1
8 7 6 5 4 3 2 1
106
R03
110
101
102 42V
TC01
XS22
XP22
031
022
YV01
073
074
070
071
072
151
152
153
154
AC-UNIT
FAN UNIT AC
XT23
023
024
501
505
506
EV02
XS21
XP21

cdte1e04

DESCRIPTION OF OPERATION

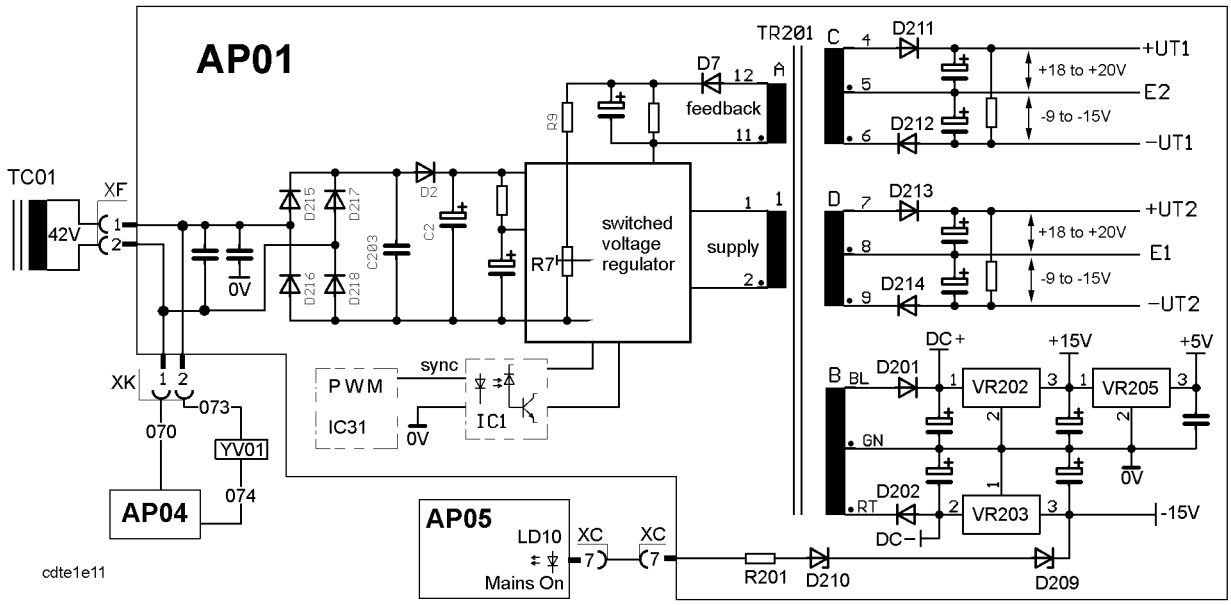
AP01 DC Control circuit board

Circuit board AP01 controls the DC part of the machine. It also acts as an interface between processor board AP04 and circuit boards AP02, AP05 and AP06. Some of the functions of those circuit boards are also described here.

From serial no. 246-xxx-xxxx a new version of the board is fitted to the machines. This description applies to all versions of the board. All versions can be used in all machines.

NOTE: All potentiometer settings are made at the factory. **Only** potentiometers R301, R333 and R335 may need to be readjusted when replacing the circuit board, see page 24.

AP01:1 Power supply



Power supply circuits on the DC circuit board, AP01

Power is supplied by a switched voltage regulator with a switching frequency of about 40 kHz. The HF transformer, TR201, has a dielectric test voltage of 5kV. The regulator is syncronised with the PWM controller via optocoupler IC1.

To check the output voltage: measure between connector XD pin 1 (DC+) and XD pin 3 (0V). It must be 19V ±0.5V. If it is not, adjust with potentiometer R7. See the componet positions diagram for location of R7 and connector XD.

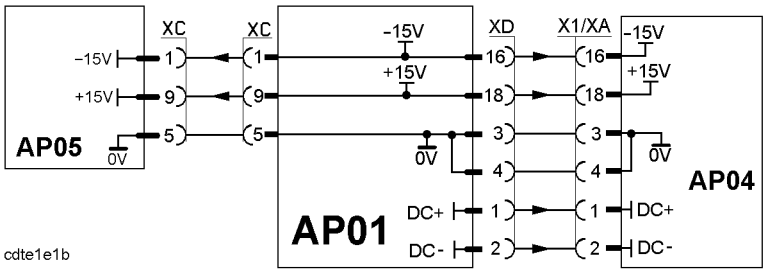
The +5V and ±15V supplies are regulated by normal voltage regulators. The tolerances are ±4%. When the machine is switched on the -15V suppy powers the Mains On LED on the front panel of the machine.

±UT1, ±UT2, E1 and E2 are used for the IGBT drives, see page 20.

+5V is used internally on AP01.

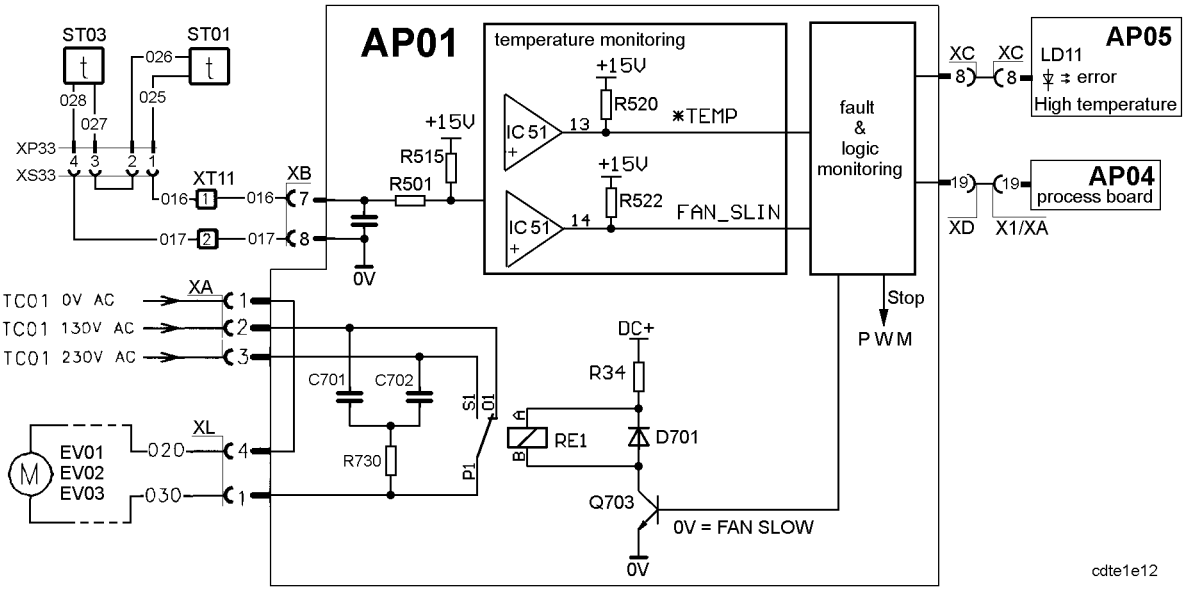
±15V, DC+ (19 ±0.5V) and DC- (about -18 to -20V) are used internally and also supply other circuit boards. See the overwiev below.

0V is connected to 0V on AP04, AP05 and to shunt RS01 via wire 015. See the wiring diagram and the diagram below.



Overwiev of the power supplies from circuit board AP01

AP01:2 Temperature and fan monitoring



Overwiev of the temperature monitoring on circuit board AP01

Temperature sensor ST01 is fitted at one of the screws securing the IGBT module Q05. Sensor ST03 is fitted on the main transformer TM01. The sensors are PTC resistors which are monitored by circuit board AP01.

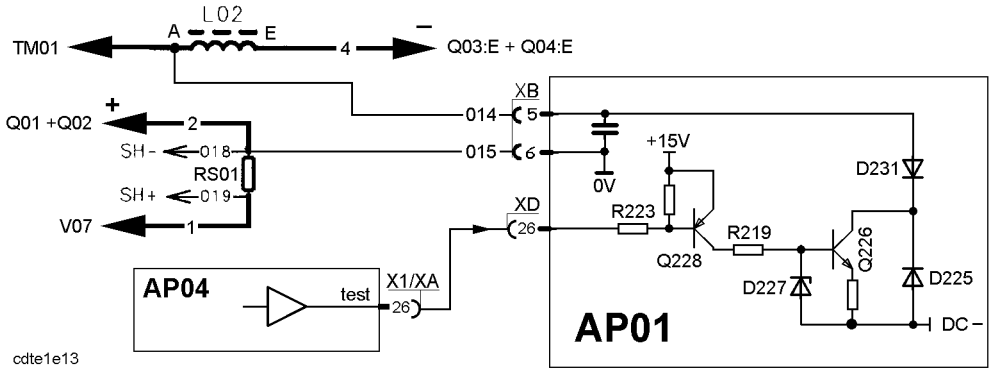
When the temperature is below approximately 50°C the signal FAN_SLIN is 0V. At higher temperatures the signal level changes to +5V and the fans (EV01, EV02 and EV03) run at full speed. When the temperature drops below 50°C the signal level of FAN_SLIN changes to 0V, but there is a 4-10 minute delay before the fan speed changes to slow speed.

If the higher fan speed cannot remove the heat, so that the temperature continues to rise, the signal *TEMP changes at about 75-80°C from +10V to 0V. This generates a stop signal to the PWM circuit and the processor board. This also causes the error LED on the front of the machine to light. See the signal path for error monitoring on page 38.
The machine cannot be restarted until it has cooled down.

When ST01 and ST03 are cold (20°C), the voltage between terminal XT11:1 and XT11:2 is about 0.3V. The resistance is about 60Ω for each of the sensors.

When the mains is switched on, the fans run at high speed for about five seconds, and then switch to low speed.

AP01:3a Lift Arc Test voltage



Lift Arc test voltage

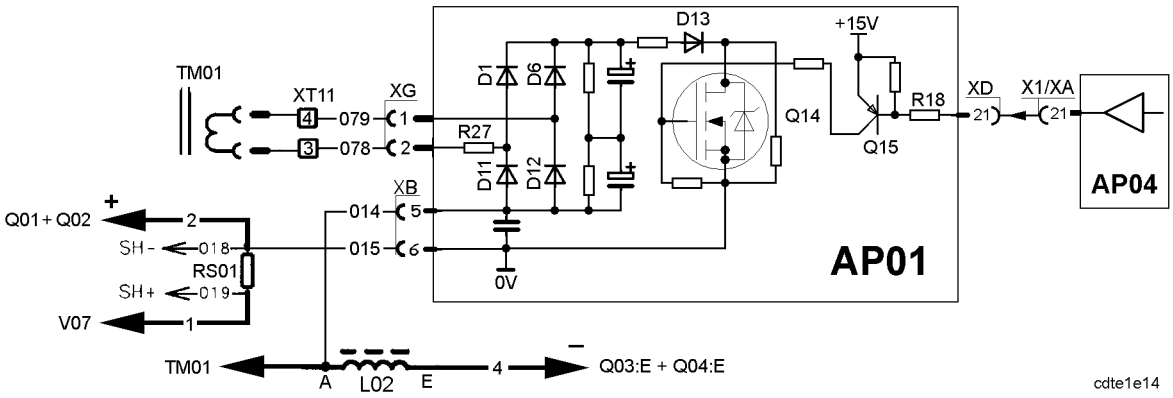
In Lift Arc mode a test voltage is used to detect when the electrode is in contact with the workpiece.
Normally the signal test from AP04 is +15V. When the torch trigger is depressed it changes to 0V, activating transistors Q228 and Q226. DC-, which is about -19V, is then connected in parallel with the welding voltage. The emitter resistor of Q226 limits the current produced by DC- to about 11mA.

The procedure for the Lift Arc start is as follows:

1. The torch switch is depressed, activating the test voltage and the gas valve.
2. The electrode contacts the workpiece. AP04 senses the change in voltage via the arc voltage input (see the diagram on page 23). No action is activated by the machine yet.
3. The electrode is lifted from the workpiece. AP04 senses the voltage change and activates the modulation, i.e. the machine starts and strikes an arc.

This was a technical description of the Lift Arc start. The welder's instructions can be found on page 73.

AP01:3b HF Start voltage

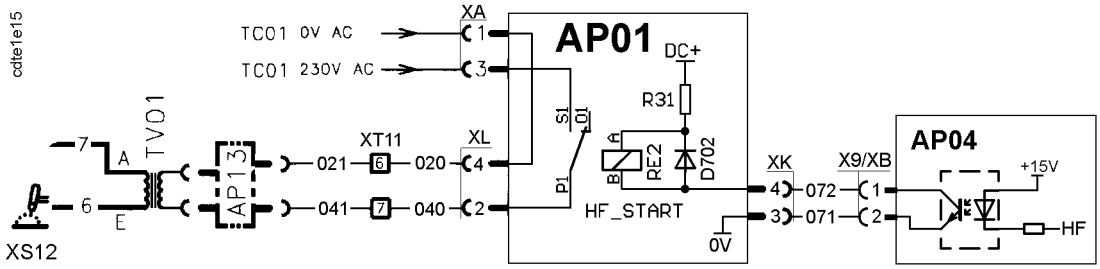


Auxiliary HF start voltage

To achieve a good HF start, it is neccessary also to increase the voltage at the electrode during the start. The voltage from an auxiliary winding on the main transformer is used to produce the increased voltage, which is about 90-100V.

An output from AP04 activates the start voltage, which is connected in parallel with the welding voltage by transistor Q14. The start voltage is activated as long as the HF genarator is active: see AP01:4.

AP01:4 HF Generator



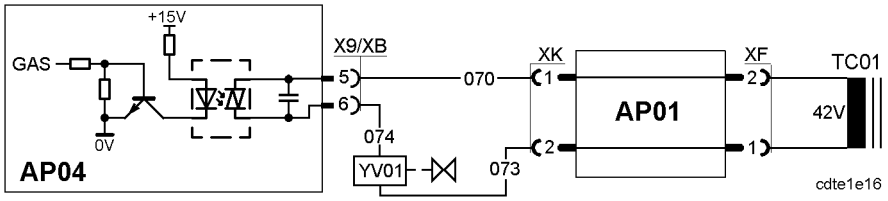
Control circuits for the HF start unit

The HF generator, AP13, is controlled from processor board AP04. It is on only until an arc is established. If no arc is established, the generator is stopped after about two seconds.

To check if the HF generator works: Make a short circuit between X9:1 and 2. **Note:** Don't leave the generator on for more than a couple of seconds, otherwise it might be overheated. Some HF generators have an inbuilt overtemperature protection feature which switches off the generator when it is too hot. When the generator has cooled down, it can be operated again.

The output voltage from AP13 is about 550V. The voltage at the secondary side of TV01 is about 7 to 9kV.

AP01:5 Gas valve

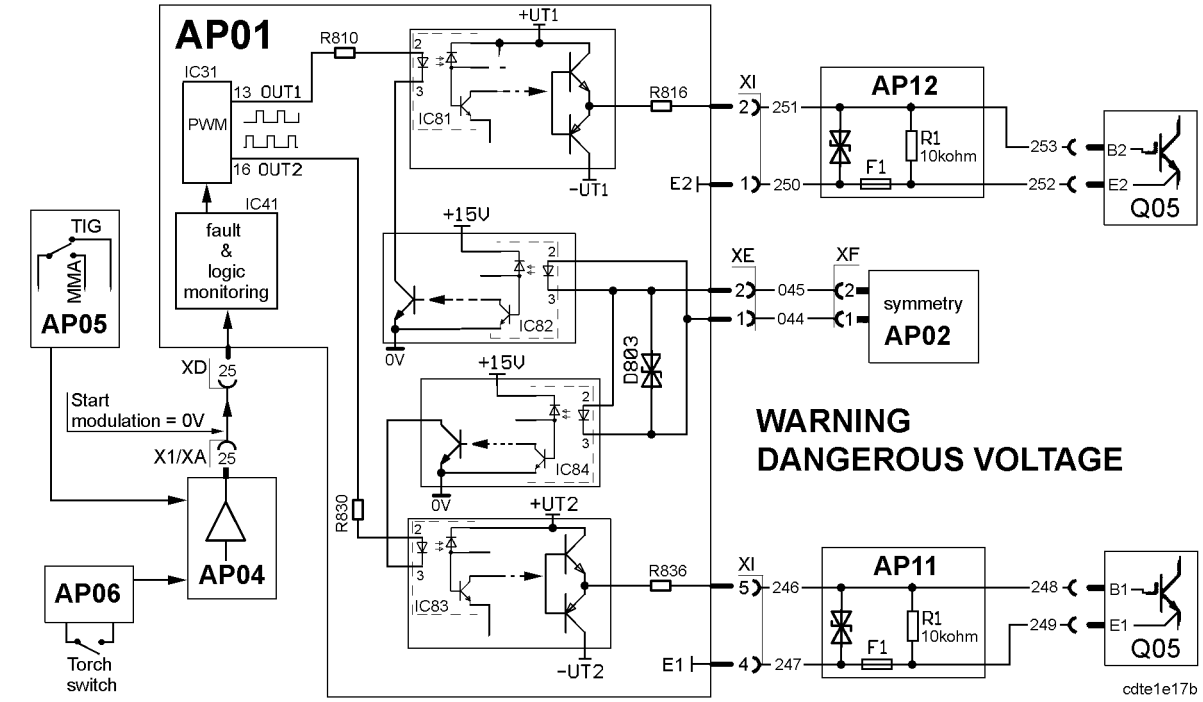


Control circuits for the gas valve

The gas valve is controlled from processor board AP04.

Easy test of the gas valve: Make a short circuit between X9:5 and 6.

AP01:6 Gate pulses from AP01



IGBT drivers, symmetry monitoring and symmetry control

The IGBT drivers, symmetry monitoring and symmetry control employ opto couplers with an isolation voltage of 5kV.
When there is no signal from the symmetry circuits on AP02, IC81:3 and IC83:3 are connected to 0 V.

When signal OUT1 is low, gate B2 of IGBT Q05 is negative, i.e. Q05 is off.
When signal OUT1 is high, gate B2 of IGBT Q05 is positive, i.e. Q05 is conducting.

OUT2 and gate B1 of IGBT Q05 operate in the same way as the circuits above.

If there is a signal from the symmetry monitoring on circuit board AP02, either gate B1 or gate B2 is locked, depending on the polarity, until the symmetry fault is gone. This action does not stop the welding.
For more information about symmetry monitoring, see page 27.

Circuit boards AP11 and AP12 protect AP01 if there is a short circuit in the IGBT module Q05. If the IGBT module is faulty, check the fuses on AP11 and AP12: see instructions on page 55. Check the gate pulses too, using the instructions on the next page.

Test instruction for the IGBT module is on page 61.

NEVER check the gatepulses when the machine is connected to the mains in the normal way.

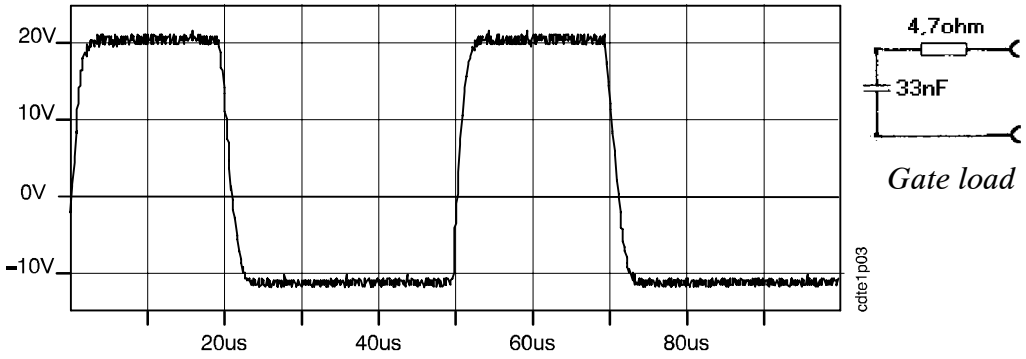
CHECKING THE GATE PULSES

a. Before attempting to measure the gate pulses to the IGBTs, **it is essential to disconnect the power supply from rectifier unit AP03.**

DTE 255: Switch off the machine and remove wires 090 and 007 from rectifier unit AP03. See the wiring diagram on page 12.
DTE 200: Switch off the machine and remove wires 090 and 007 from rectifier V02. Mark the heat sink with a + where wire 007 is connected to V02, before disconnecting. See the wiring diagram on page 14.

b. Disconnect AP11 and AP12 from AP01 and connect a gate load (4.7Ω 33nF) to each gate output (circuit board AP01 connector XI:1-2 and XI:4-5).
See the diagram on page 20 and the component positions on page NO TAG.

c. Connect the oscilliscope with its screen to XI:4 and the probe to XI:5, alternatively with the screen to XI:1 and the probe to XI:2.
Set the machine to MMA mode and switch it on.
The pulse shapes must be as shown below.



Gate load

Gate pulses measured with gate load at AP01

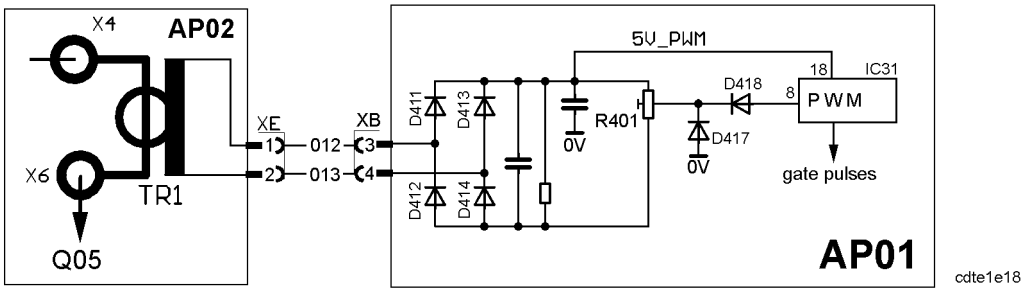
d. Measure the following pulse parameters on both gate outputs:

- Frequency: 20kHz ±0.5kHz.
- Pulse time: 19-21µs measured at the 0V level.
- The voltage of the positive pulse must be 18 to 20V
  The voltage of the negative pulse must be -9 to -15V

e. If the pulses are within the tolerances, the pulse driver circuits are OK.

NOTE: When reconnecting wires 007 and 090, make sure that wire 007 is connected to the positive of the rectifier.

AP01:7 Primary overcurrent protection



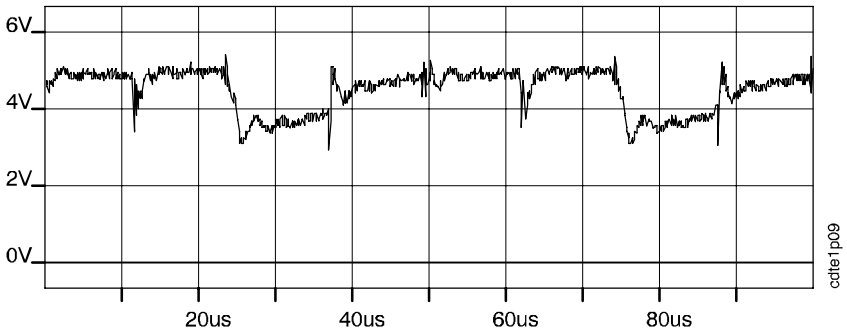
Primary current monitoring circuits

Current transformer TR1 is mounted on circuit board AP02, see the diagram on page 27. The signal from TR1 is rectified on AP01. Potentiometer R401 (which is factory-adjusted) adjusts the level of the signal to that needed to shut down the PWM controller.
R401 has been adjusted to switch off the power source at a current corresponding to 320A welding current under normal conditions. The shut down input at IC31:8 is at +5V when the circuit is enabled for operation. If the input is pulled down to 0V, the output signals are blocked.

When the PWM circuit is blocked there is no current, i.e. no overcurrent. The PWM circuit is then automatically soft-started, which means that it slowly increases the current. If the cause of the overcurrent, for example a short-circuited secondary rectifier diode, is still present. The shut down input will be pulled down again, and this action will continue.

In case of primary overcurrent: There are no indications on the front panel, but the machine cannot be used for welding.

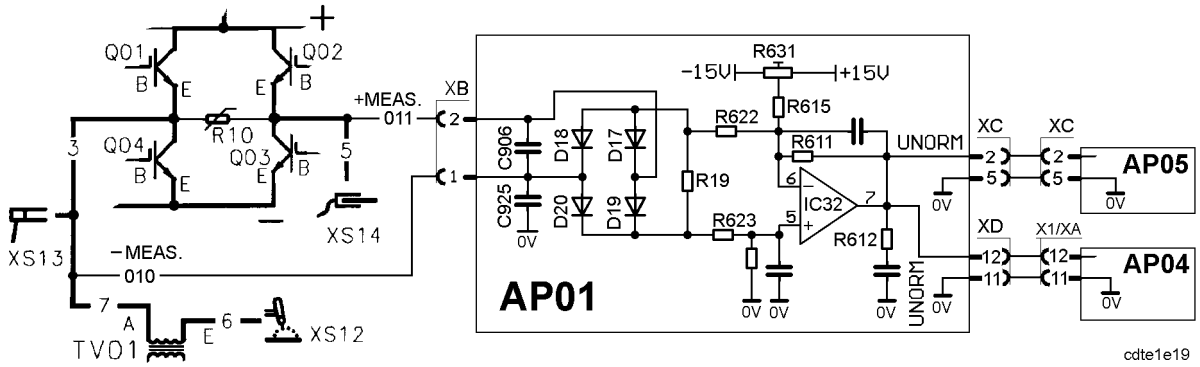
NOTE: TR1 must never be operated with an open-circuit secondary (= output). This could destroy it by flashover between the windings.



Signal measured at the cathode of D417

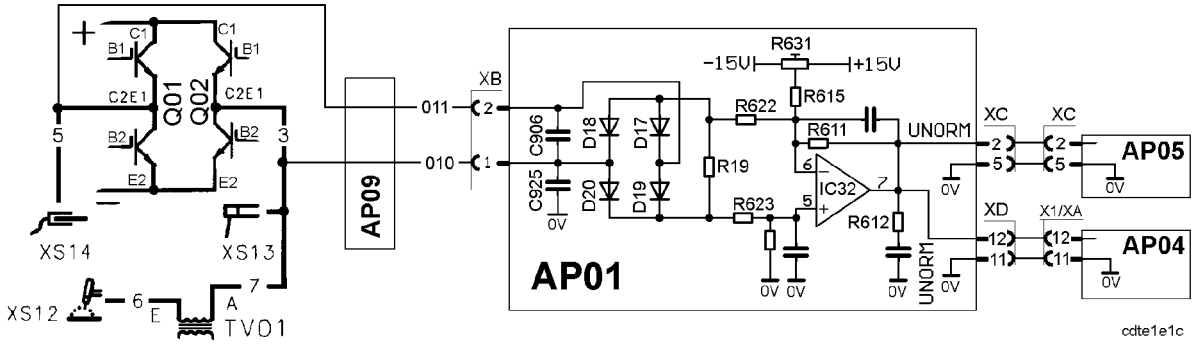
The signal above is measured at a welding current of 200A and 18V under normal conditions. The higher the primary current, the more the signal is pulled towards 0V.

AP01:8 Arc voltage sensing



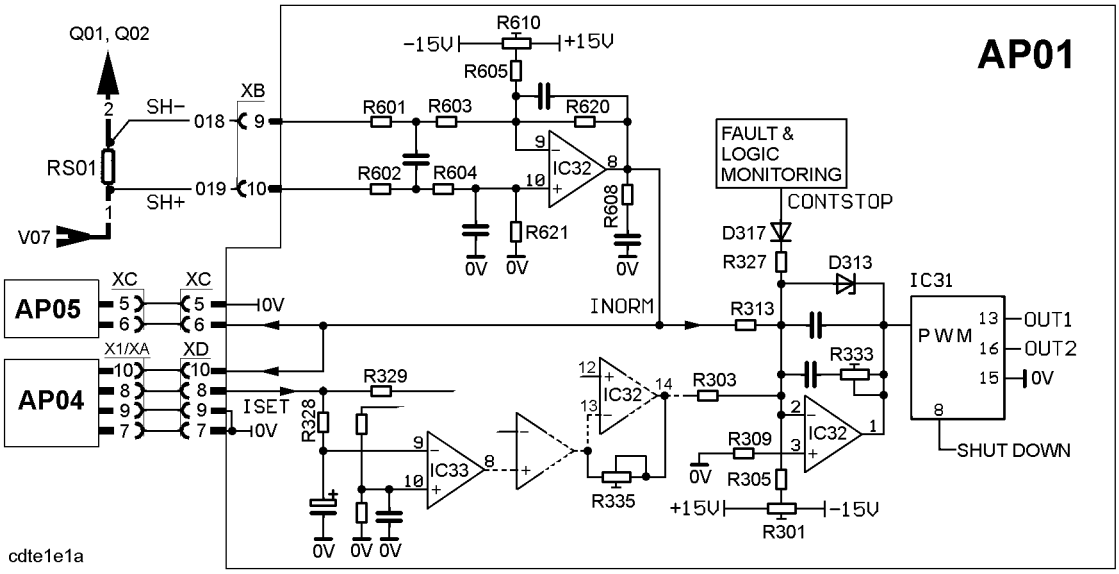
Signal path for arc voltage sensing in the DTE 255

IC32 has a gain of 0.1, which means that a welding voltage of 10V produces 1V at the output (UNORM). The signal is connected to AP05 and AP04, and used for process control on AP04. R631 is a zero offset trimmer.



Signal path for arc voltage sensing in the DTE 200

AP01:9 Current monitoring



Welding current control circuits

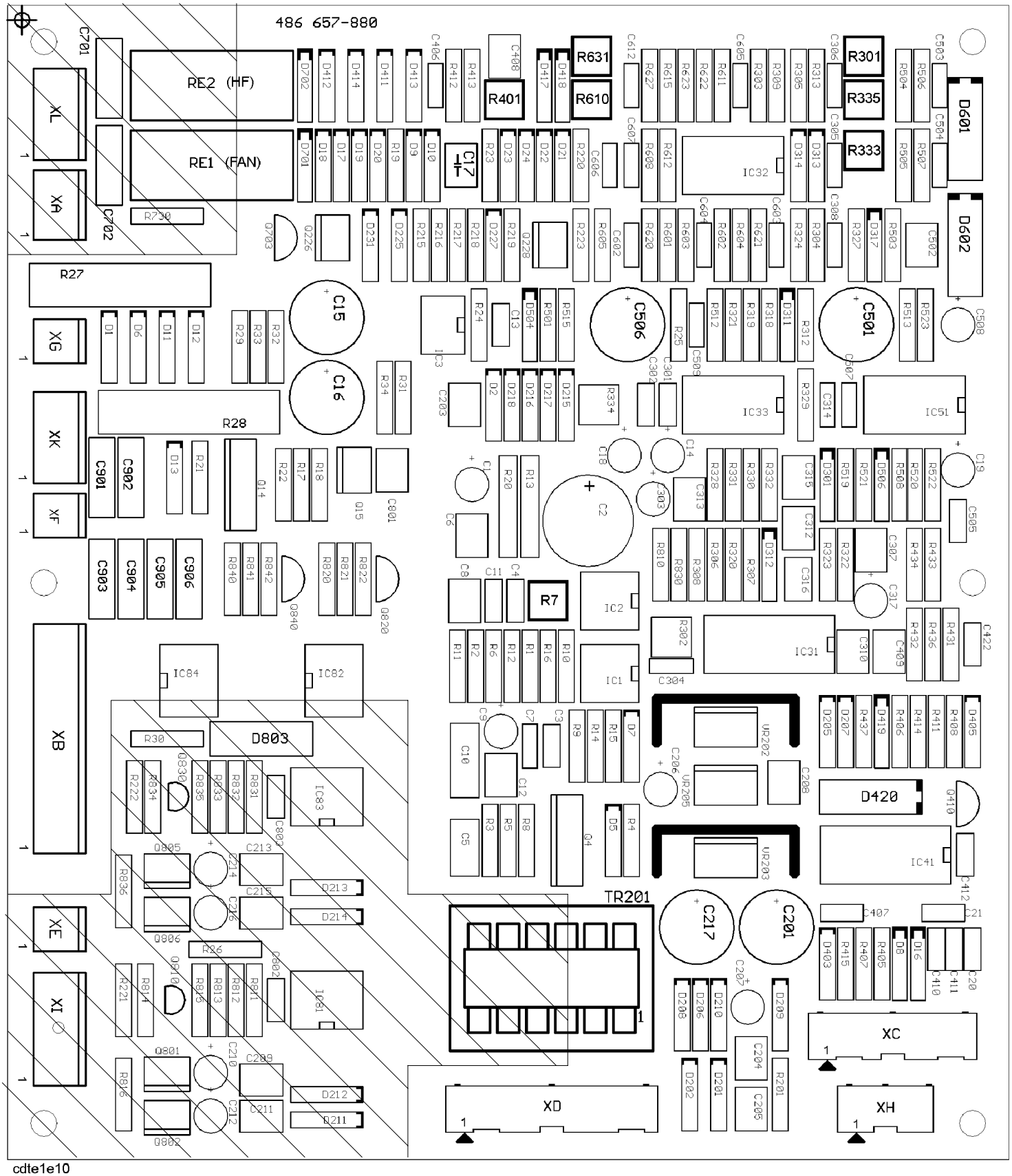
The shunt voltage is 60mV at 250A welding current. The signal INORM from IC32:8 is 1V at a welding current of 100A. Potentiometer R610 is a zero offset trimmer for the shunt signal.

The current set point value ISET comes from the processor board: it is 1V for 100A welding current.

The minimum current can be adjusted with R301, and must be 5–7A.
The maximum current can be adjusted with R335, and must be 250 ±5A for the DTE 255 and 200 ±5A for the DTE 200.
R333 is used to adjust the feedback of the controller (e.g. adjust R333 when the arc is too noisy).

The welding current is controlled with the PWM circuit. The voltage at the shutdown input (IC31:8) is +5V when the circuit is enabled for operation. If the input is pulled down close to 0V, the output signals are blocked.

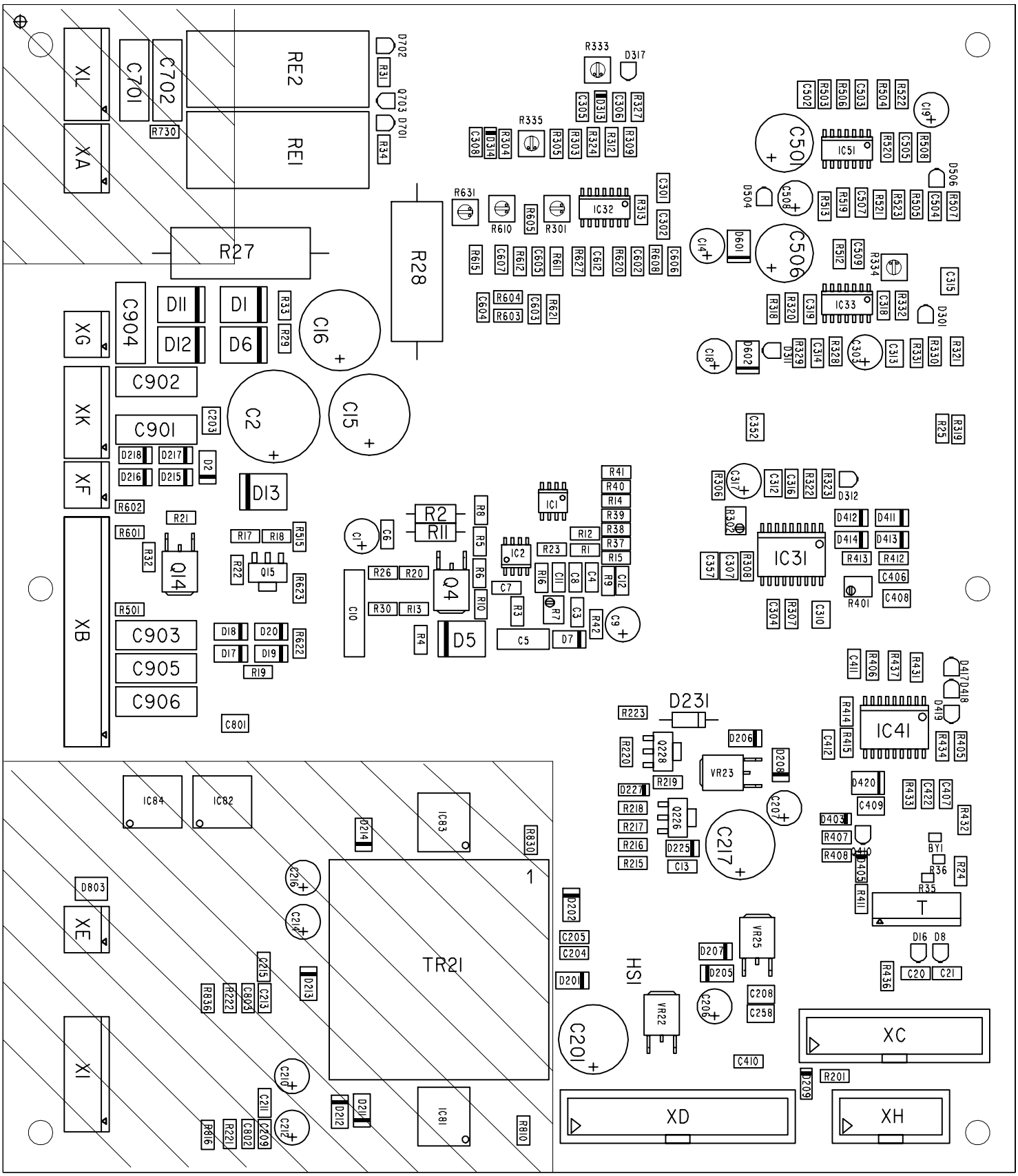
AP01 Component positions



cdte1e10

Component positions for version 1 of circuit board AP01, with part no. 0486 657 880

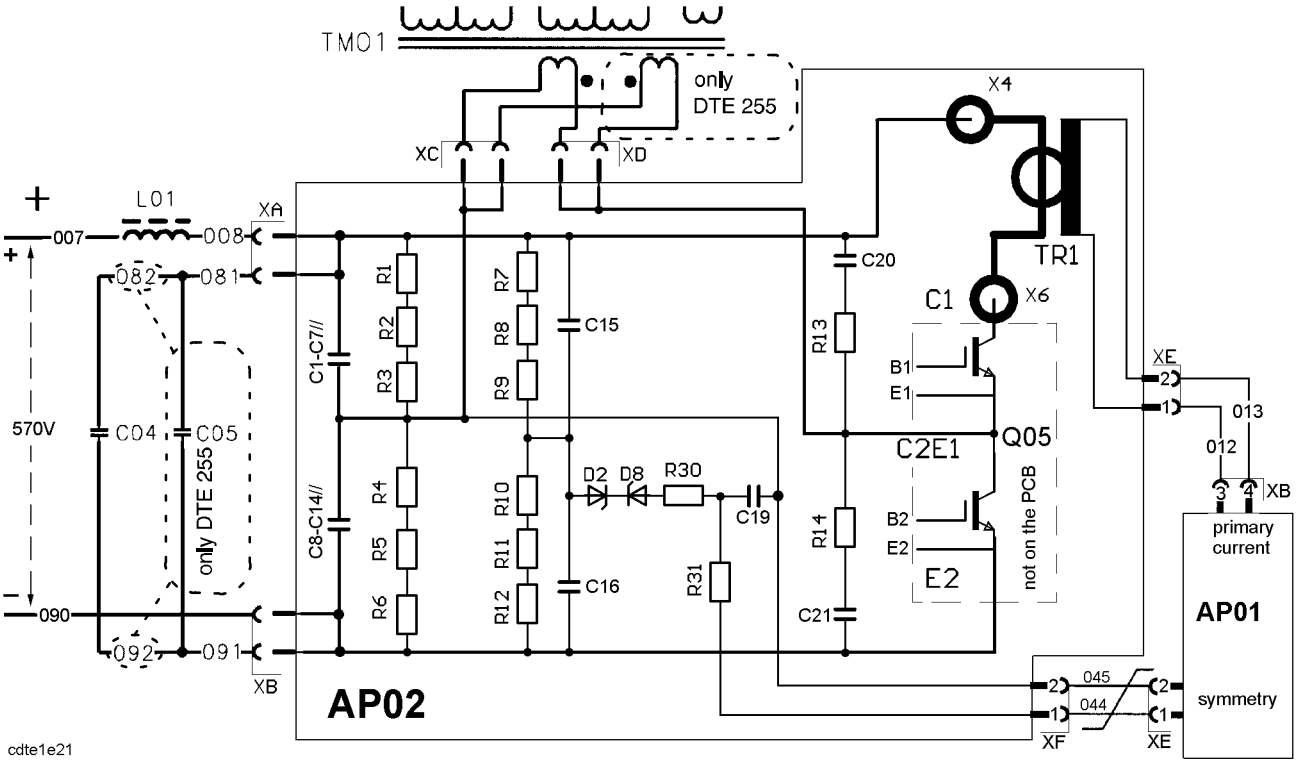
WARNING: high voltage in the shaded areas



Component positions for version 2 of circuit board AP01, with part no. 0486 810 880

WARNING: high voltage in the shaded areas

AP02 Primary IGBT circuit board



Circuit diagram for AP02

Comments to the diagram above: Capacitor C05 is fitted only in the DTE 255.
In the DTE 200, main transformer TM01 has only one primary winding.
Capacitors C1, C2, C13 and C14 are fitted to circuit board AP02 only in the DTE 255.

Test instructions for the IGBT module are on page 61.

IGBT circuit board AP02 performs the following duties:

- Connecting the main transformer TM01 with the IGBT half-bridge Q05.

  Q05 drives an alternating current through the primary side of transformer TM01 by charging and discharging C1-C7 and C8-C14 at a frequency of 20kHz.

- Creating a signal to maintain the symmetry (avoid saturation) of the main transformer.

  The voltage difference between a fixed middle point at the anode of diode D2 and a variable point at connector XF:2 is used as the reference for the symmetry. Unbalanced operation of the transformer is avoided by blocking the firing cycle of whichever side which is causing the unbalance. This is carried out by the gate circuits: see page 20.

  A window of 62V without any interaction is provided by the zener diodes D2 and D8. This means that only if the unbalance is more than 62V will the outputs of XF:1 and 2 start to act. This action does not stop the welding.

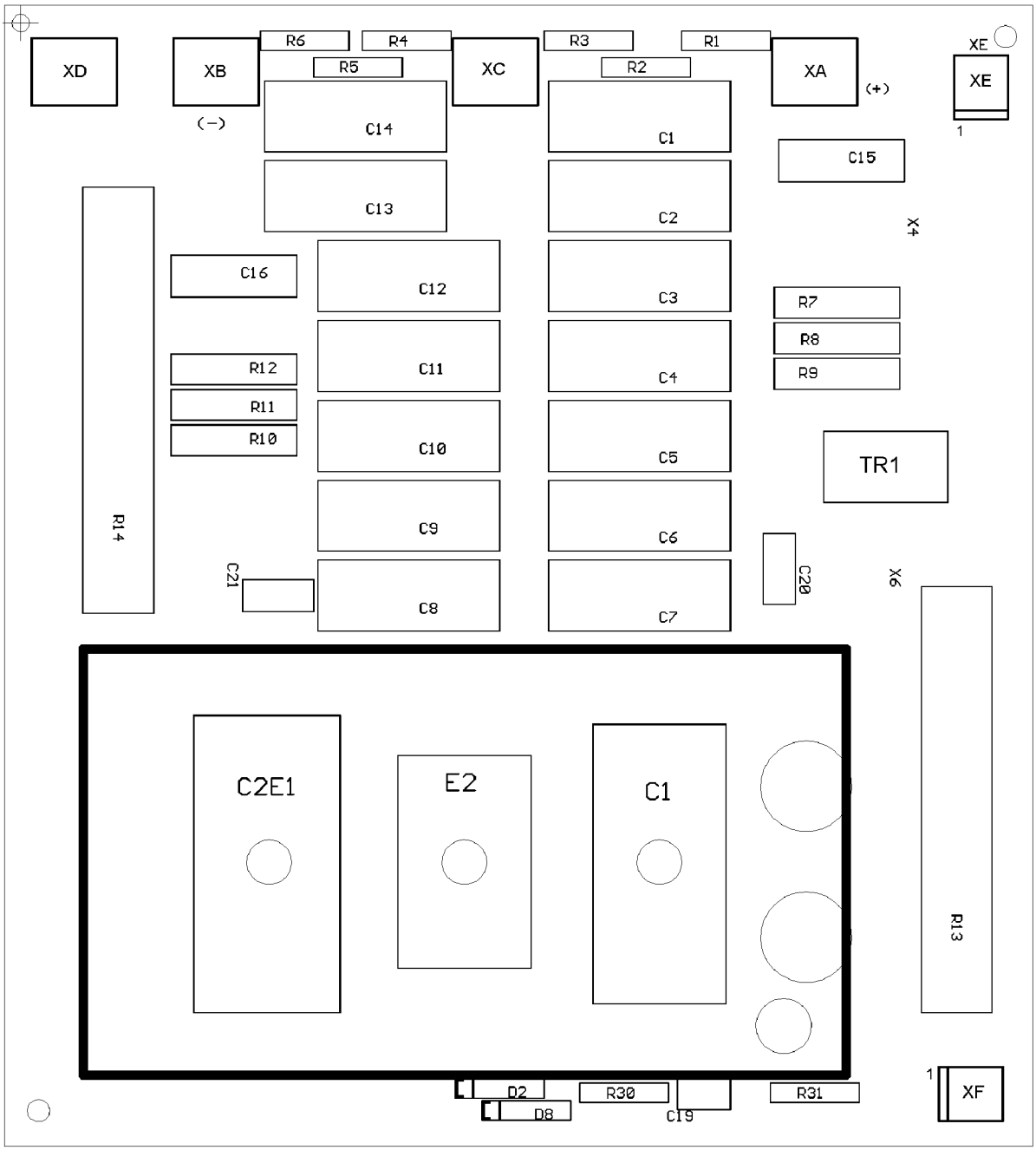
  Note: The polarity of the signal from connector XF is important.

- Generating a primary current signal to protect the machine.

  Current transformer TR1 must never be operated with an open-circuit secondary (= output). This could destroy it by flashover between the windings.

  See page 22 for more information on the primary overcurrent protection .

AP02 Component positions



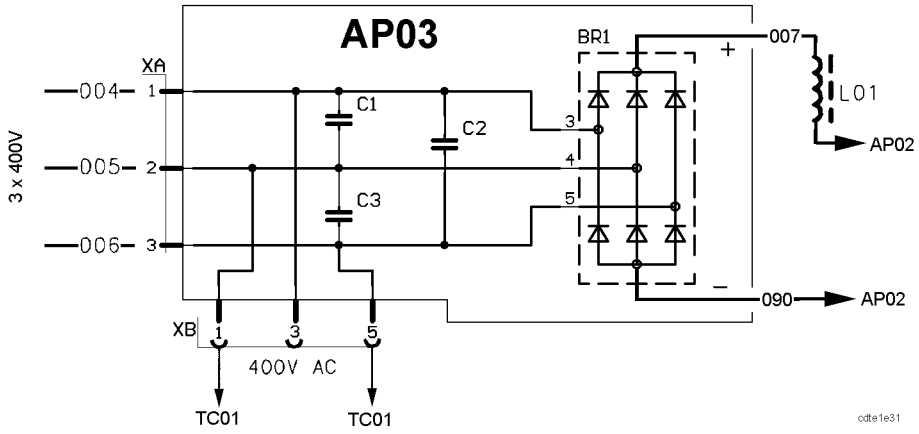
cdte1e20

Component positions, circuit board AP02

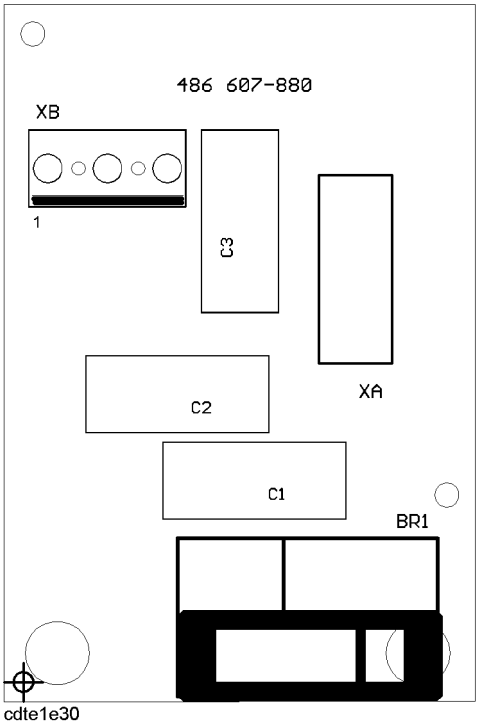
When connectors XC and XD have been disconnected, make sure that **both** sleeves of the two connectors are properly reconnected. See the diagram on previous page.
The machine will also work with one of the primary windings connected, but the main transformer, TM01, will be overheated.

AP03 Mains rectifier circuit board

This circuit board is used only in the DTE 255.



Circuit diagram for circuit board AP03



Component positions for circuit board AP03

AP04 Processor circuit board

There are two versions of the board, the in- and output signals are the same, both versions fits in any machine having version 1 or 2 of the front panel circuit board, AP05. Machines having version 3 of circuit board AP05 must have version 2 of AP04.

Version 2 of AP04 has part no. 0486 770 880, it is fitted to the machines from May 2002.
Version 1 of AP04 has part no. 0486 665 880, this board is not more available.

The denominations of the in- and output connections are different on version 1 and 2 of the board:
Version 1 / Version 2 = X1 / XA, X3 / XC, X4 / XD, X9 / XB

Processor board AP04 performs the following duties:

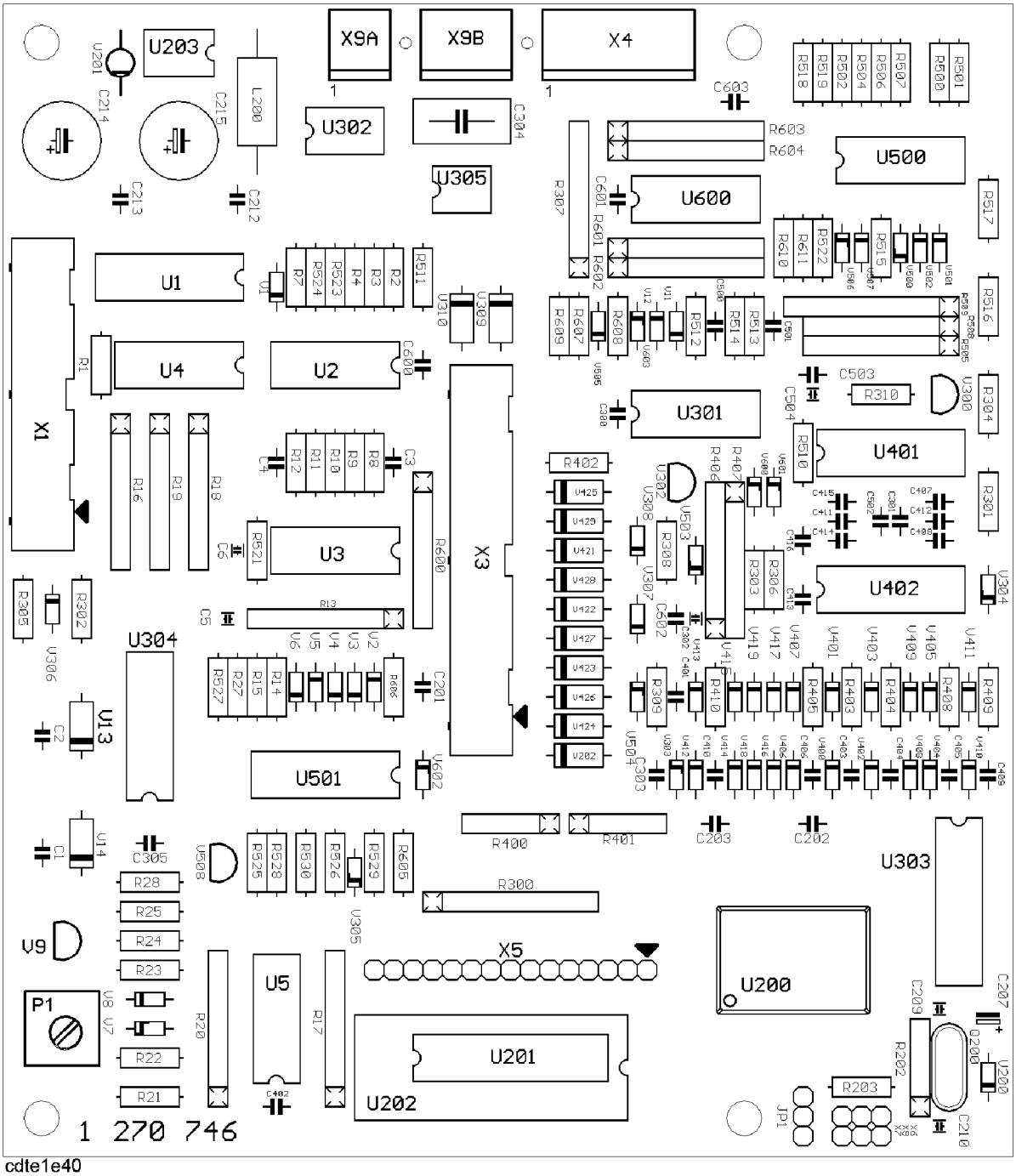
- Control of all logical functions, e.g. mode of operation.
- Control of time functions:, e.g. slope time
- Creating the current set value.
- Setting the hotstart current level for MMA to two times the set current.
- Creating the frequency and balance for the AC operation.
- Controlling the AC unit, AP07.
- Controlling the HF generator and the gas valve.
- Matching the control signal according to the actual welding mode.
- Realisation of the Arc Force for MMA welding.

An arrangement of analogue circuits that characterise the control function of certain welding modes, such as TIG and MMA welding, is included on the board. All functions are monitored and controlled by a microprocessor on the board.

The power supply to AP04 comes from AP01: see AP01:1 on page 16-17.

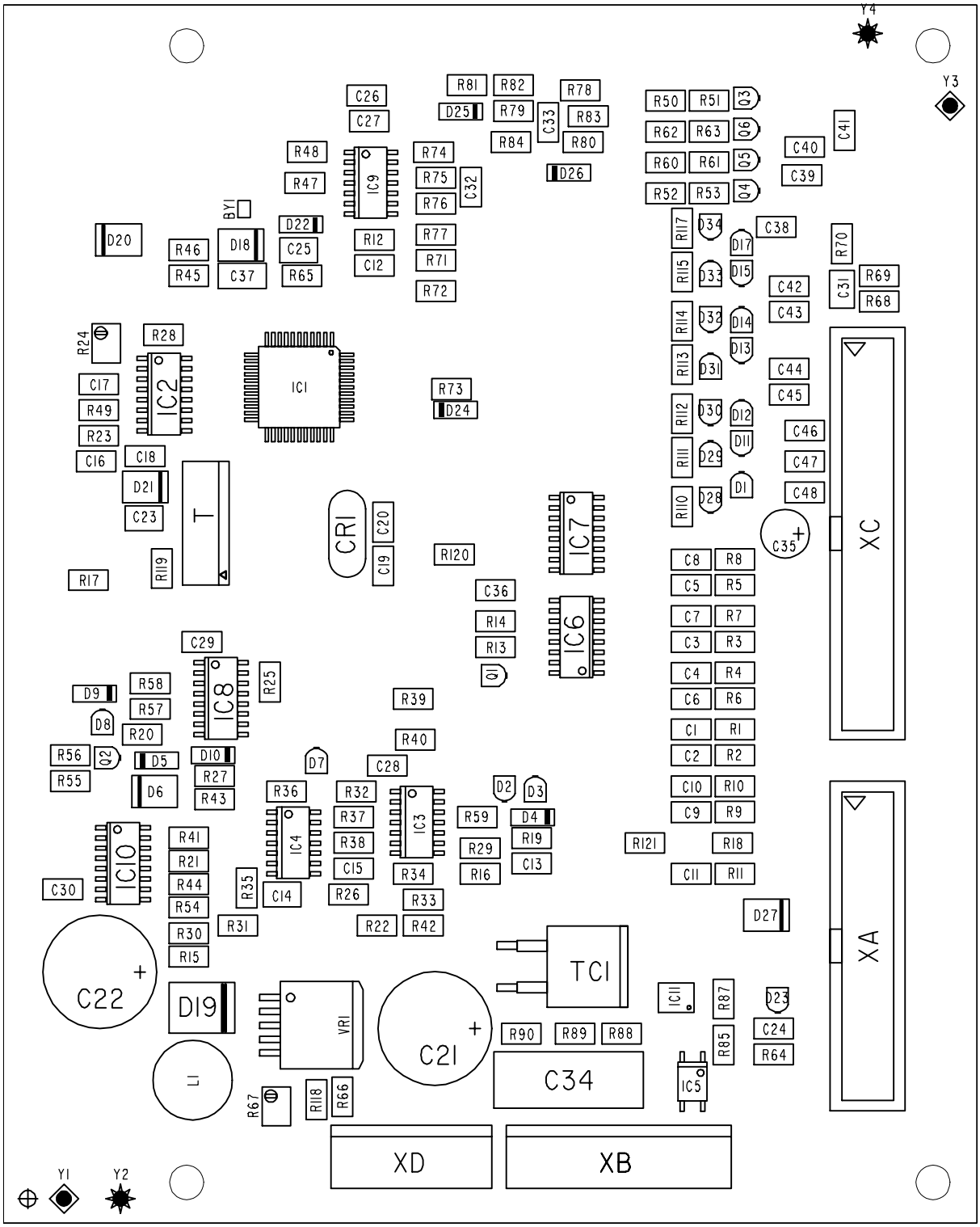
Functions on AP04 which are connected to other circuit boards are described in conjunction with those boards.

AP04 Component positions



cdte1e40

Component positions for version 1 of circuit board AP04, part no. 0486 665 880



Component positions for version 2 of circuit board AP04, part no. 0486 770 880

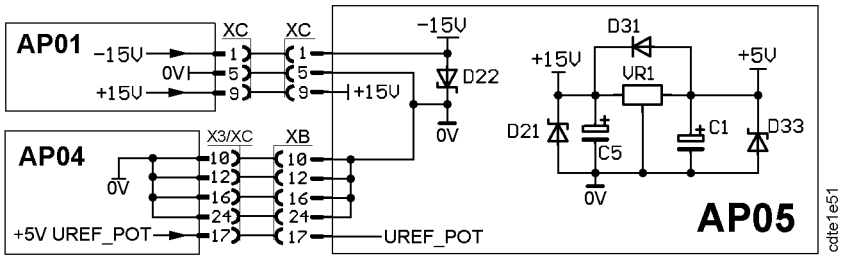
AP05 Front panel circuit board

There are three versions of circuit board AP05. Version 1 is used in the DTE 255 up to serial no. 844-950-xxxx. Version 2 is used in all other machines up to and including serial no. 948-xxx-xxxx. Version 3 is used in all machines from serial no. 246-xxx-xxxx.

The difference between the versions is described on pages 40 and 41.

AP05:1 Power supply

Valid for all versions of circuit board AP05

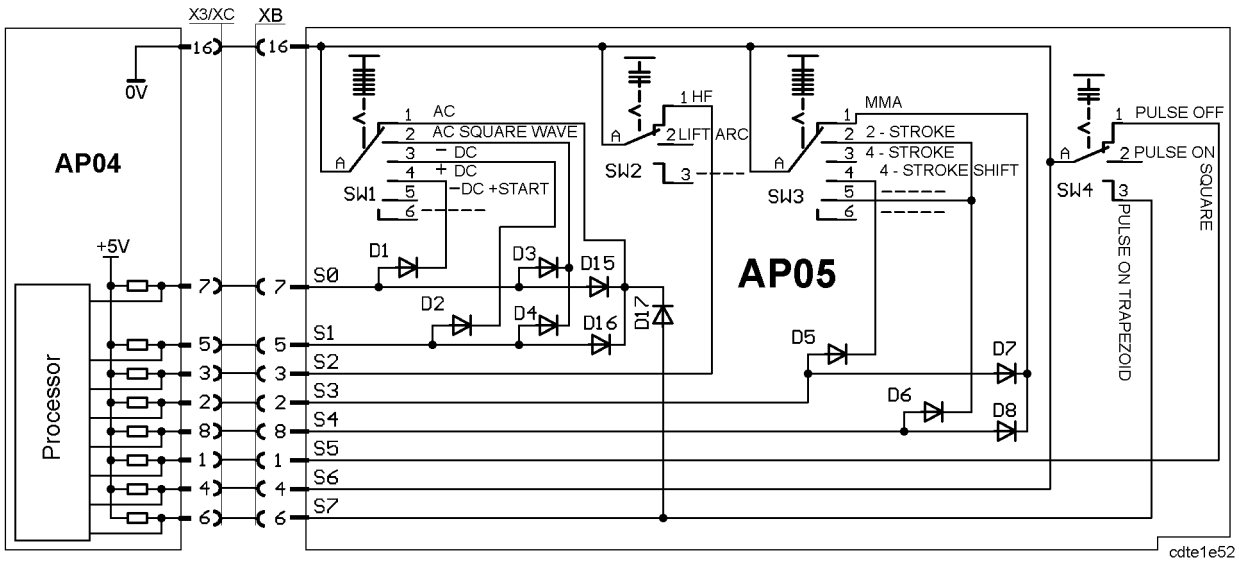


Power supply, front panel circuit board AP05

AP05 is supplied with ±15V from AP01. +5V from regulator VR1 is used internally on AP05.

AP05:2 Operation mode selection

Valid for all versions of circuit board AP05

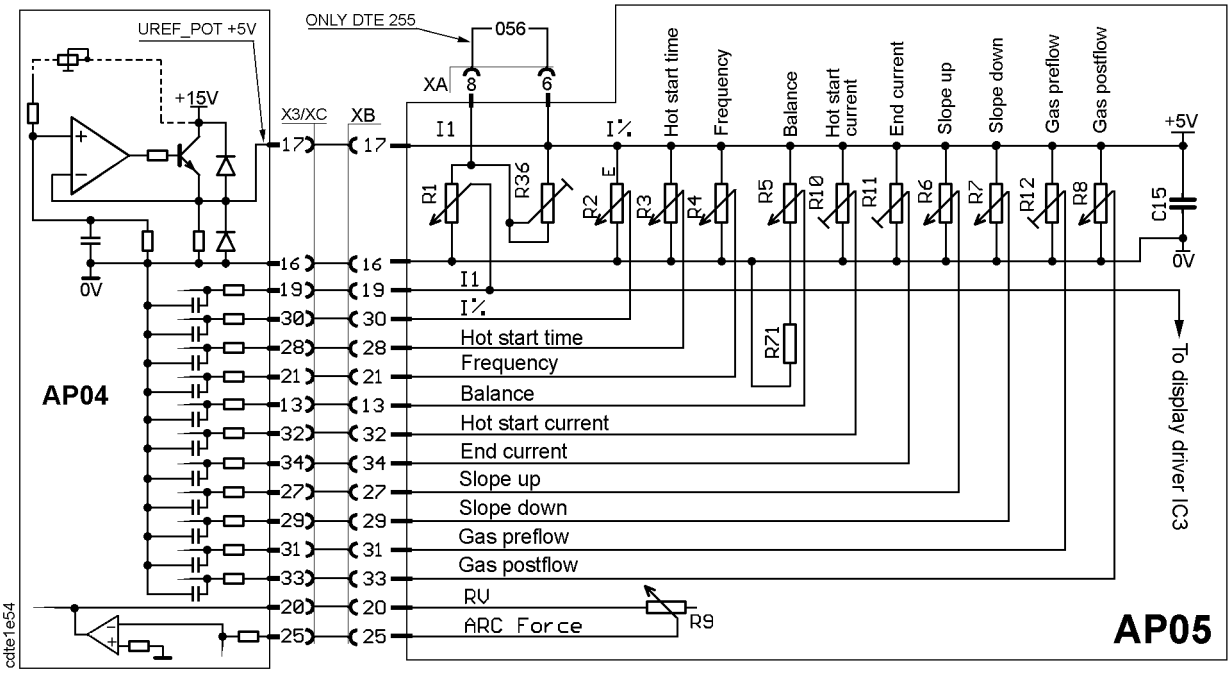


Selector switches SW1, SW2, SW3 and SW4 (of which SW1 and SW3 are connected to diode networks) generate an 8 bit word. This is used by AP04 to select the mode in which the machine is to work.

The location of the switches on the front panel is shown on page 71.

AP05:3 Analogue settings

Valid for version 1 and 2 of circuit board AP05



Analogue settings, version 1 of circuit board AP05.

All analogue signals from AP05 to the processor board AP04 are related to a regulated 5V supply from AP04 (UREF_POT +5V). This voltage has an accuracy of ±1%. All boards, including spare parts, are adjusted at the factory.

The potentiometers on the front panel are described in the instructions on page 72, which also shows their locations.

TRIM POTENTIOMETERS

R10 TIG hotstart current, adjustable between 50 and 200A.
On delivery, the hot start current has been set to 100A.

The hotstart for MMA is set by the processor board, see page 30.

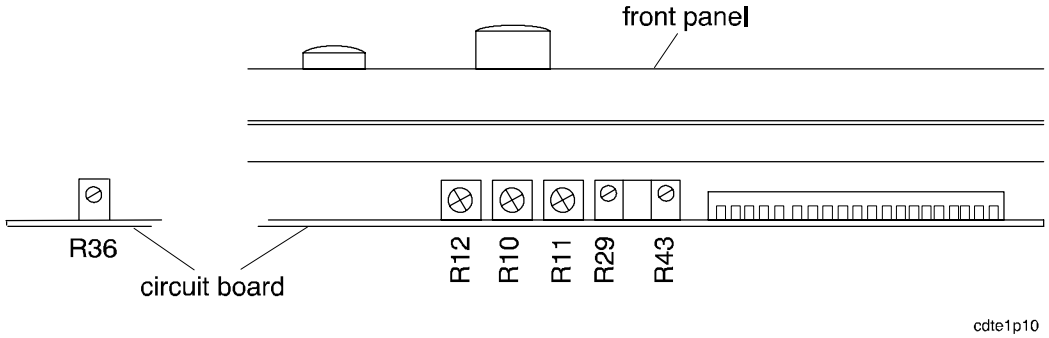
R11 End current after slope down, adjustable between 5 and 55A.
On delivery, the end current has been set to 5A.

R12 Gas preflow time, adjustable between 0 and 5 seconds.
On delivery, the preflow time has been set to 10ms.

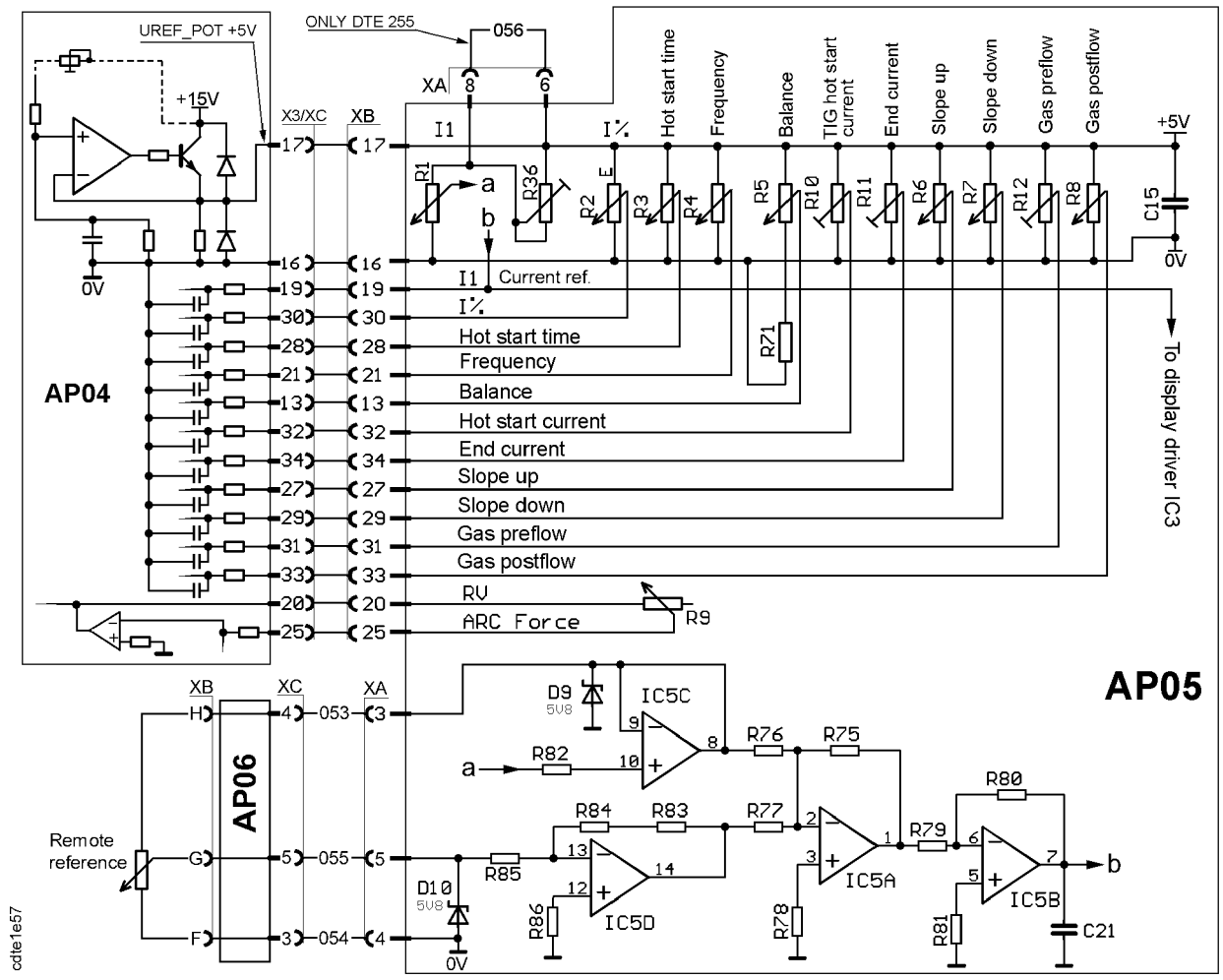
R29 Adjustment for the minimum reading of the display, 5A.

R43 Adjustment for the maximum reading of the display (250A for the DTE 255 and 200A for the DTE 200).

R36 Is used in the DTE 200 to provide correct reading of the 200A range. XA6 and 8 are bridged in the DTE 255.



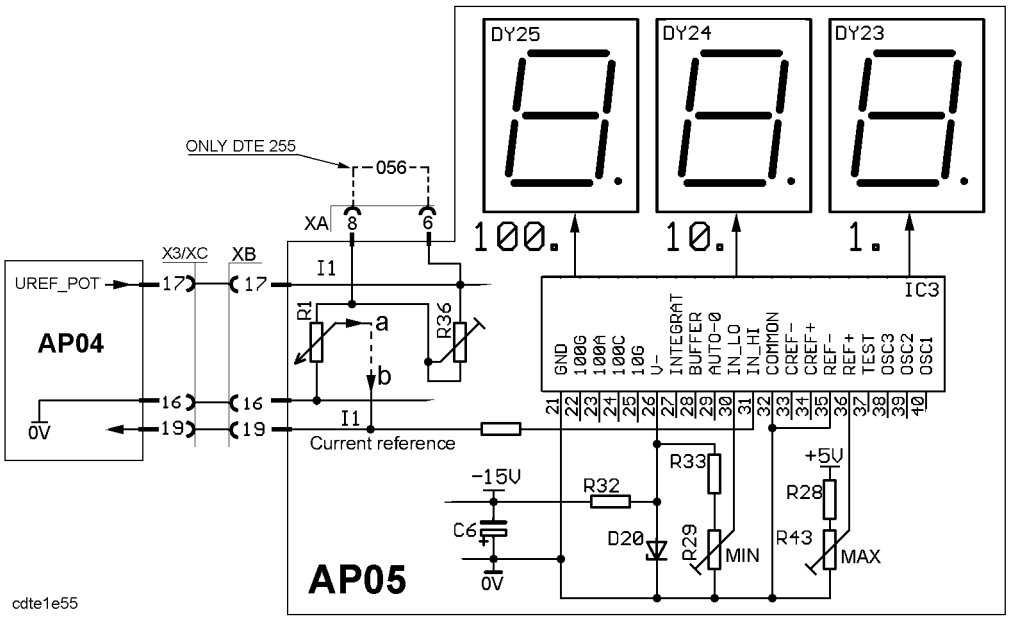
Trim potentiometers on version 1 and 2 of circuit board AP05



Analogue settings, version 2 of circuit board AP05.

AP05:4a Digital display

Valid for version 1 and 2 of circuit board AP05



Drive circuit for the digital display, version 1 and 2 of AP05

When a remote control is used version 1 displays always the welding current which is set by potentiometer R1 on the front panel.
Version 2 displays the value set by the remote control.

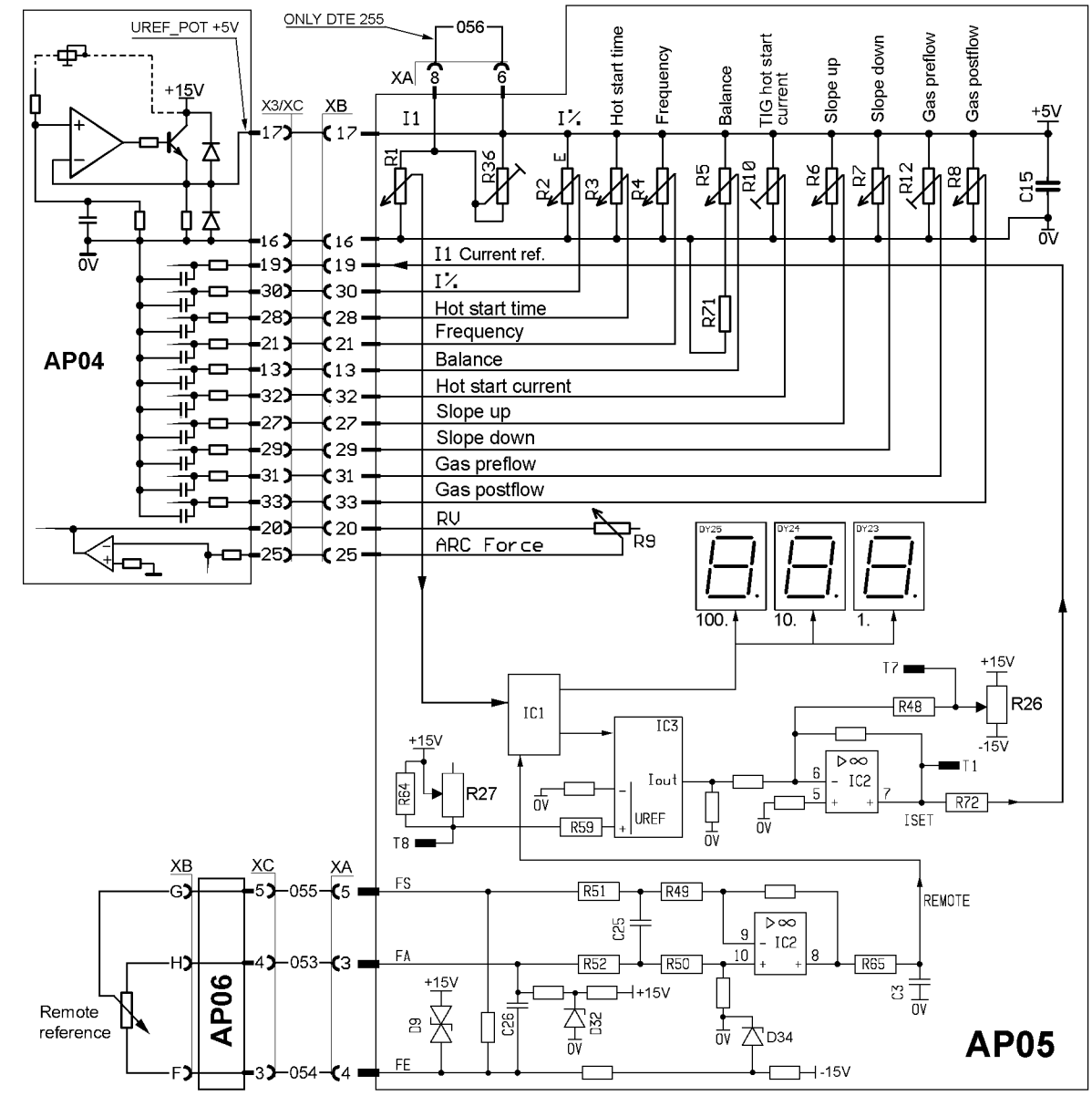
On circuit board version 1, a is connected to b as in the diagram above. The connection between a and b for version 2 is shown on page 35.

The minimum reading can be adjusted by potentiometer R29, while the maximum reading can be adjusted by potentiometer R43.

The function of potentiometer R1 is described on page 72 and R36 is described on page 34.

AP05:4b Analogue settings and digital display

Valid for version 3 of circuit board AP05



Analogue settings and digital display, version 3 of circuit board AP05

All analogue signals from AP05 to the processor board AP04 are related to a regulated 5V supply from AP04 (UREF_POT +5V). This voltage has an accuracy of ±1%. All boards, including spare parts, are adjusted at the factory.

The potentiometers on the front panel are described in the instructions on page 72, which also shows their locations.

TRIM POTENTIOMETERS

R10 TIG hotstart current, adjustable between 50 and 200A.
On delivery, the hot start current has been set to 100A.

The hotstart for MMA is set by the processor board, see page 30.

R12 Gas preflow time, adjustable between 0 and 5 seconds.
On delivery, the preflow time has been set to 10ms.

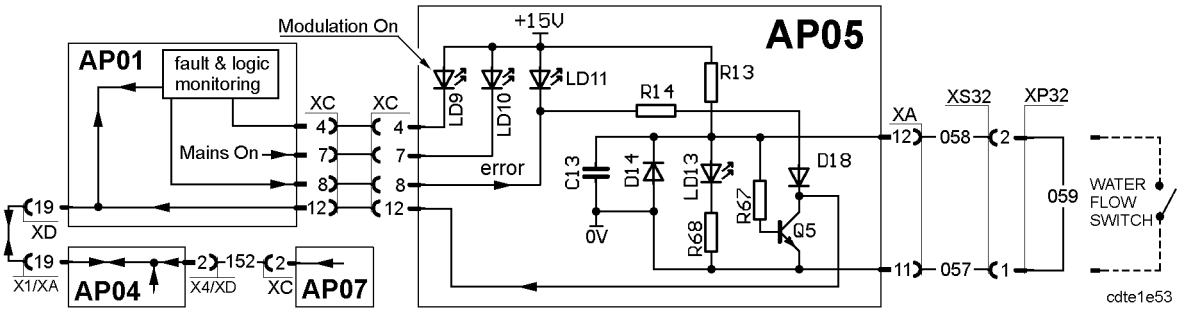
R26 Adjustment for the minimum current reference.

R27 Adjustment for the maximum current reference (250A for the DTE 255 and 200A for the DTE 200).

R36 Is used in the DTE 200 to provide correct reading of the 200A range. XA6 and 8 are bridged in the DTE 255.

AP05:5 Error monitoring

Valid for all versions of circuit board AP05



Signal path for the error monitoring

All error messages are monitored by processor board AP04, which stops the machine if neccessary.

The voltage at connector XC:12 is about 0V when an error is present. During normal operation, the voltage is 14–15V.

Diode **LD9** is on when the PWM circuit on AP01 is generating pulses, e.g. when the machine is producing an output voltage.

Diode **LD10** is on when the mains switch is on: see AP01:1 on page 16.

Diode **LD11** is on when the machine is stopped by an error:

- Overheating in the DC part of the machine. One or both of temperature sensors ST01 and ST03 is/are activated. See description on page 17.
- Overheating in the AC part of the machine. Temperature sensor ST02 is activated. See description on page 47.
- Overtemperature at AP07 discharge circuit: see description on page 48.
- Overvoltage at AP07 discharge circuit: see description on page 48.
- Lack of water flow: see LD13 below.

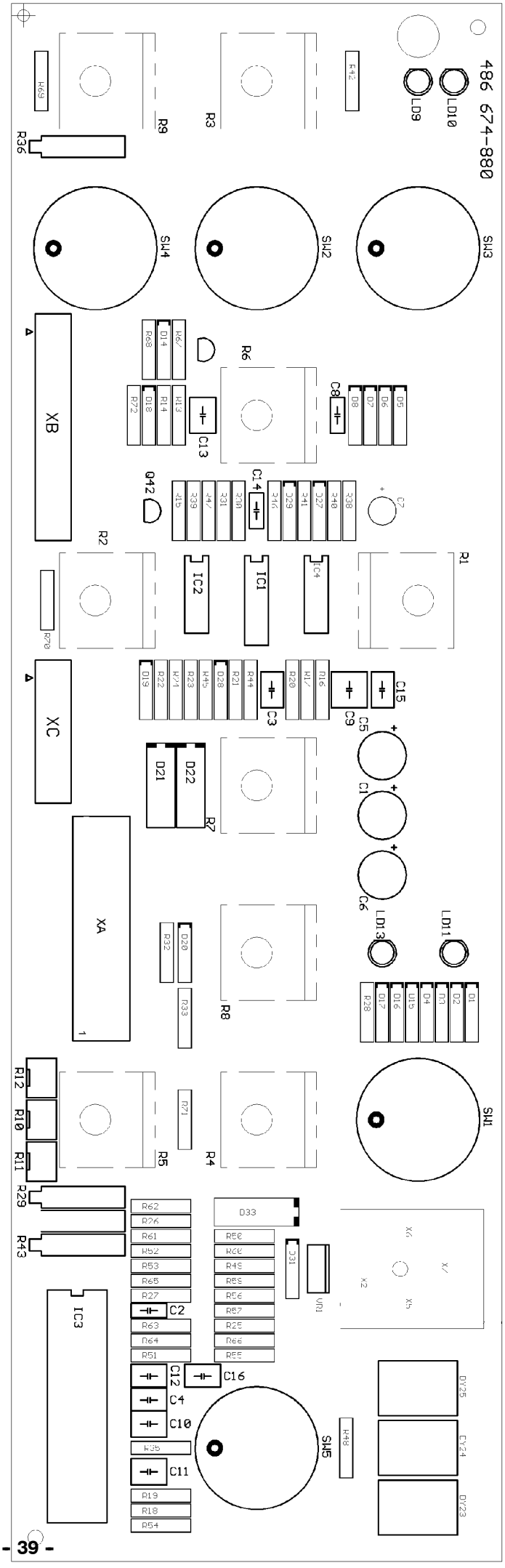
Diode **LD13** is on when the connection between XA:11 and 12 is open. When LD13 is on, LD11 is also on.

The LEDs LD9, LD10, LD11 and LD13 are visible on the front panel.

AP05 Version 1, Component positions

Version 1 of circuit board AP05 is used in the DTE 255 before serial no. 844-950-xxxx. This version has not been used in the DTE 200.

NOTE: when this version of AP05 is replaced by version 3 of AP05, the machine must be equipped with the latest version of circuit board AP04, part no. 0486 770 880



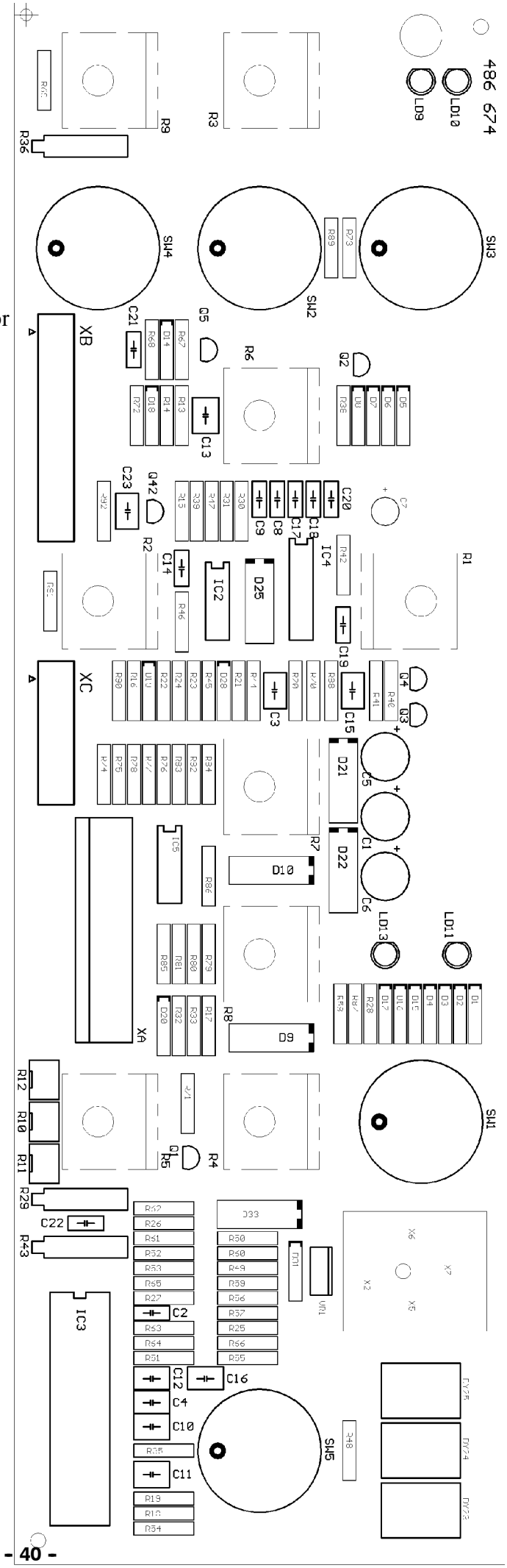
AP05 Version 2, Component positions

Version 2 of circuit board AP05 is used in all DTE 200 and in DTE 255 from serial no. 844-950-xxxx up to and including ser. no. 948-xxx-xxxx.

The following improvements have been made to version 2 of the front panel circuit board:

- In MMA mode the modulation is switched off for a short moment when the welding polarity is changed by the polarity selection switch (SW1).
- When the machine is in the MMA mode and not used for 25 minutes, the open circuit voltage is switched off. Restart it by turning the methode selection switch to TIG and then back to MMA.
- Full balance range at DC pulsing, 20 - 80%. AC balance is limited to 40 - 80%.
- When a remote control is connected, the remote set value is displayed.

NOTE: when this version of AP05 is replaced by version 3 of AP05, the machine must be equipped with the latest version of circuit board AP04, part no. 0486 770 880



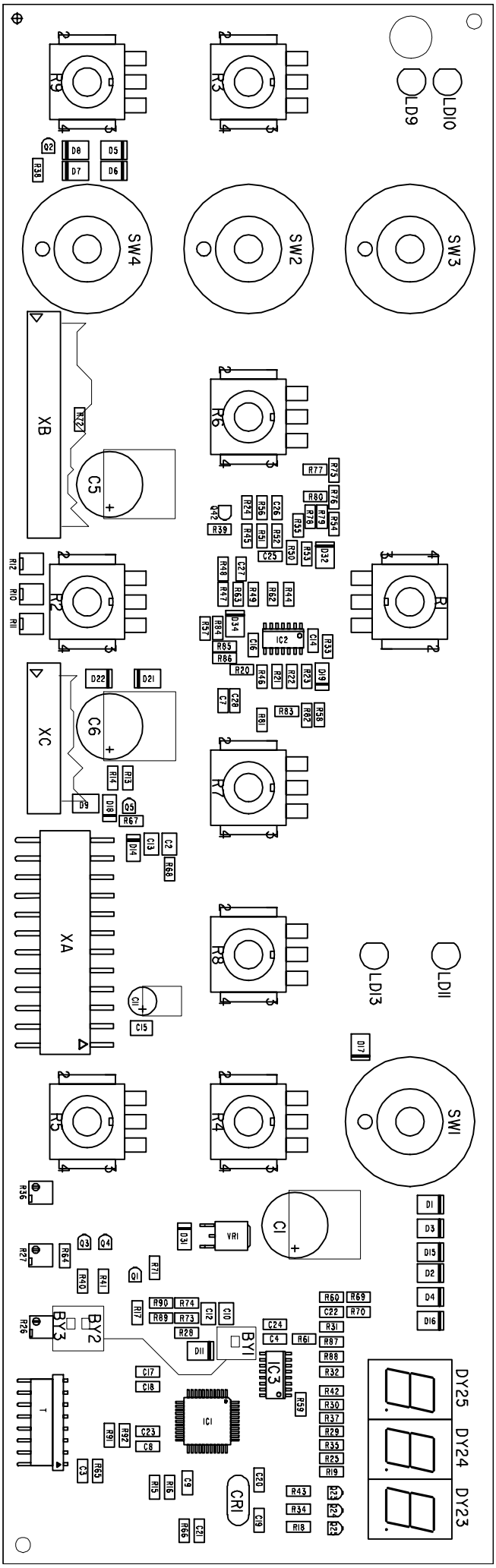
AP05 Version 3, Component positions

Version 3 of circuit board AP05 is used from serial no. 246-xxx-xxxx

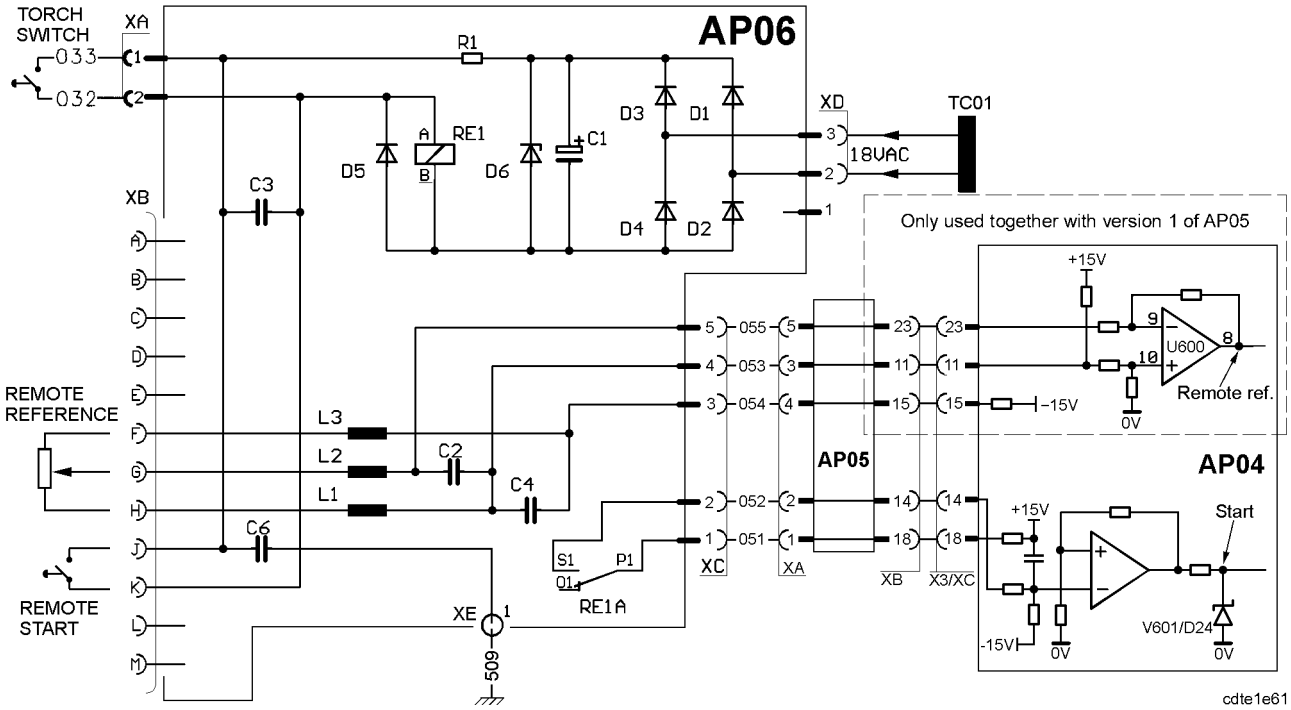
The following changes have been made to version 3 of the circuit board:

- SMD components are used for most of the functions.
- New controller device (IC1) with display driver.
- End current after slope down is set to 5 A by the software (R11 is removed).
- Potentiometers for calibration of max and min current added. See page 37.

NOTE: when this version of AP05 is used as spare part, the machine must be equipped with the newest version of circuit board AP04, part no. 0486 770 880



AP06 Start and remote control circuit board



Circuit diagram for circuit board AP06

START SIGNAL

Relay RE1 galvanically isolates the start switch from the machine. When the relay is activated, the voltage at the cathode of V601/D24 is low (0 to -0.5V). When it is deactivated the voltage is between 4 and 5V.

REMOTE REFERENCE

A potentiometer connected as in the diagram above can be used to set the remote reference. It is also possible to use an external voltage to set the reference. When using an external voltage, connect XB:G to 0V and XB:H to a voltage source.
For version 1 of AP05 the voltage source must be variable between 0 and +10V.
For version 2 of AP05 the voltage source must be variable between 0 and +5V.

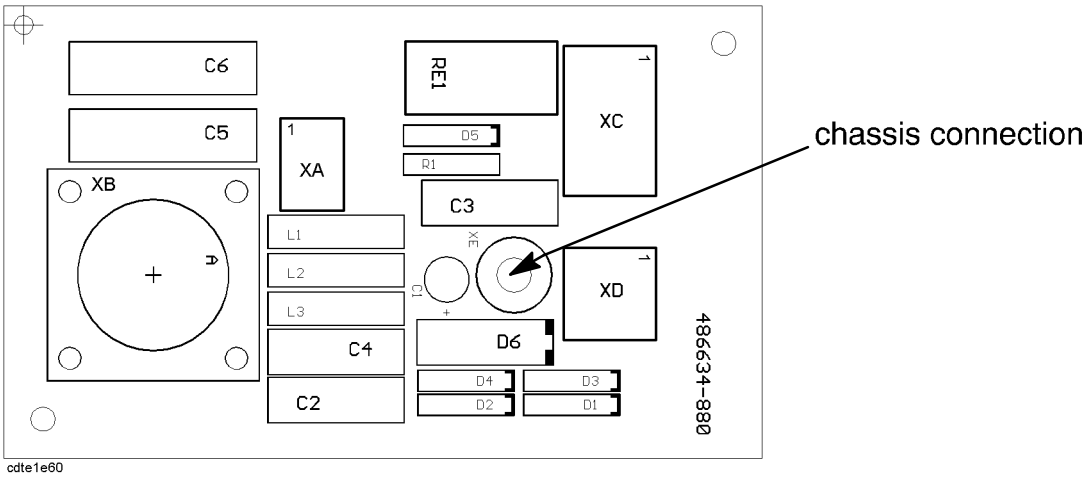
When version 1 of circuit board AP05 is used the reference signal can be measured at U600:8. When no remote control is connected the voltage is more than +5V. When the remote control is in the min. position the voltage is 0V and when in the max. position it is +5V or less.

With version 2 of circuit board AP05, the remote reference is connected as in the diagram on page 35.

Note:
The internal current setting limits the current set by the remote control. See page 71 for instructions.

DTE 255 before serial number 844-950-xxxx, with version 1 of circuit board AP05:
When using a remote control, the display will show the possible maximum current and not the current set by the remote control.

DTE 255 from serial number 844-950-xxxx and all DTE 200:
When using a remote control, the display will show the current set by the remote control.



Component positions for circuit board AP06

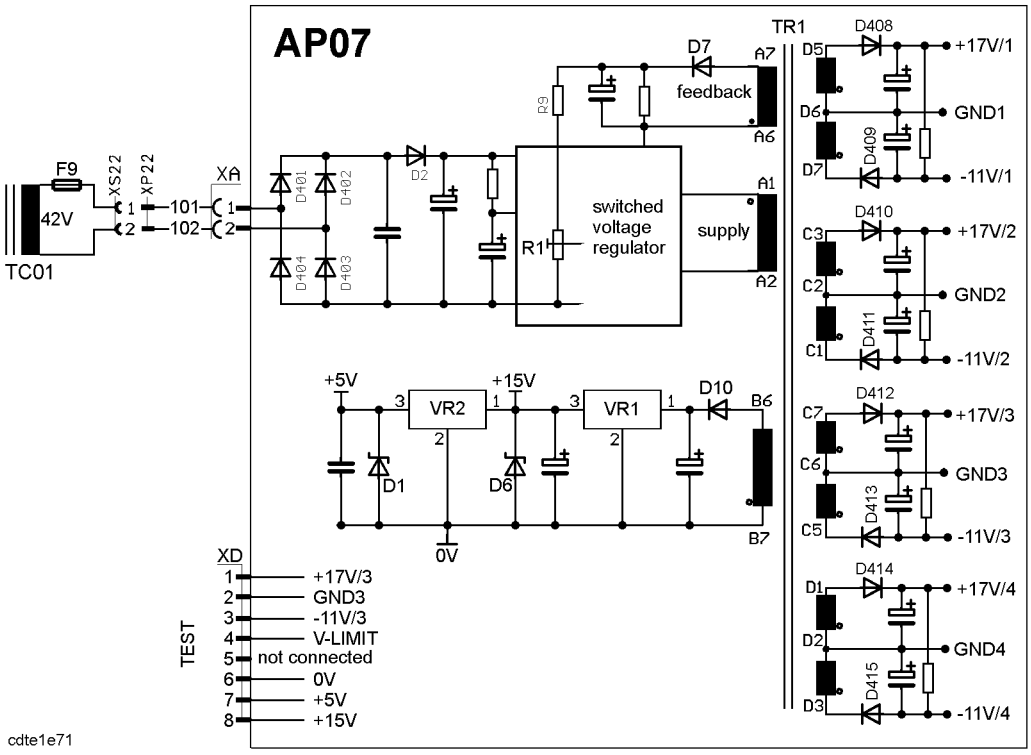
It is important that the connection shown above is properly connected to the front plate of the machine and to the chassis connection cable marked 509. If the connection is poor, the machine will be sensitive to external noise.
The connection point is marked with XE in the diagram on the previous page.

AP07 AC control circuit board

All functions on this circuit board are galvanically isolated from the rest of the machine, except GND3, which is connected to negative. See the the diagram on page 45.

From serial no. 246-xxx-xxxx a new version of the board is fitted to the machines. This description applies to all versions of the board. All versions can be used in all machines.

AP07:1 Power supply



Power supply for AP07

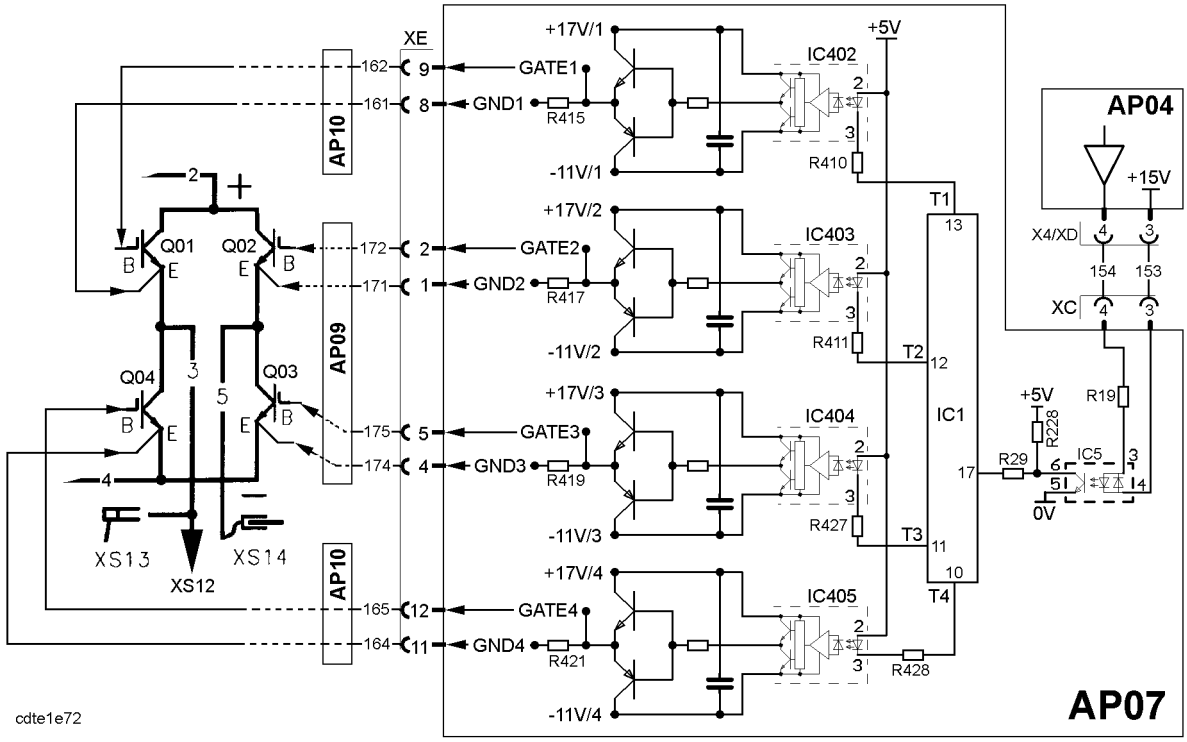
A switched power supply, operating at 40kHz, is used in order to provide galvanic separation of the IGBT drive voltages.

To check the adjustment of the power supply measure between pins 1 and 3 at the test connector XD. The voltage must be 28V ±1V. If it is out of tolerance adjust with potentiometer R1.

The voltages +17V/1-4, -11V/1-4 and GND1-4 are connected to the IGBT drives, see page 45.

+5V and +15V is used for internal power supply on the board. The tolerances are ±4%.

AP07:2 Gate pulses from AP07



Gate control circuits for the AC IGBT's in the DTE 255

The IGBTs are contolled by AP04. When connection XC:4 is low (=0V) the polarity of the electrode is negative. **NOTE:** when measuring at XC:3, measure relative to XC:1, which is 0V from AP04.

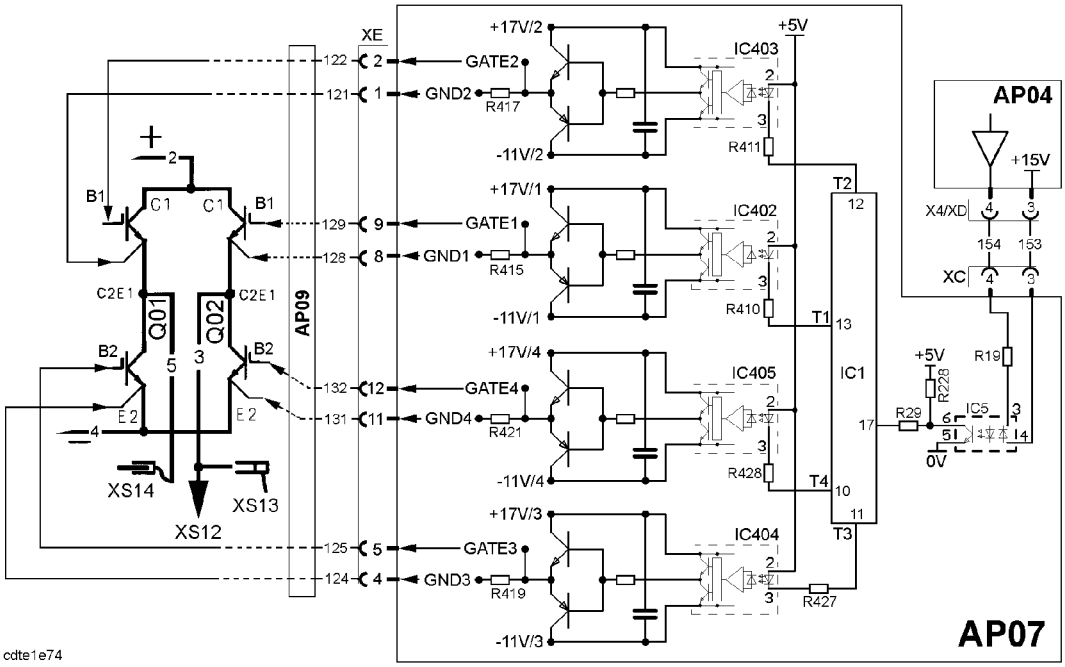
The IGBTs can have four different states:

1. All off (= open).
   Error state. IC1, which also monitors the fault control on circuit board AP07, has deactivated the IGBTs. IC1 outputs T1 - T4 are high (+5V).
2. All on (= closed).
   Is used during polarity change. The time for polarity change is controlled by IC1, which holds its outputs T1 - T4 at 0.5V for about 200µs.
3. **DTE 255:** Q01 and Q03 are on, Q02 and Q04 are off.
   DTE 200: Q01:1 and Q02:2 are on, Q02:1 and Q01:2 are off.
   The electrode is positive.
4. **DTE 255:** Q02 and Q04 are on, Q01 and Q03 are off.
   DTE 200: Q02:1 and Q01:2 are on, Q01:1 and Q02:2 are off.
   The electrode is negative.

   When an IGBT is on, the voltage at the gate is +17V: when it is off the voltage is -11V.

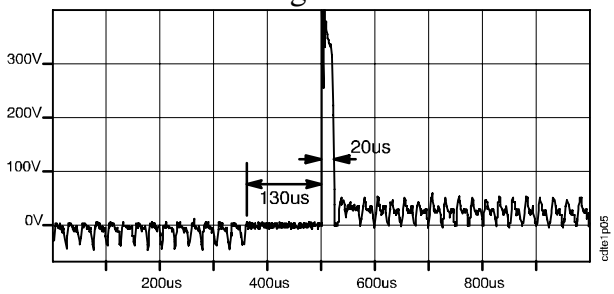
DTE 255 has two snubber boards, AP09 and AP10, which are described on pages 53 and 54. DTE 200 has one snubber board, AP09, described on page 56. The snubber boards carry fuses to protect the gate pulse driver circuits against a short circuit in the IGBTs.

The test instructions for the IGBTs are given on pages 62 and 63. To check the gate pulses see: SOFT STARTING, items 9 and 10 on pages 58-59.



Gate control circuits for the AC IGBTs in the DTE 200

The picture below shows the voltage peak that makes the polarity change so fast that no additional HF ignition is needed when the polarity is changed.



Voltage between the welding terminals XS14 and XS13 at 200A AC welding

Compare the actual waveform with the above waveform only during AC welding with a standard torch. The waveform above is not valid for a resistive load.

Looking at the picture above from left to the right: First the welding voltage is negative. Then all IGBTs are conducting for 130µs: the voltage is zero. Then two IGBTs are turned on, producing a positve voltage peak of about 400V for 20µs, after which welding continues at normal welding voltage.

To ensure the correct voltage peak, the welding current must not be too high or too low during the polarity change. This is controlled by the processor board AP04.

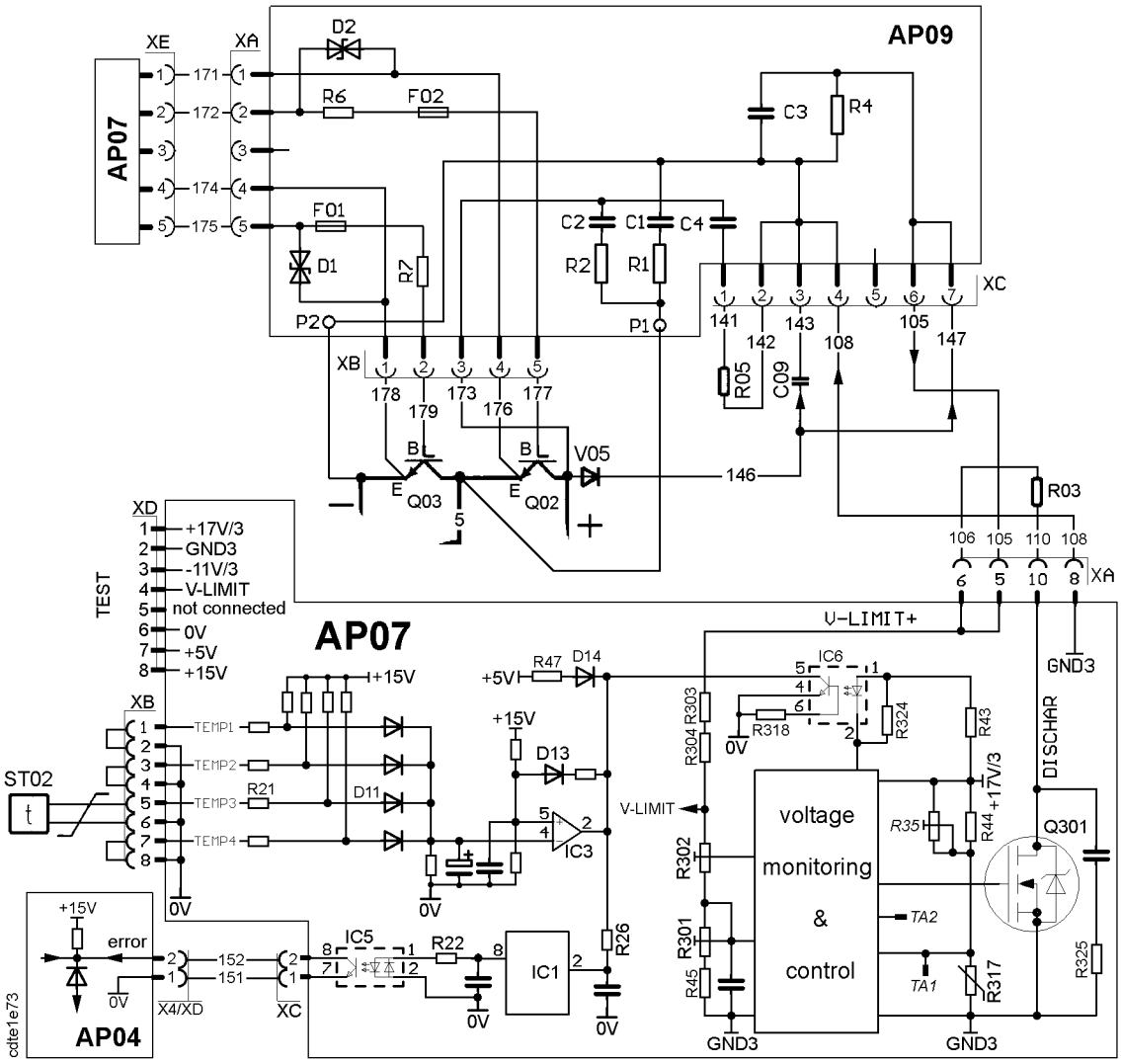
If the current is lower than 50A, it will be increased to 50A shortly before all the IGBTs are turned off. After the polarity is changed, the current is the same as it was originally.

If the current is higher than 100A, it will be decreased to 100A shortly before all the IGBTs are turned off. After the polarity is changed, the current is the same as it was originally.

If the current is between 50 and 100A, there is no change in its value before the polarity is changed.

AP07:3 Temperature and voltage monitoring

This description applies to both the DTE 200 and the DTE 255. The IGBTs and circuit board AP09 in the diagram below apply only to the DTE 255. The corresponding diagram for the DTE 200 is on page 56.



Schematic diagram for the temperature and voltage monitoring of the DTE 255
R35, TA1 and TA2 are only fitted to version 2 of the board.

FAULT MONITORING

If the temperature monitoring or the voltage control detect an error, IC1 will send an error signal to the processor board. This stops the machine and shuts off all IGBTs in the AC unit. See page 33 for the signal path of the error monitoring.

TEMPERATURE MONITORING

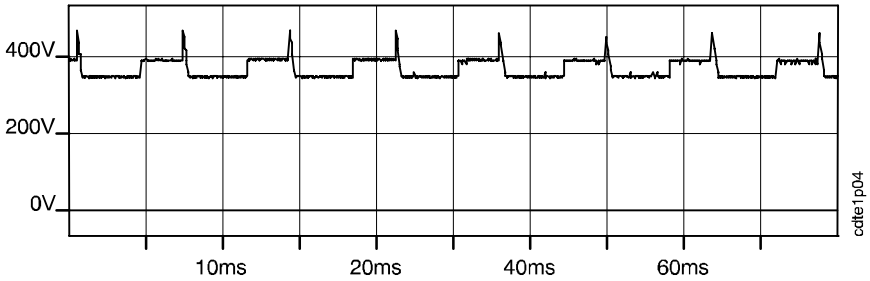
The temperature monitor has a four-channel external input. Unused channels must be short-circuited to disable them. The voltage divider at IC3:5 is set to 10.8V. If the input voltage at IC3:4 exceeds 10.8V, the output of IC3 is switched to 0V. PTC resistor ST02, activates the output of IC3 when the temperature exceeds about 75-80 °C. This results in an error signal to AP04.

ST02 is mounted on the cooling fins. When the temperature is below 30°C, the resistance of ST02 is between 50 and 150Ω, (about 60Ω at 20°C).

VOLTAGE CONTROL

To protect the IGBTs of the AC unit, the voltage across them must not exceed 600V. Filter Capacitor C09 is charged from the positive and negative rails via diode V05. Measure the voltage between XA:5 (+) and XA:8 (-), V-LIMIT+.

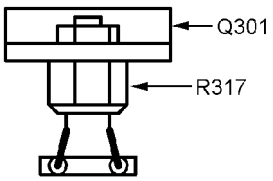
The voltage over C09 is controlled by the monitoring circuit, which uses transistor Q301 and resistor R03 for discharging. Adjust discharge with trim potentiometer R302 so that the mean voltage level does not exceed 400V.



Voltage at discharge capacitor C09 at 200A (AC welding)

Version 1 of AP07

To protect Q301 and R03 from overload, a PTC resistor (R317), of the same type as ST02 on previous page, is fitted on the transistor. When the voltage across R317 rises due to high temperature, IC6 is activated and the input to the error monitor IC1 goes low (0V). The threshold level for the voltage across R317 is 5.1V.



R317 fitted on Q301

Version 2 of AP07

To protect Q301 and R03 from overload, a temperature detector (R317) is fitted on the transistor. When the voltage across R317, testpoint TA1, rises due to high temperature, IC6 is activated and the input to the error monitor IC1 goes low (0V). The threshold level for the voltage across R317 is 5.6V, it can be measured at testpoint TA2. Trimpotentiometer R35 is adjusted at the factory to set the voltage at TA1 to 4.77V ±0.5V when the machine is cold.

As a last protection, in case the voltage control does not work, the maximum allowed voltage is adjusted to about 580V with R301. If the voltage is too high, IC6 supplies an error signal to IC1, which stops the machine.

Note: The voltage supply to the voltage control comes from the IGBT drive supply +17V/3 and GND3. GND3, is connected to the machine negative rail. 0V for the supply voltages (+5V and +15V) on this board is not connected either to GND3 or to the machine electronic zero (0V), which is connected to the positive rail.

ADJUSTMENT PROCEDURE

All machines and circuit boards are adjusted when delivered from the factory. The threshold levels may be checked and readjusted as follows:

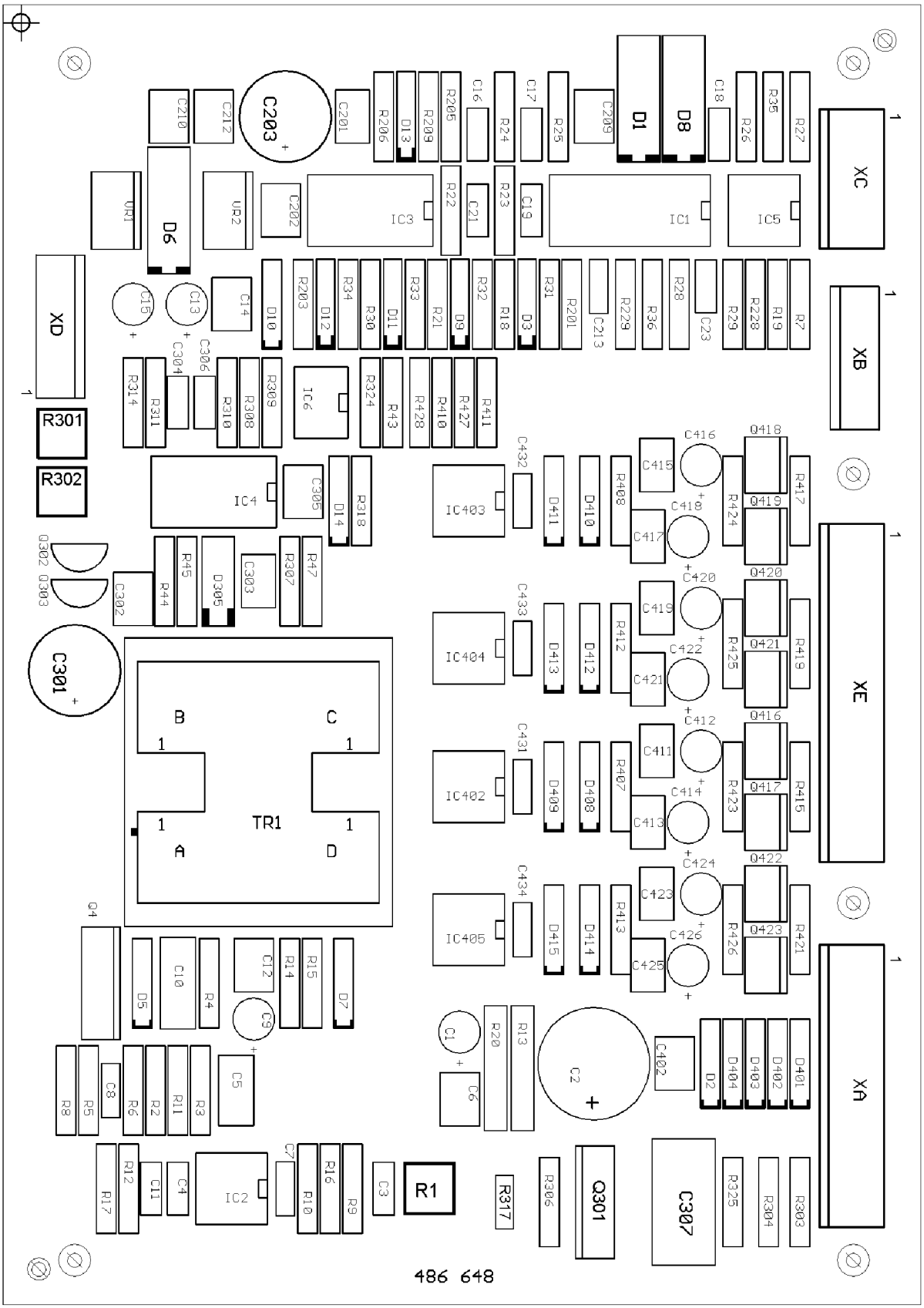
WARNING: Take great care: if you do something wrong here, you may destroy the IGBTs.

1. Disconnect the supply to the HF unit AP13, by disconnecting wires 021 and 041 from terminal XT11. See the wiring diagram.

Terminal XT11 is mounted on the side of the ferrite core of the main transformer TM01.

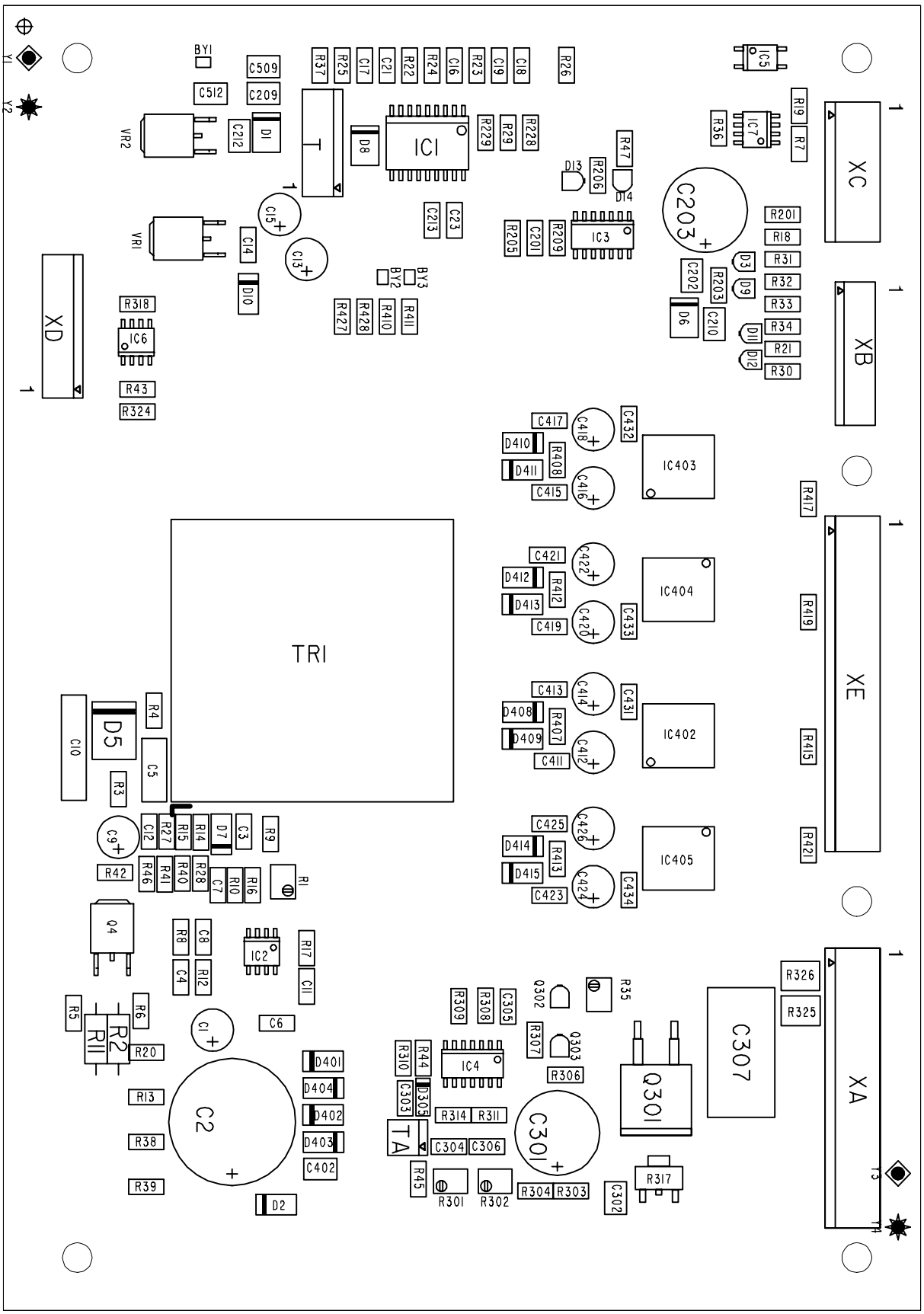
2. Connect an oscilloscope or a multimeter across capacitor C09.
3. Disconnect wire 110 from the discharge resistor R03.
4. Load the machine with a resistive load and start it in AC mode. Set the current to 50A. Slowly increase the current until the voltage is 570 - 580V. The machine should then stop and the yellow Error LED on the front panel should light. If the machine does not stop, adjust with R301 until it does.
5. Switch off the machine, connect wire 110 to R03.
6. Load the machine with a resistive load and start it in AC mode. Set the current to 50A. Slowly increase the current until the voltage is about 400V. If you continue to increase the current, the voltage must not exceed an average of 400V, if it does, adjust with R302.
7. After the adjustment, secure the potentiometers with varnish and reconnect the HF unit.

AP07 Component positions



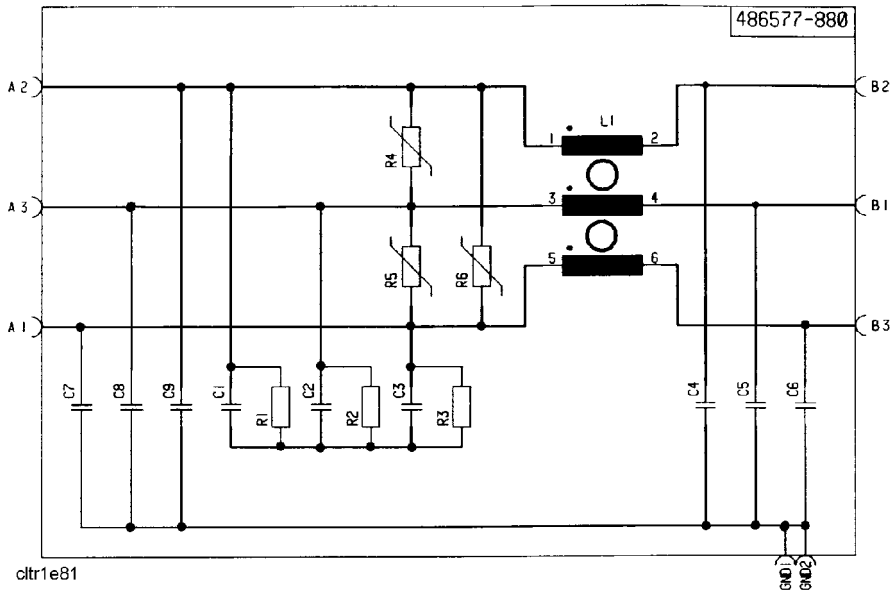
cdte1e70

Component positions for version 1 of circuit board AP07

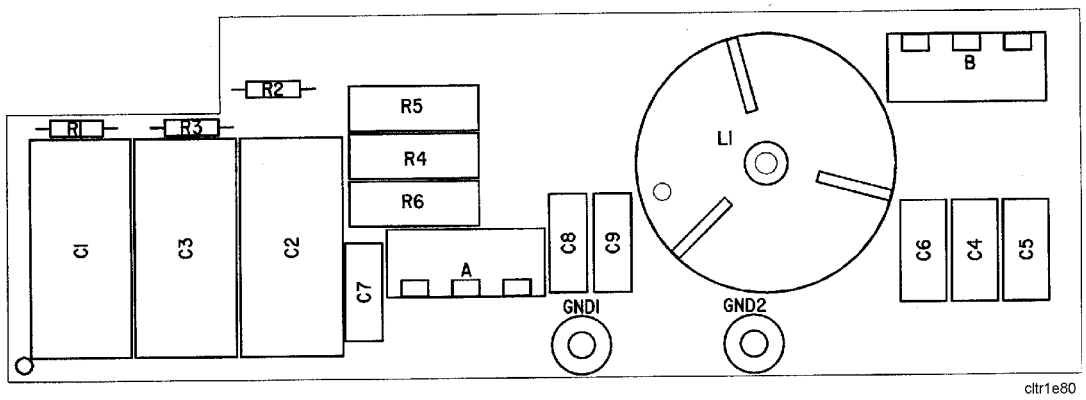


Component positions for version 2 of circuit board AP07

AP08 Interference suppression board



Circuit diagram for circuit board AP08 (EMC board)



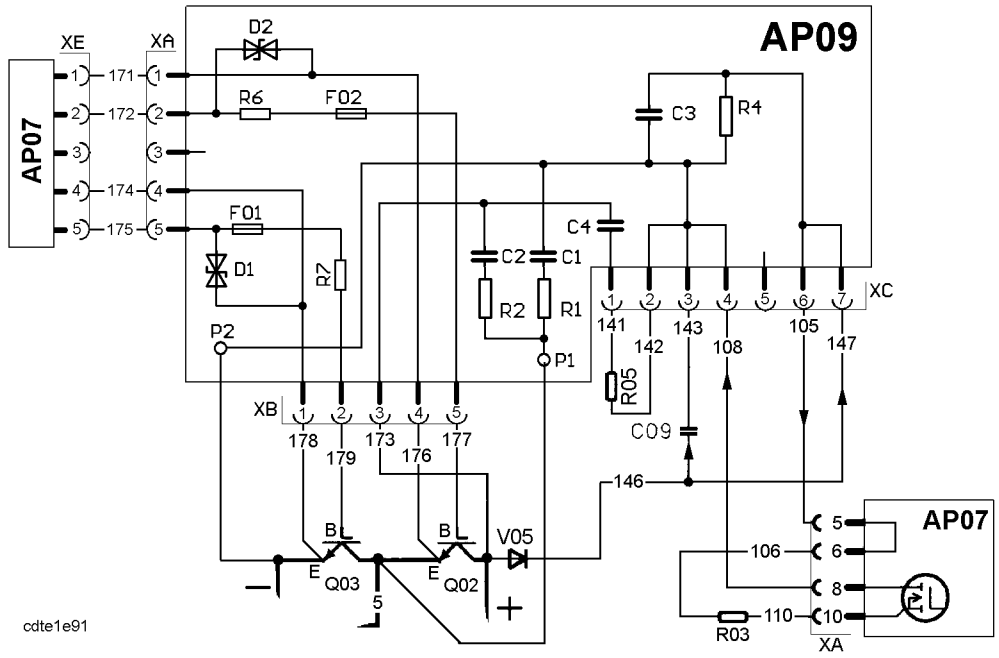
Component positions for circuit board AP08

It is important that connection points GND1 and GND2 are properly connected to the chassis of the machine.

AP09 DTE 255 AC snubber 'A' circuit board

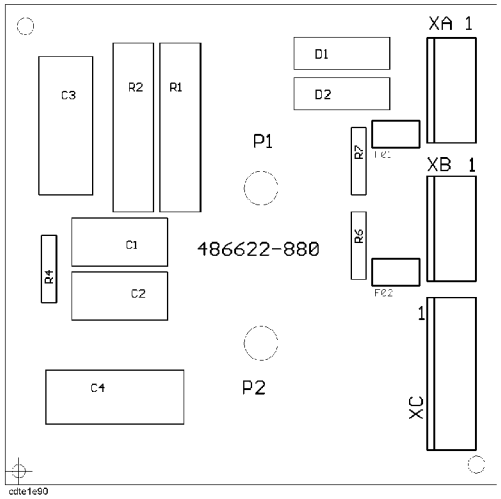
This circuit board is used only in the the DTE 255. The snubber board for the DTE 200 is described on page 56.

Circuit board AP09 protects the IGBTs Q02 and Q03 from voltage peaks generated by the switching of the IGBTs. High-speed fuses F01 and F02 protect the IGBT drive circuits on circiut board AP07 in the event of IGBT failure.



Circuit diagram for circuit board AP09, DTE 255

To protect the IGBTs in the AC unit, the voltage must not exceed 600V. Capacitor C09 is charged up from the positive and negative rails via diode V05. This voltage is connected to XA:5 and 6 on AP07.
AP07 monitors the voltage between connections XA:5 (+) and XA:8 (-). If it exceeds 400V, the capacitor is discharged via a transistor on AP07.
If capacitor C04 is not properly discharged, the machine will be switched off if the voltage exceeds 570V. There is a more detailed description of this function on pages 47 and 48.



Do not mix up connectors XA and XB.

<--- 4 wires are connected to connector XA

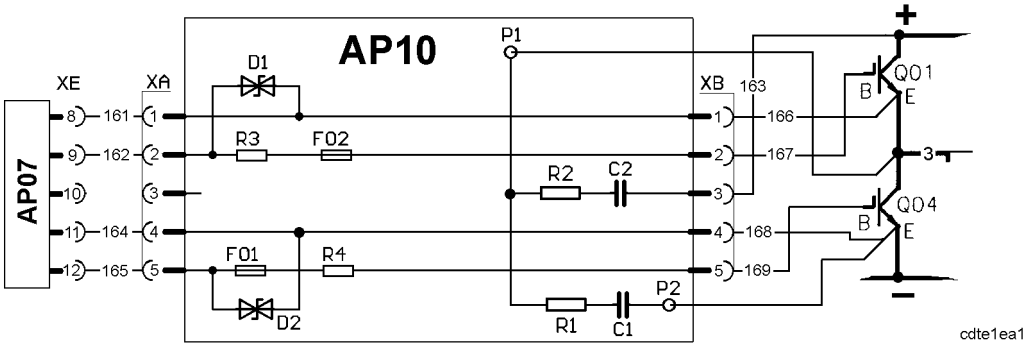
<--- 5 wires are connected to connector XB

Component positions for circuit board AP09, DTE 255

AP10 DTE 255 AC snubber ’B’ circuit board

This circuit board is used only in the DTE 255. The snubber board for the DTE 200 is described on page 56.

Circuit board AP09 protects the IGBTs Q01 and Q04 from voltage peaks generated by the switching of the IGBTs. High-speed fuses F01 and F02 protect the IGBT drive circuits on circiut board AP07 in the event of IGBT failure.

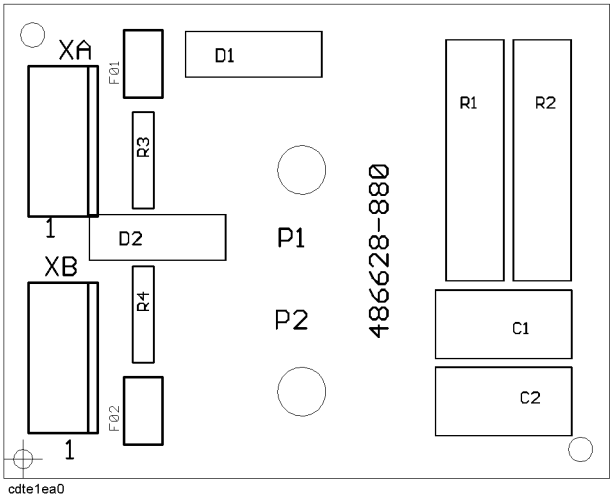


Circuit diagram for circuit board AP10

Do not mix up connectors XA and XB.

4 wires are connected to connector XA -->

5 wires are connected to connector XB -->

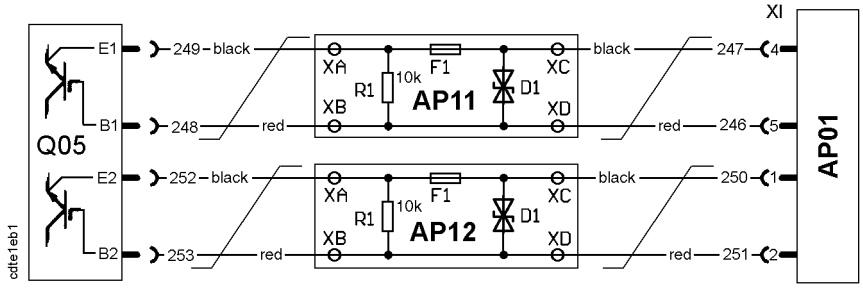


Component positions for circuit board AP10

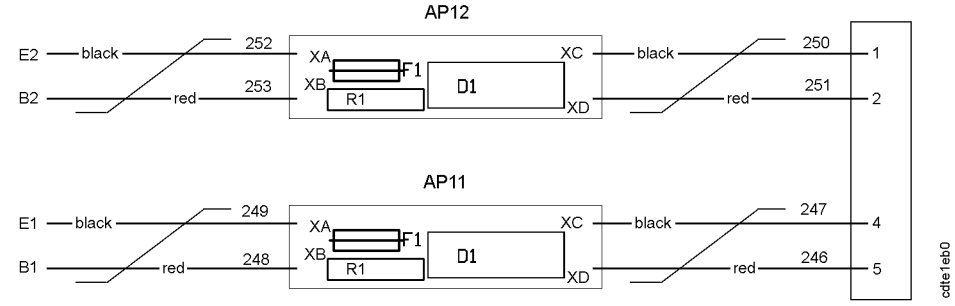
AP11, AP12 DC protection boards

The high-speed fuses on the boards protects the IGBT drive circuits on circuit board AP01 in the event of IGBT failure.

To detect whether a fuse is healthy or blown, measure the resistance at connector XI. With a healthy fuse, this resistance will be 10kΩ (resistor R1). If the fuse has blown, IGBT module Q5 has probably also burnt out. Test instructions for the IGBT module are on page 61.



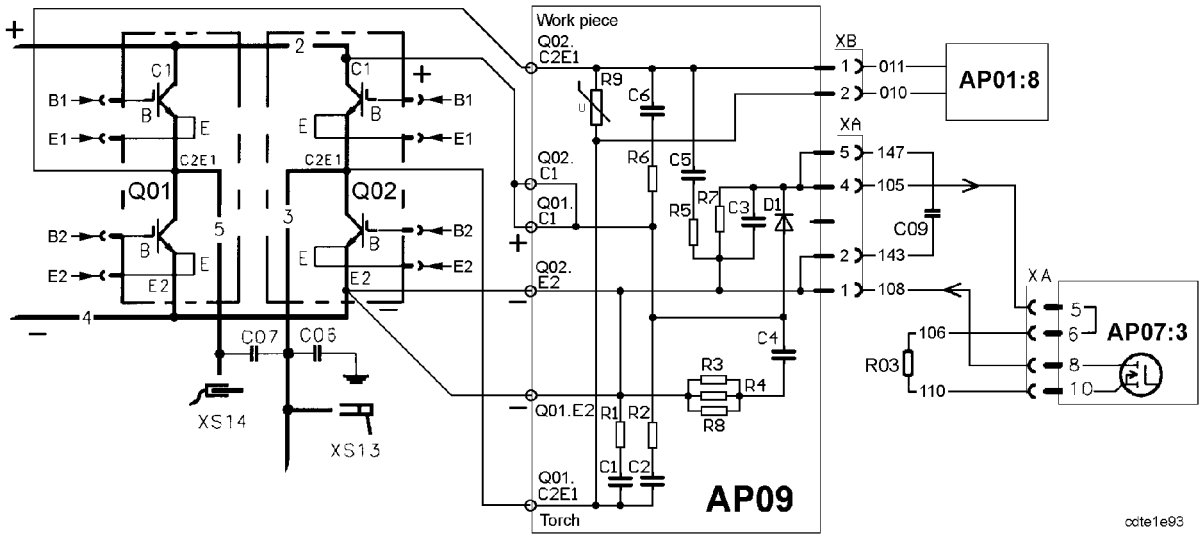
Circuit diagram for circuit boards AP11 and AP12



Component positions for circuit boards AP11 and AP12

AP09 DTE 200 AC snubber circuit board

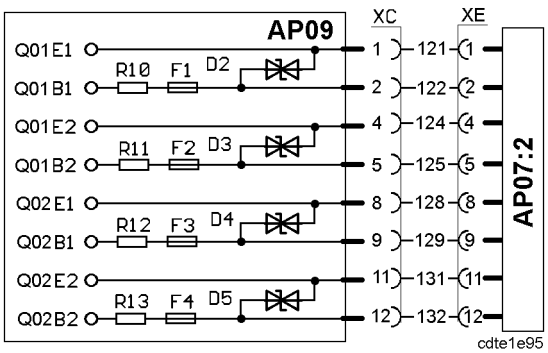
This circuit board is used only in the DTE 200. The snubber boards for the DTE 255 are described on page 53 and 54.



Circuit diagram for snubber and discharge circuits of circuit board AP09, DTE 200

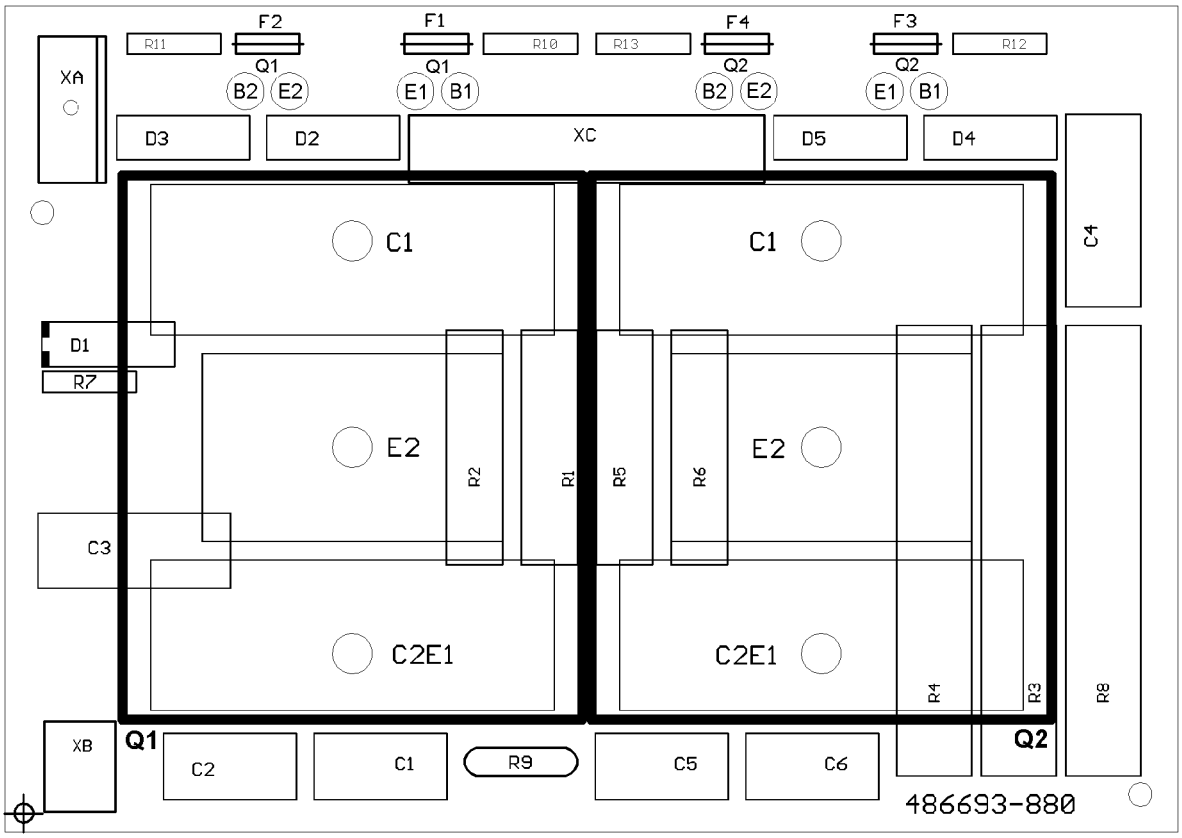
Circuit board AP09 protects IGBT modules Q01 and Q02 from voltage peaks generated by the switching of the IGBTs. High-speed fuses F1 - F4 protects the IGBT drive circuits on circiut board AP07 in the event of IGBT failure. The test instructions for the IGBTs are on page 63.

To protect the IGBTs of the AC unit, the voltage must not exceed 600V. Capacitor C09 is charged up from the positive and negative rails via diode D1. This voltage is connected to XA:5 and 6 on AP07.
AP07 monitors the voltage between connections XA:5 (+) and XA:8 (-). If it exceeds 400V, the capacitor is discharged via a transistor on AP07.
If C04 is not properly discharged, the machine will be switched off if the voltage exceeds 570V. There is a more detailed description of this function on pages 47 and 48.



Gate driver protection circuits on circuit board AP09, DTE 200

The following connections in connectors XC and XE are not used: 3, 6, 7 and 10.



Component positions for circuit board AP09, DTE 200

SERVICE INSTRUCTIONS

Soft starting

Note: NEVER use a mains fuse with higher rating than 16A.

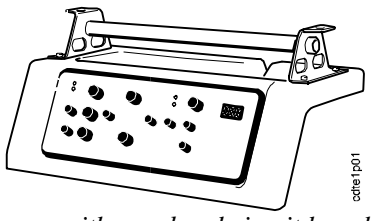
We recommend that you perform the soft start when any components have been replaced. The soft start procedure is also useful to use when fault tracing.

A special test circuit board (order no. 0486 640 880) is required for soft starting.
It is described on page 64.

1. **DTE 255:** Remove wires 090 and 007 from rectifier unit AP03. Diagram on page 12.

   DTE 200: Remove wires 090 and 007 from rectifier V02. Before disconnecting, mark the heat sink with a + where wire 007 is connected to V02. See the diagram on page 14.

2. Remove the top cover with the front panel and circuit board AP05. (Unscrew four screws at the handle and two screws below the front panel).
   Disconnect all cables from AP05.
   NOTE: The cable lug on the yellow/green ground cable has a lock function.



Top cover with panel and circuit board

3. Remove the screening box which is fitted over the circuit boards.
   Remove connector XD (the ribbon cable to AP04) from circuit board AP01. See the component positions on page NO TAG.

4. Remove connector X4 from circuit board AP04 and connect it to XC on the test circuit board. See the component positions for AP04 on page 31.

5. Connect the two ribbon cables from the test circuit board to AP01.
   Test XA to AP01 XD, test XB to AP01 XC.

6. Connect a regulated external 30V DC power supply to wire 090 and 007, with the positive connected to 007.
   The power supply must have a current limit set to a maximum of 1A.

7. Set the selector switch on the test board to position 1: OFF. Set the potentiometer on the test board to about 20% from minimum position. (Min. pos. = max. anti clockwise)

   Connect a multimeter to the welding outlets. Connect the positive terminal to XS13 (MMA) and the negative to XS14 (workpiece). Select DC voltage on the multimeter. Leave the meter connected throughout the whole softstarting procedure.

8. Switch on the machine. LEDs MAINS, TEMP and DC FAIL will briefly light up, and then all except MAINS will go out.

   Switch on the external DC power supply.

9. Set the selector switch to position 2: TEST ON.

   The meter must show 17 to 20V. This voltage comes from connections AP01:XB5 and 6. It is a test voltage used to detect when the electrode is in contact with the workpiece when Lift Arc is selected. See description on page 18.

The control voltages to the AC IGBTs can be checked in this and next test position: see page 60. The polarity command comes from AP04: see page 45.

This tests AP07, AP09, AP10, Q1-Q4 and parts of AP01.

10. Set the selector switch to position 3: CHANGED POL.

    The voltage must be -17 to -20V.

    This tests AP07, Q01-Q04 and cabling for the reversed polarity.

11. Set the selector switch to position 4: MOD ON.

    The primary IGBT Q5 is activated. The voltage must be 3 to 5V.

    This tests AP01, AP02, AP11, AP12, Q05 and cabling.

12. Set the selector switch to position 5: MOD AND AUX.

    The meter now displays a voltage which is about 25% higher than in the previous test. The additional voltage is a rectified voltage from a separate secondary winding on the main transformer TM01. See description on page 18.

    This tests TM01, AP01 and cabling.

13. Set the selector switch to position 6: MOD CHA. POL.

    The meter displays the same voltage as in item 11 above, but with reversed polarity. Differences up to ±0.3V may occur.

14. If all the test values are correct, disconnect the machine from the mains and disconnect the external DC supply. Reconnect wires 090 and 007. **Note:** 090 must be connected to the negative of the rectifier and 007 to the positive.
    Do not disconnect the test board. Set up the test board and the multimeter as described in item 7 above. To improve the accuracy of the measurements, connect a 5.6kΩ 5W resistor in parllel with the multimeter. Those measurements are shown in the right-hand column of the table below.
    Note: The voltages measured at e, f and g below depend on the mains voltage.

    a. Switch on the mains. LEDs MAINS, TEMP and DC FAIL will briefly light up, and then all except MAINS will go out.

	Switch position	Voltmeter reading	Voltmeter reading with 5.6kΩ in //
b.	1: OFF	0V	0V
c.	2: TEST ON	+17 to +20V	+17 to +20V
d.	3: CHANGED POL	-17 to -20V	-17 to -20V
e.	4: MOD ON	+70 to +90V	+60 to +75V
f.	5: MOD AND AUX	+100 to +120V	+95 to +120V
g.	6: MOD CHA. POL	-70 to -90V	-60 to -75V

If all test values are correct, reset the machine for normal operation and make a test weld.

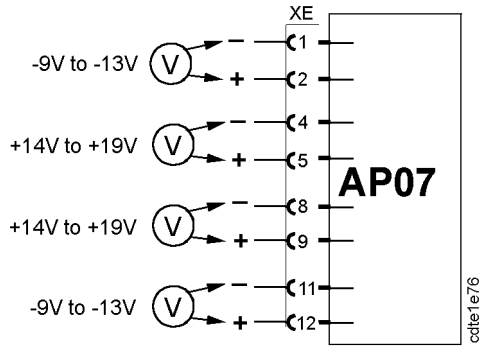
If some tests fail and it is unclear whether the fault is in the AC or DC part of the machine, convert the machine to a DC machine, as described on page 66.
Then perform the softstarting procedure above, except that items 10, 13, 14.d and 14.g are not relevant for a DC machine.

When working as a DC machine, circuit boards AP07, AP09 and AP10 are bypassed.

Gate pulses to the AC IGBTs

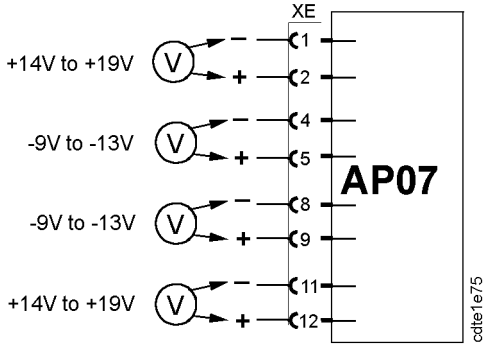
This instruction applies to items 9 and 10 on pages 58-59.

Measure the voltages at connector XE when the selector switch on the test board is in position 2: TEST ON. Measure as shown in the diagram below.



Gate voltages when electrode (XS13) is positive

Measure the voltages at connector XE when the selector switch on the test board is in position 3: CHANGED POL. Measure as shown in the diagram below.



Gate voltages when electrode (XS13) is negative

If the voltages are within the tolerance, the gate drive circuits are healthy.

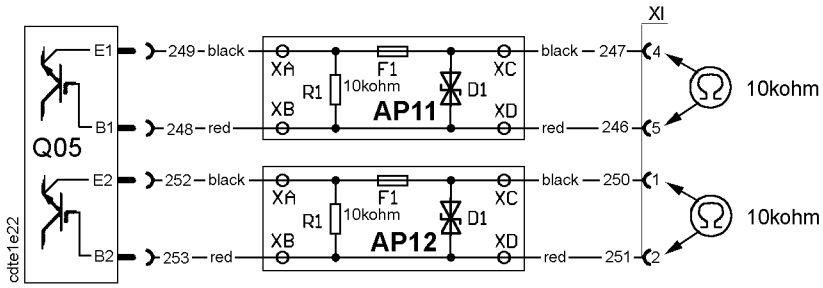
To check the temperature monitoring of the IGBTs: Disconnect connector XB (= temp. sensor ST02). All measurements above must now show -9V to -13V. The temperature monitoring is described on page 47.

DC IGBT, test and fitting instructions

DTE 200 / DTE 255

Make all measurements listed below with the machine disconnected from the mains.

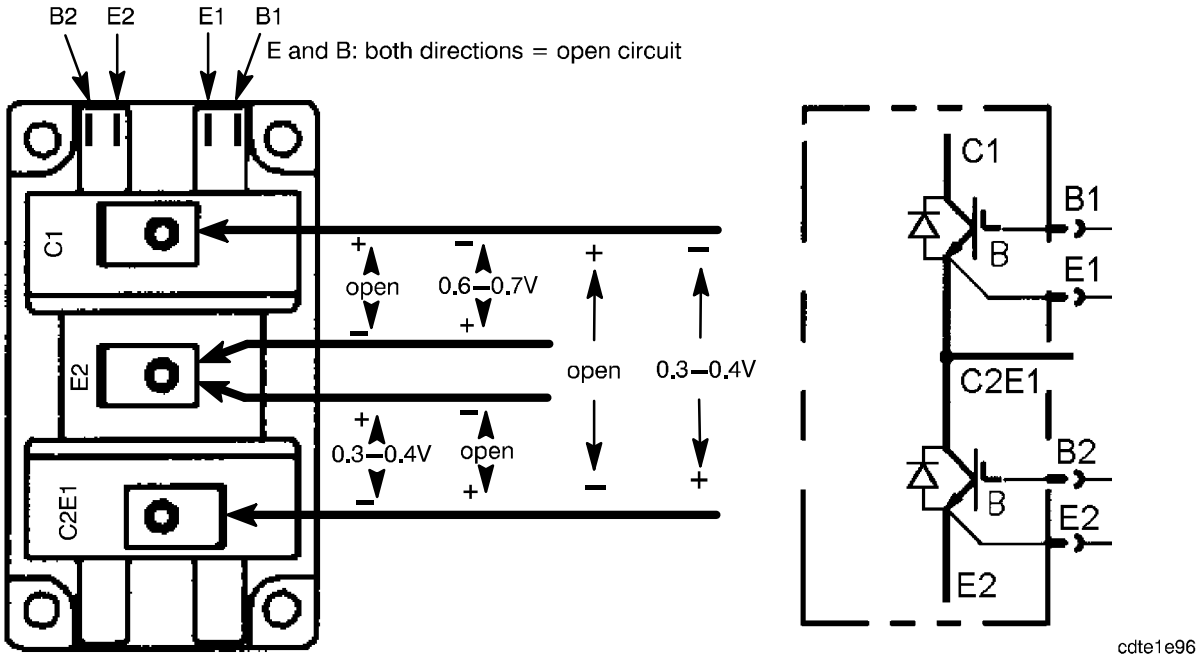
Generally, if the IGBT module has burnt out, one or both of the high-speed fuses on the protection boards will also have blown. To check the fuses, disconnect connector XI from circuit board AP01. Measure as shown in the diagram below. If the fuses are healthy the meter will display 10kΩ..



Checking gate fuses

To make a complete check of the IGBT module, remove the screws at C1, E2 and C2E1, then remove circuit board AP02. Use a multimeter in diode test position to measure as shown in the diagram below.

Warning: The IGBT module is sensitive to ESD.



Test measuring the DC IGBT module

Fitting instructions for Q05

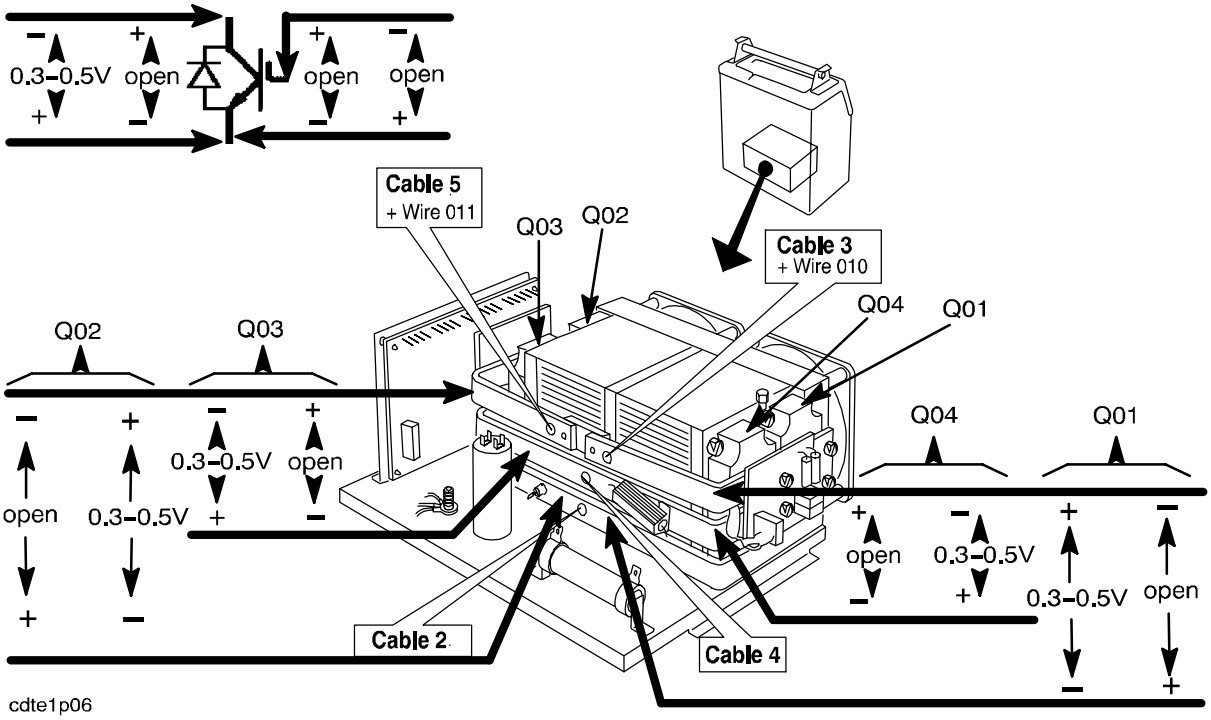
Follow the fitting instructions for Q01 - Q04 on page 62.

AC IGBT DTE 255, test and fitting instructions

Disconnect cables 2, 3, 4, 5, wire 010 and 011 from the AC unit. Use a multimeter in diode test position to measure as shown in the diagram below.

Generally, if the IGBT module has burnt out, one or more of the high-speed fuses on AP09 and AP10 will also have blown. Check the fuses. The circuit diagrams for AP09 and AP10 are on page 53 and 54.

Warning: The IGBT modules are sensitive to ESD.



Test measuring AC IGBT modules, DTE 255

Fitting instructions for Q01 - Q04

The IGBTs are **extremely** sensitive to ESD. Never touch an IGBT having an open gate input. Apply appropriate ESD protection measures when fitting the IGBT's.

Start by cleaning the heat sink, and then apply a **thin**, even layer of thermally conducting grease to the contact surface of the IGBT. The purpose of this grease is to fill any hollows in the surface of the IGBT and the heat sink: those parts of the IGBT and the heat sink that are in true metallic contact may have such contact.

The order number for the thermally conducting grease is given under item 412 in the spare parts list. Only the grease recommended by us may be used.

Fit the IGBT and tighten the screws to a torque of 1 Nm. Further tighten the screws to a torque of 3.0 Nm, tightening them alternately.

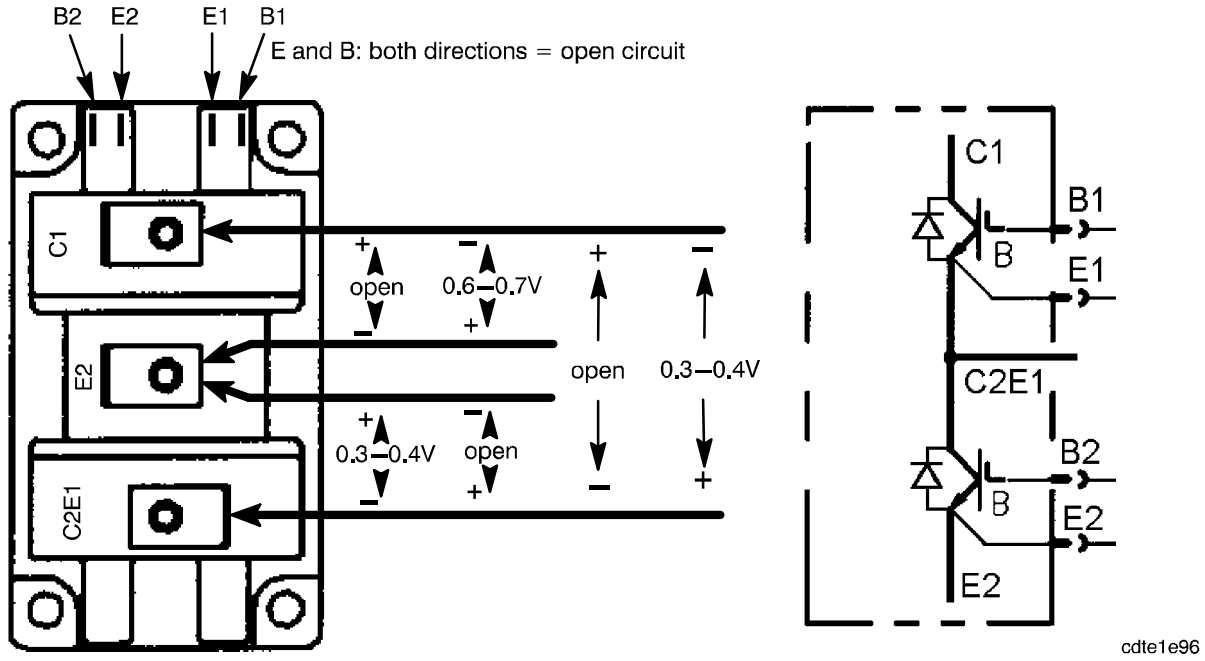
Warning: An incorrectly fitted IGBT module can lead to failure. Do not tighten the screws harder than 3.0 Nm.

AC IGBT DTE 200, test and fitting instructions

Remove the AC unit from the machine and remove Circuit board AP09 from the two IGBT modules. Use a multimeter in diode test position to measure as shown in the diagram below.

Generally, if the IGBT module has burnt out, one or more of the high-speed fuses on AP09 will also have blown. Check the fuses. The circuit diagram for AP09 is on page 56.

Warning: The IGBT modules are sensitive to ESD.



Test measuring AC IGBT module, DTE 200

Instructions for reconnection of the cables to the IGBT modules and circuit board AP09 are on page 67.

Fitting instructions for Q01 and Q02

The IGBT modules are **extremely** sensitive to ESD. Never touch a module having an open gate input. Apply appropriate ESD protection measures when fitting the modules.

Start by cleaning the heat sink, and then apply a **thin**, even layer of thermally conducting grease to the contact surface of the module. The purpose of this grease is to fill any hollows in the surface of the module and the heat sink: those parts of the module and the heat sink that are in true metallic contact may have such contact.

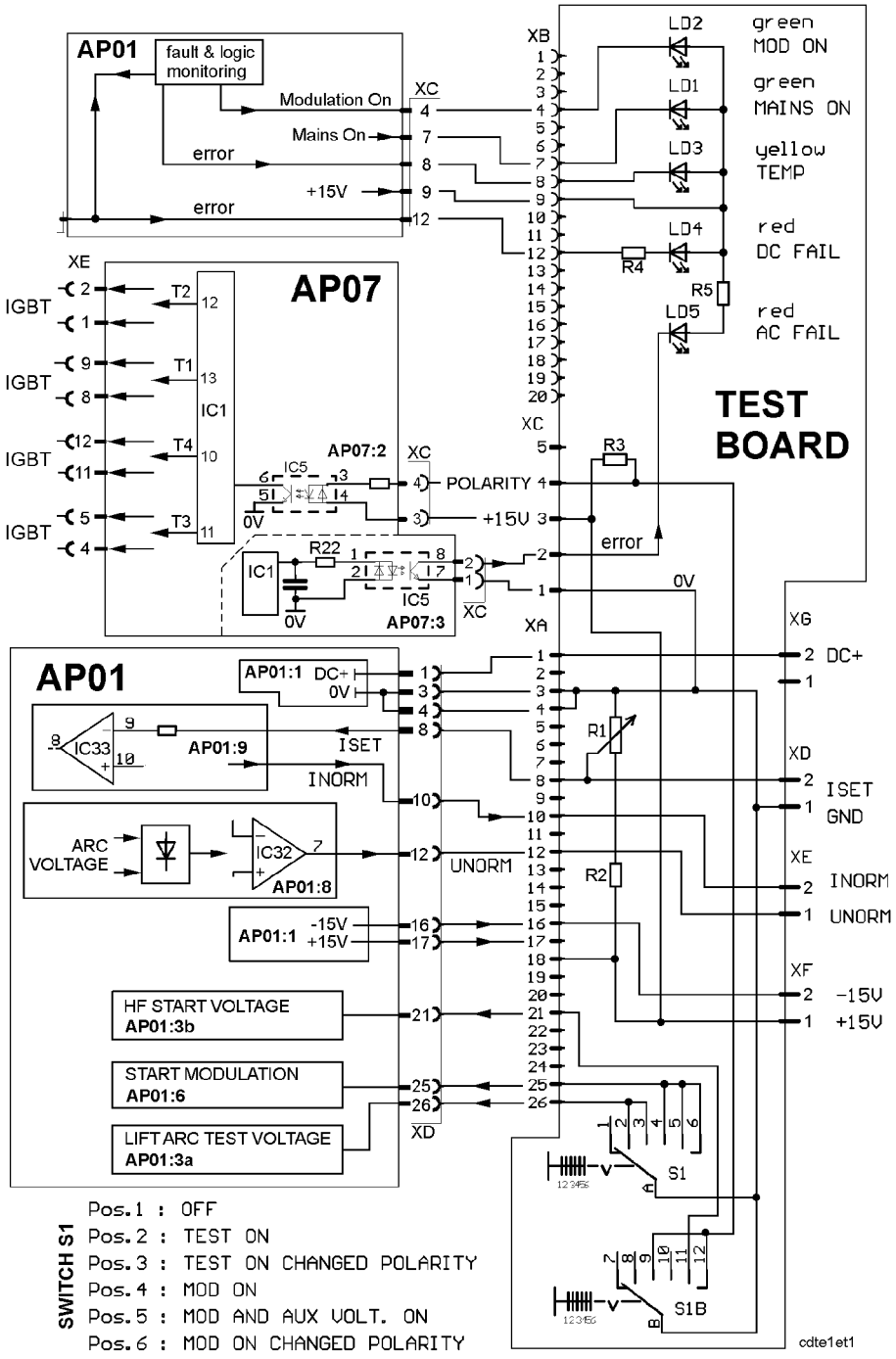
The order number for the thermally conducting grease is given under item 412 in the spare parts list. Only the grease recommended by us may be used.

Fit the module and tighten the screws to a torque of 1 Nm. Further tighten the screws to a torque of 3.0 Nm, tightening them alternately.

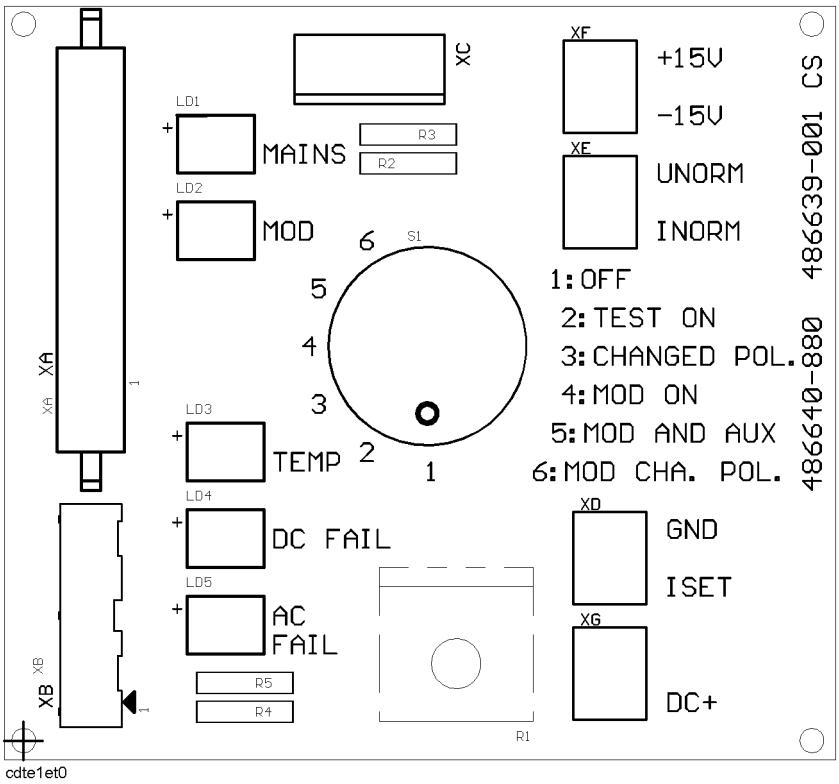
Warning: An incorrectly fitted IGBT module can lead to failure. Do not tighten the screws harder than 3.0 Nm.

Test circuit board

The test board is mainly intended to be used when soft starting the machine. It can also be used for fault tracing. For more information about the circuits which may be checked with the test board, see the description of those circuits.



Circuit diagram for the test circuit board and its connections to the machine



Component positions for the test circuit board

The test board has 5 LEDs, as follows:

LED	
MAINS	On in positions 1 to 6
MOD	On in positions 4 to 6
TEMP	On if the thermal sensors ST01, ST02 or ST03 are activated, and when the discharge circuit in the AC unit is overloaded.
TEMP DC FAIL	On if the primary IGBT, Q5, and/or its control circuits do not work, or if the thermal sensors ST01 or ST03 are activated. The TEMP and DC FAIL LEDs are on or off at the same time.
AC FAIL	On if the secondary IGBTs, and/or their control circuits, do not work. On if the thermal sensor ST02 is, and when the discharge circuit in the AC unit is overloaded.

Conversion to DC machine

Follow the instructions below:

1. Disconnect connector AP04:X4. (Control signals to/from AP07.)

2. Disconnect connector XS22 from XP22. (42V AC supply to AP07.)

3. Disconnect connector XS21 from XP21. (Supply to fans EV02 and EV03.)

4. **DTE 255:** Disconnect wire 010 and 011 from the copper rails.

   DTE 200: Disconnect connectors XC and XB (wire 010 and 011) from AP09.

5. Remove the shunt cable (2) and the workpiece cable (5) from their connections to the rails. Connect the two cables to each other and to wire 011.

   Note: mark up the cables and the rails before you start disconnecting.

6. Remove the other two cables and connect them to each other. (Cable 4 from L02 and cable 3).
   Remove varistor R10, which is connected between the connections for cable 3 and 5. It is not used now but must be reconnected when the machine is used as a normal AC/DC machine.

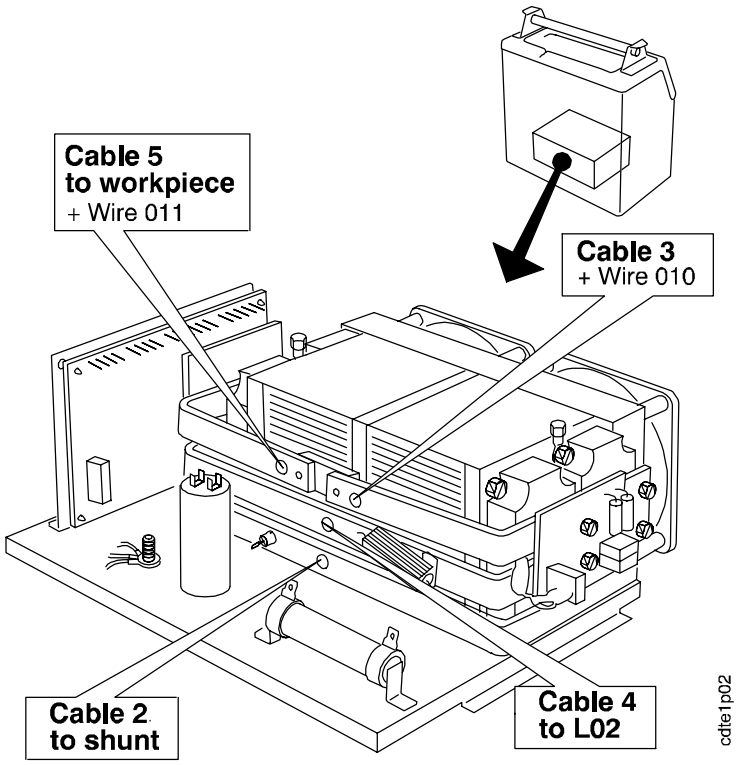
   If you want to measure the arc voltage signal from AP01 (UNORM), connect wires 010 and 011 to cables 3 and 5.

7. It is now possible to remove the whole AC unit of the machine, but it is not neccesarry for this test.

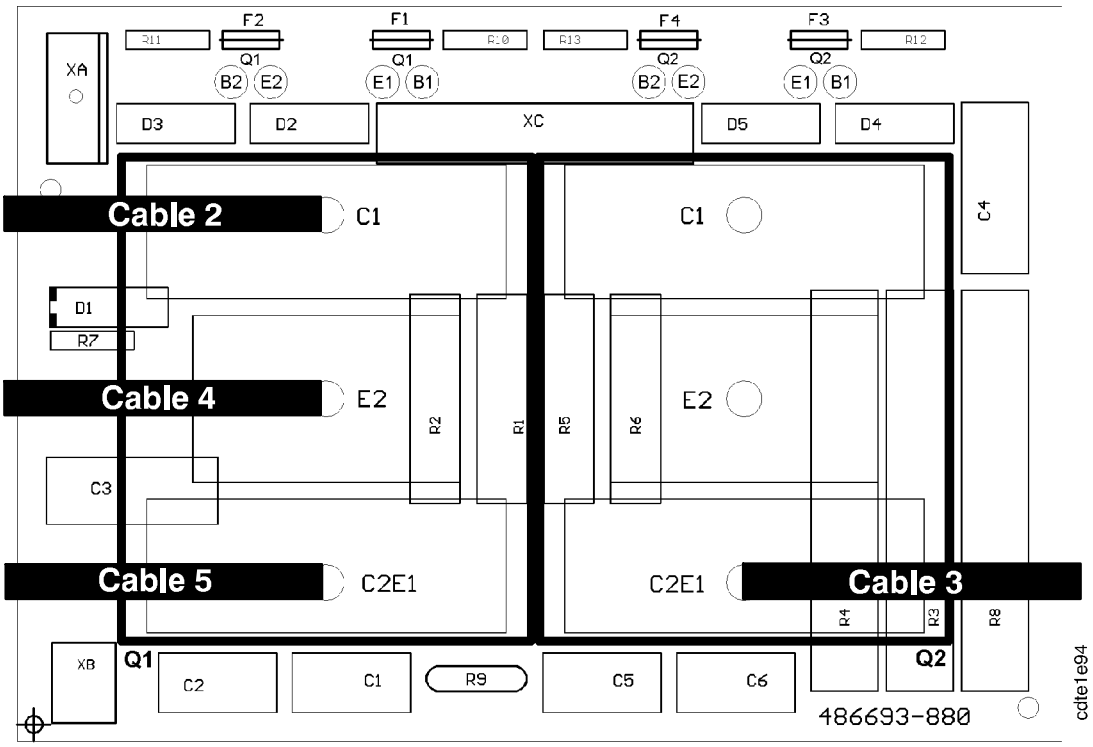
   Note: take care when removing the unit, there is a sharp screw end at the bottom of the unit.

8. Make a soft start and check the DC functions, see page 58 - 59.

9. When reconnecting the AC unit, make sure that the copper bars are parallel and properly tightened to the IGBTs.



The AC unit in the DTE 255 and its cable connections



Circuit board AP09 in the DTE 200 and the cable connections to the AC IGBT modules

INSTRUCTIONS

This chapter is an extract from the DTE 200 and DTE 255 instruction manuals.

SAFETY

Users of ESAB welding equipment have the ultimate responsibility for ensuring that anyone who works on or near the equipment observes all the relevant safety precautions.
Safety precautions must meet the requirements that apply to this type of welding equipment.
The following recommendations should be observed in addition to the standard regulations that apply to the work place.
All work must be carried out by trained personnel well familiar with the operation of the welding equipment.
Incorrect operation of the equipment may lead to hazardous situations which can result in injury to the operator and damage to the equipment.

1. Anyone who uses the welding equipment must be familiar with:
   - its operation
   - location of emergency stops
   - its function
   - relevant safety precautions
   - welding
2. The operator must ensure that:
   - no unauthorized person is stationed within the working area of the equipment when it is started up.
   - that no-one is unprotected when the arc is struck
3. The work place must:
   - be suitable for the purpose
   - be free from draughts
4. Personal safety equipment
   - Always wear recommended personal safety equipment, such as safety glasses, flame-proof clothing, safety gloves.
   - Do not wear loose-fitting items, such as scarves, bracelets, rings, etc., which could become trapped or cause burns.
5. General precautions
   - Make sure the return cable is connected securely.
   - Work on high voltage equipment **shall only be carried out by a qualified electrician.**
   - Appropriate fire extinquishing equipment must be clearly marked and close at hand.
   - Lubrication and maintenance must **not** be carried out on the equipment during operation.

INTRODUCTION

The DTE 200 and DTE 255 are welding power sources for two different welding methods – welding with tungsten electrodes (TIG) and manual metal arc welding with coated electrodes (MMA), using direct or alternating current.

They are is available in two designs:

- with OKC connection for the TIG torch
- with central connection for the TIG torch

Note:
Remove the TIG torch when using the MMA method.
When TIG welding, remove the electrode holder.

The machines are delivered with:

- Mains cable (5 m)
- Return cable (5 m)
- Gas hose
- Hose clamps

INSTALLATION

The installation shall be executed by a professional.

WARNING

This product is intended for industrial use. In a domestic environment this product may cause radio interference. It is the user's responsibility to take adequate precautions.

The machines have mains voltage compensation, which means that ±10% variation in the supply voltage produces only ±0.2% variation in the welding current.

To reduce the voltage drop resulting from the use of long welding cables, a cable with a larger sectional area than the one indicated under *Technical Data* on page 6 could be used.

When the machine is started, the fan works at a reduced rotation speed, partly to reduce the amount of dirt being sucked in, partly to reduce the noise level.
Only when the load is high does the fan work at full rotation speed.

Location and connection

- Place the welding power source so that the cooling air in- and outlets remain free.
- Connect the shielding gas (see fig. on next page).
- Connect the TIG torch and the torch return cable, alternatively the welding and return cable of the electrode holder (see fig. on next page).
- Make sure the welding power source is connected to the right mains voltage and that it is properly fused. Connect to earth according to applicable regulations.

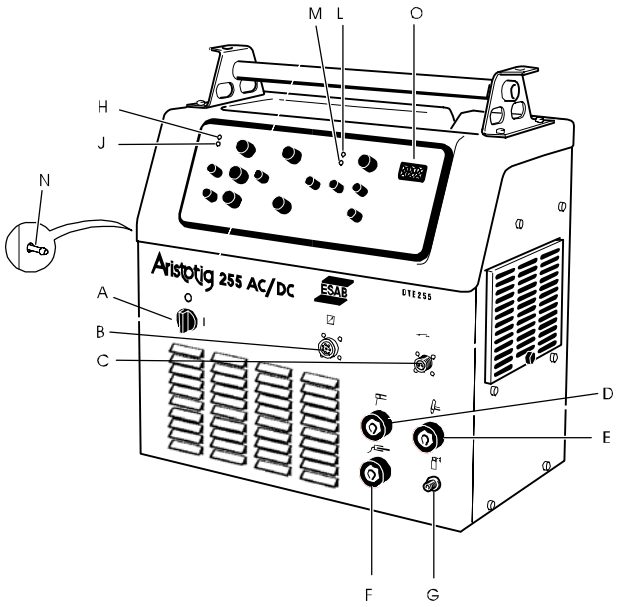
  Rating plate with connection data is located on the rear of the welding power source.

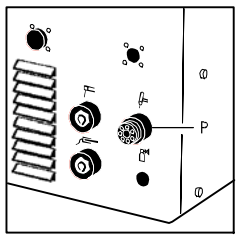
The machine is now ready for use.

OPERATION

General safety regulations for the handling of the equipment appear from page 68. Read through before you start using the equipment!

Controls and connections





Central connection

A	Mains switch ON/OFF	**H**	Mains voltage ON, LED
B	Connection for remote control unit	**J**	Welding voltage ON, LED
C	Torch connector	**L**	Error / Overheating, LED
D	Connection for electrode holder (MMA)	**M**	Flow guard, LED (In operation when the cooling unit is connected)
E	OKC connection for TIG torch	**N**	Connection for shielding gas to the machine
F	Return cable connection	**O**	Control unit, digital display
G	Shielding gas connection	**P**	Central connection for TIG torch

N.B. The positions C and G are dropped when the central connection is used.

When the mains switch is switched on, the LED (H) goes on.

When open circuit voltage is applied LED (J) goes on.

When an error occurs, for example overheating, LED (L) goes on.

When there is no water flow LED (M) goes on.

When there is a fault that can cause temporary high output voltage, the LED (J) switches off, (output voltage has been switched off). When idling for longer than 30 minutes, the output voltage is switched off and LED (J) goes out.
Restart by turning the switch (1) to TIG mode and then back to MMA mode.

Remote control unit

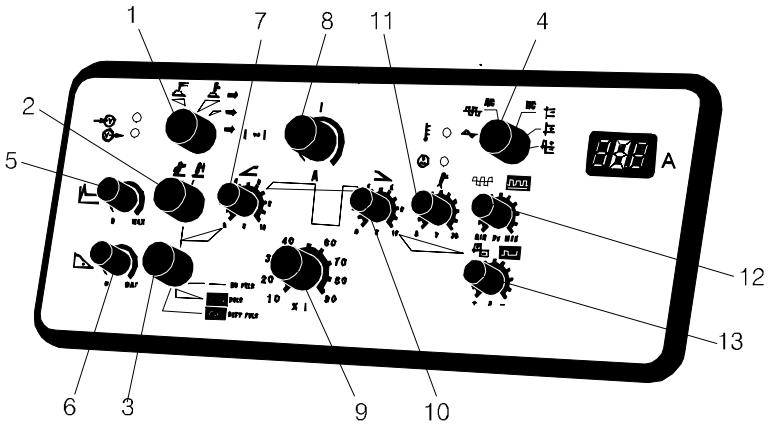
For both the TIG and MMA methods the welding current can be adjusted by way of a remote control unit. The welding power source registers automatically when a remote control unit is connected.

If the remote control is to include the whole current range, the current must be set to max. on the welding power source. Max. value = The reference value set on the welding power source. This is also the value shown by the display on the DTE 255 prior to serial no. 844-950-xxxx. For other DTE 255 machines and DTE 200 the value set by the remote control is shown by the display.

Protection against overheating

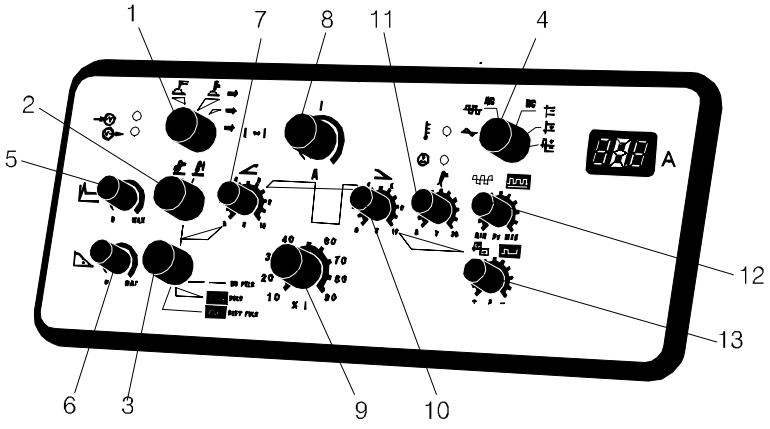
Three thermal cut-outs prevent the power source being overloaded as a result of too high temperature. If this should happen, the welding current is interrupted and the yellow diode (L) goes on. (See page 70.)
When the temperature has gone down, the welding current circuit is reclosed and the diode goes out.

Control panel



1	**Method selection switch** **(SW3)**	• MMA welding (hand welding electrodes) • TIG, two-stroke (also for remote control) • TIG, four-stroke • TIG four-stroke with the possibility to shift between two currents (shift function). See items 8 and 9 below for setting of the two currents.
2	**Ignition selection switch** **(SW2)**	• HF ignition • Lift-Arc ignition, see page 73.
3	**Pulsing selection switch** **(SW4)**	• Non-pulsed welding, d.c. and a.c. • Welding with square-wave pulsing; d.c. and a.c. • Welding with trapezi-form pulsing; d.c. and a.c.
4	**Polarity selection switch** **(SW1)**	• Alternating current • Square-wave alternating current • Direct current, negative electrode (normal in TIG welding) • Direct current, positive electrode • Direct current, negative electrode, but with positive electrode at the start (for example for 3.2 mm electrodes, TIG welding).

5	**Potentiometer, Hot Start time (R3)**	• For setting and optimising the starting cycle with regard to the electrode size. **TIG welding (10 - 500 ms)** **MMA welding (0.1 - 2 s)**
6	**Potentiometer, Arc Force (R9)**	• For setting and optimising the Arc Force function (Anti Stick), for MMA welding **only**.
7	**Potentiometer, Slope Up (R6)**	• For setting the slope-up time of the welding current (0 to 10 seconds).
8	**Potentiometer I1 (R1)**	• For setting the non-pulsed welding current and the current pulse when welding with pulsed current.
9	**Potentiometer I2 (R2)**	• For setting the background current for pulsed welding and the lower current level when using the shift function.
10	**Potentiometer, Slope down (R7)**	• For setting the welding current slope-down (0 to 10 seconds).
11	**Potentiometer, Gas Post Flow (R8)**	• For setting the gas postflow time (3 to 30 seconds).
12	**Potentiometer, Frequency (R4)**	This potentiometer has double functions: • For setting the pulse frequency between 0.3 and 300 Hz for pulsed welding with direct current. • For setting the a.c. frequency between 30 and 300 Hz for non-pulsed welding with alternating current. **N.B. When welding with pulsed alternating current, the a.c. frequency is automatically set to 100 Hz! The max. pulse frequency to be set is then 100 Hz!**
13	**Potentiometer, Balance (R5)**	This potentiometer has double functions: • For setting the relationship between positive and negative half wave when welding with alternating current to optimise the cleaning or the penetration. (Turning right =>increased penetration.) • For setting the time relation between the background and the peak current when welding with direct current. (Turning right =>longer pulse current time.) **N.B. When welding with pulsed ac the time balance between the pulse current and the base current will automatically be 50/50%.** The relationship between positive and negative halfwave is adjustable as for unpulsed ac welding.



Position = MMA

In this position the welding power source is prepared for welding with coated electrodes. The HF unit and the Lift-Arc are disconnected, and the hot-start function is activated in order to supply increased current at the start.

Position = HF unit ON

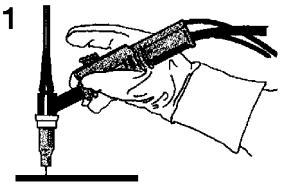
When pressing the torch trigger the gas starts flowing, the HF unit goes on, generating an electric spark between the electrode and the welding material, the gas is ionised and an arc is produced. When the arc is stable, the HF unit will automatically be disconnected.

Position = Lift Arc

By Lift-Arc is meant that you place the torch with the electrode on the spot where you want to start the welding, press the torch trigger and lift up the torch. In doing so an arc is produced.

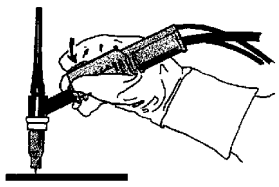
By way of the slope-up function the current now goes up to the set value. When you want to terminate the welding, release the switch and the current goes down slowly according to the slope-down time set.

1



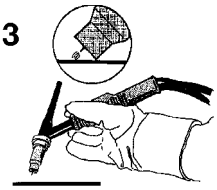
Place the electrode against the workpiece

2



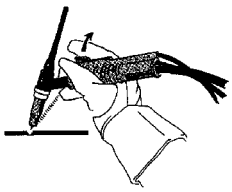
Press the torch trigger

3



Tilt the torch a little, lift and an arc is produced

4



To stop, release the torch trigger

Position Two/four stroke

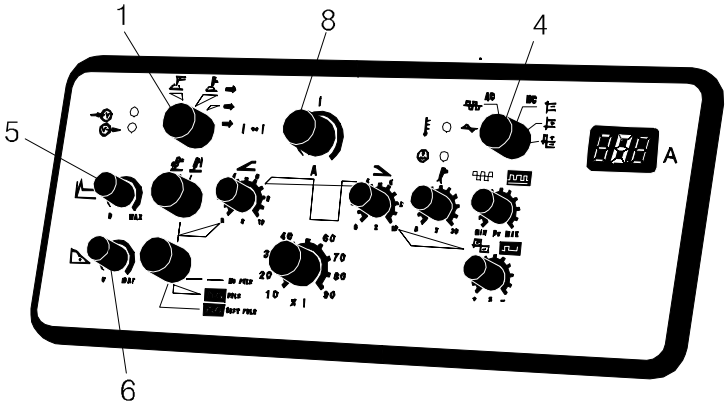
Two stroke means that the arc is struck when the torch trigger is pressed and extinguished when it is released.

Four stroke means that it is not necessary to keep the torch trigger pressed while the welding is going on. The arc is struck by pressing an releasing the switch and is extinguished by repeating the action.

Four stroke with the possibility to shift between two currents (Shift function).

By activating the torch trigger for less than 0.5 seconds, the shift function permits switching between the set current and the background current. Keeping the torch trigger down, the current will start dropping (slope down).

MMA welding (Hand welding electrodes)



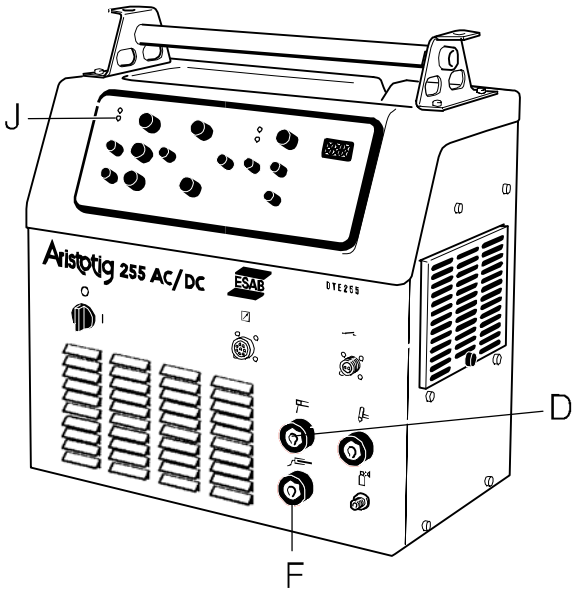
Adjusting the control panel for MMA welding

- Connect the welding and return cable to the OKC terminals D and F.
- Set switch (1) to the position for hand welding electrodes. If the machine is in MMA mode when the mains is switched on, there will be no open circuit voltage. Activate the machine by turning the switch (1) to TIG mode and then back to MMA mode.
  The LED (J) indicates that open circuit voltage is available on the welding terminals.
- Set the desired value for welding current using potentiometer (8).

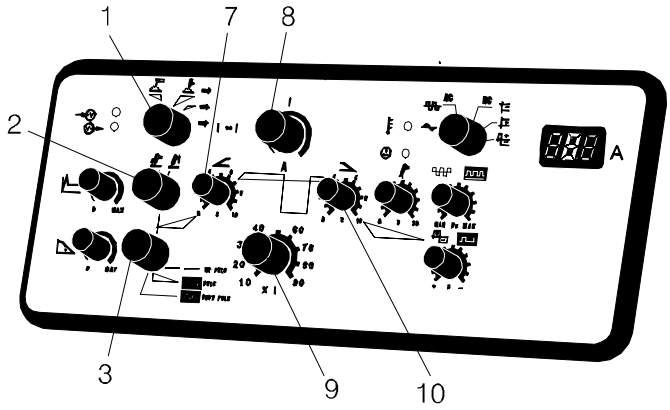
  It is also possible to use pulsed welding current. The settings are made in the same way as for pulsed TIG welding.
- Potentiometer (5) is used for stepless setting of the Hot-Start time (0.2 to 2 s), potentiometer (6) for stepless setting of the Arc-Force function, and thereby the control dynamics.
- Depending on the electrode type to be used, direct current and polarity or one of the alternating current alternatives can be selected by way of switch (4) without shifting the welding cables.

The welding current can be set over a hand-operated remote control unit.

The DTE has an inbuilt energy saving function. When the machine is in the MMA mode and not used for 25 minutes, the open circuit voltage is switched off.
Restart by turning the switch (1) to TIG mode and then back to MMA mode.



TIG welding



In TIG welding the torch trigger has three different functions:

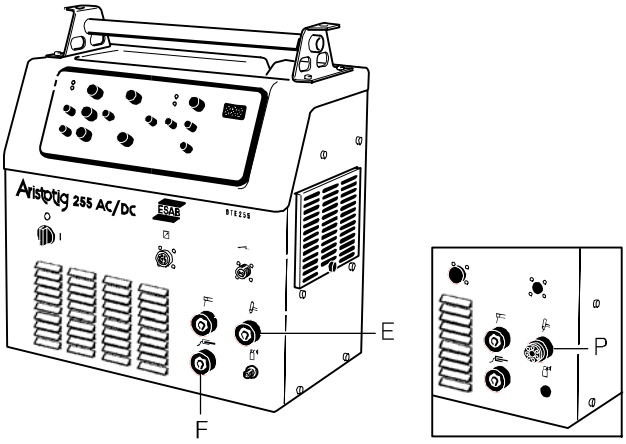
- Two-stroke.
- Four-stroke.
- Four-stroke with the possibility to shift between two currents (shift function).

Adjusting the control panel for TIG welding

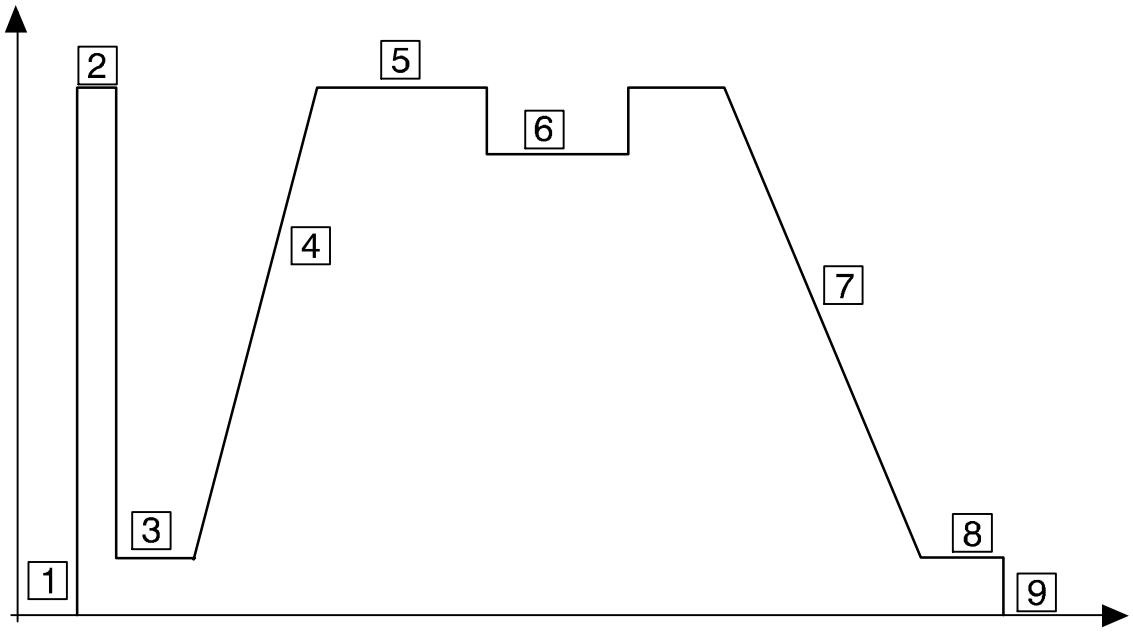
- Connect the welding cable and the respective return cable to the OKC terminals E and F, (for central connection: terminals F and P).
- Set switch (1) to the desired position.

  If a foot-operated remote control unit is to be used, set switch (1) to position two-stroke.

  NB. For direct current control over the foot-operated remote control unit, the potentiometer (7) and (10) **must** be set to position 0.
  A hand-operated remote control unit can be used for both two- and four-stroke to set the welding current.
- Select the desired striking method using switch (2).
- Adjust the welding current using potentiometer (8).
- Select the desired type of pulsing using switch (3).
- For the shift function or pulsing, adjust the lower current value using potentiometer (9).



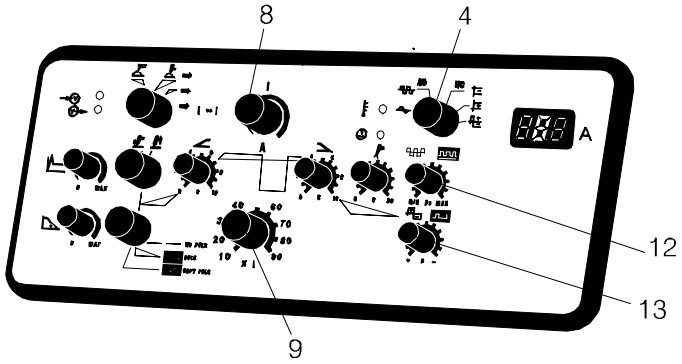
Procedure for welding with TIG 4-stroke and shift function



1. The gas preflow time is preset to 10 ms. *
2. Hot start:
   - The start current is preset to 100 A. *
   - The time is adjusted on the front panel: Between 20 and 500 ms. (For MMA welding: 200 to 2000 ms.)
3. The start current is preset by the software to 10 A in the DTE 200 and 15 A in DTE 255.
4. The slope-up time is adjusted on the front panel: 0 - 10 s.
5. The pulse current is adjusted on the front panel: 5 - 200 A, 250 A in DTE 255.
6. The background current is adjusted on the front panel: 10 - 90% of the pulse current.
7. The slope-down time is adjusted on the front panel: 0 - 10 s.
8. The end current is preset to 5 A. *
9. The gas postflow time is adjusted on the front panel: 3 - 30 s.

* Instructions for the setting of the trim potentiometers for gas preflow time, hot start current and end current are on page 34 and 36.

Setting direct and alternating current



Direct current:

- Set switch (4) to the position for direct current with negative polarity.

  If pulsing has been selected:

  - Set the pulse current value using potentiometer (8).
  - Set the background current in per cent of the pulse current value using potentiometer (9).
  - Set the pulse frequency using potentiometer (12).
  - Set the time relation between pulse and background current using potentiometer (13).

Alternating current:

Two different types of alternating current can be set over switch (4):

- A sine-wave type, characterised by low noise and a soft arc. Effective when low frequencies are used!
- A square-wave type, characterised by a hard and stable arc, resulting in a somewhat higher noise level.

The arc is always struck by way of direct current which is then automatically switched over to alternating current.

Increased alternating current frequency gives a concentrated and stable arc, suitable above all when a low amperage is used and when welding in extremely thin plate. The displacement (balance) of the half-wave in positive direction leads to **increased cleaning**, and in negative direction to **increased penetration**.
(Turn potentiometer (13) more **to the right** for increased penetration!)

Forced disconnection

If the torch trigger or the foot-operated remote control unit has been activated and no arc has been generated, the open circuit voltage is automatically disconnected after 2 seconds. The same applies in the event of an arc interruption.

This function protects from:

- Uncontrolled arc strike
- Material damage
- Shielding gas drop out
- Accidents

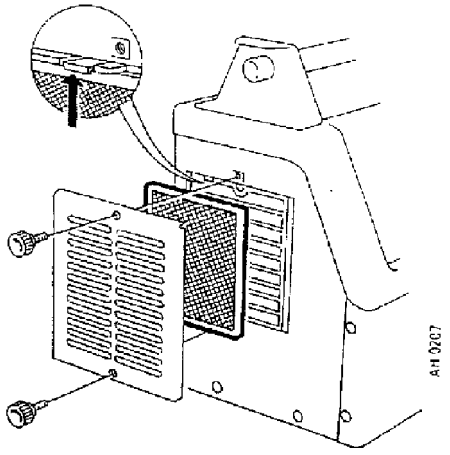
Maintenance

Note:
All warranty undertakings given by the supplier cease to apply if the customer attempts to rectify any faults on the machine during the warranty period.

Check-up and cleaning

Clean the welding power source once a year using dry compressed air (reduced pressure). The dust filter is to be checked up and cleaned regularly.
If the welding power source is used in a dusty and dirty environment, the cleaning should be performed more frequently.

For maximal service reliability it could be advisable to let an authorised retailer service the machine once a year.



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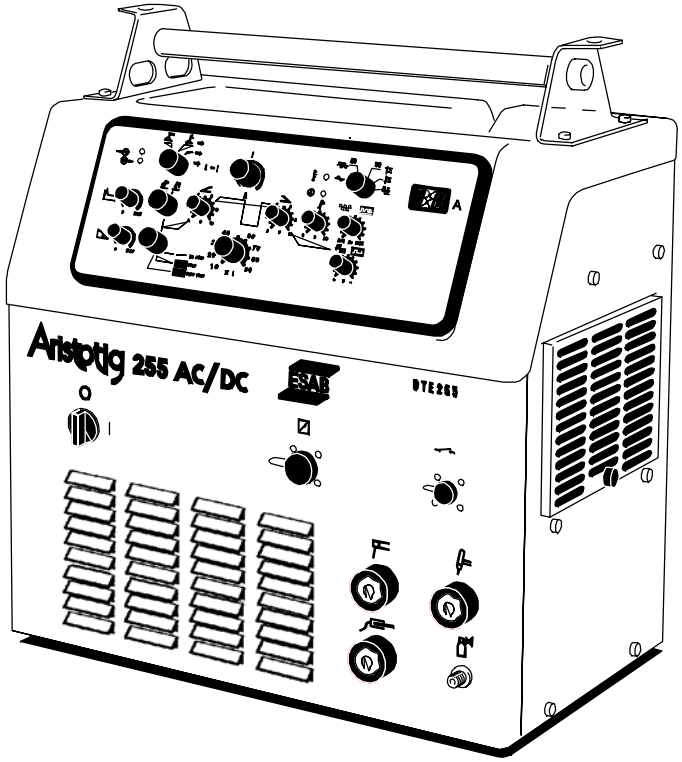
SPARE PARTS

The spare parts lists are published in separate documents.

Product	**filename / ordering no.**
DTE 200	0458 234 990
DTE 255	0457 784 990

Spare parts list



Valid for serial no. 810-xxx-xxxx, 844-xxx-xxxx, 934-xxx-xxxx, 948-xxx-xxxx, 246-xxx-xxxx

Ordering number

0301 035 880 DTE 255 with central connection for the TIG torch

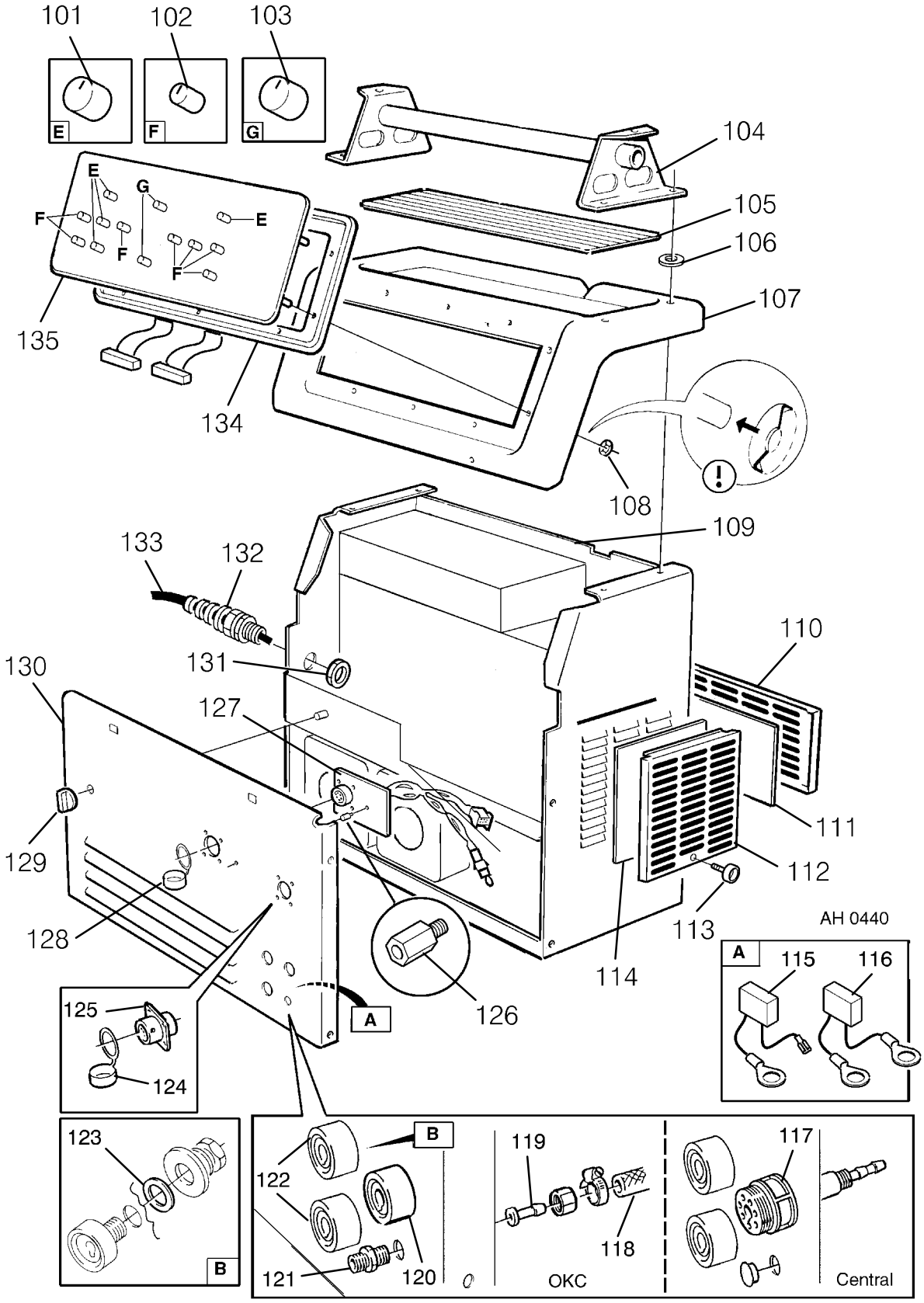
0301 035 881 DTE 255 with OKC connection for the TIG torch

Spare parts are to be ordered through the nearest ESAB agency. Kindly indicate type of unit, serial number, denominations and ordering numbers according to the spare parts list.

Maintenance and repair work should be performed by an experienced person, and electrical work only by a trained electrician. Use only recommended spare parts.

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
101	4	0192 296 104	Knob		
102	7	0191 508 102	Knob		
103	2	0192 296 102	Knob		
104	1	0468 543 882	Handle		
105	1	0468 529 001	Rubber mat		
106	4	0365 534 001	Sealing washer		
107	1	0301 015 001	Cover	When the cover is replaced, items 108 and 134 must also be replaced	
108	10	0192 859 006	Locking washer	Must be pressed with 50 kg pressure when fitted.	
109	1	0301 021 001	Rear plate		
110	1	0301 028 001	Grill		
111	1	0301 054 001	Filter		
112	1	0301 027 001	Grill		
113	3	0441 819 001	Screw		
114	1	0301 053 001	Filter		
115	1	0457 817 881	Capacitor	47 nF, 275 V AC, with cable lugs	C06
116	1	0457 817 880	Capacitor	47 nF, 1000 V AC, with cable lugs	C07
117	1	0367 258 880	Central connection	For machines with central TIG connection	XS12
118		0190 209 114	Hose	To be ordered per metre	
119	1	0252 103 501	Hose nipple	For machines with OKC TIG connection	
120	1	0156 868 880	OKC-TIG	For machines with OKC TIG connection	XS12
121	1	0156 867 001	Gas outlet bushing	For machines with OKC TIG connection	
122	2	0160 362 881	OKC		XS13, XS14
123	2	0466 325 001	Gasket	For machines with central TIG connection	
	3	0466 325 001	Gasket	For machines with OKC TIG connection	
124	1	0457 626 001	Cap		
125	1	0538 500 902	Connector socket	For machines with OKC TIG connection	XS15
126	1	0394 516 005	Spacer		
127	1	0486 634 880	Circuit board	With connector	AP06
	2	0193 260 150	Connector	2-pole	XA, XD
	1	0193 260 153	Connector	5-pole	XC
128	1	0366 285 001	Cap		
129	1	0366 296 003	Knob		
130	1	0301 049 001	Front plate		
131	1	0212 602 202	Nut		
132	1	0193 307 105	Cable clamp	Cable inlet	
133	1	0467 696 886	Mains cable		
-	2	0194 034 002	Ferrite ring core	To be fitted close to the mains cable inlet	L04
134	1	0468 304 001	Rubber seal		
135	1	0301 069 883	Panel complete	Front panel, circuit board AP05, 13 knobs (items 101, 102 and 103) and 12 locking washers (item 108) are included. When replacing item 135, item 134 must also be replaced. **NOTE: This panel does only fit in machines having processor board AP04 with part no. 0486 770 880. If the machine has a processor board with part no. 0486 665 880, this must also be replaced.**	AP05
	1	0193 260 160	Connector	12-pole	XA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AH 0440
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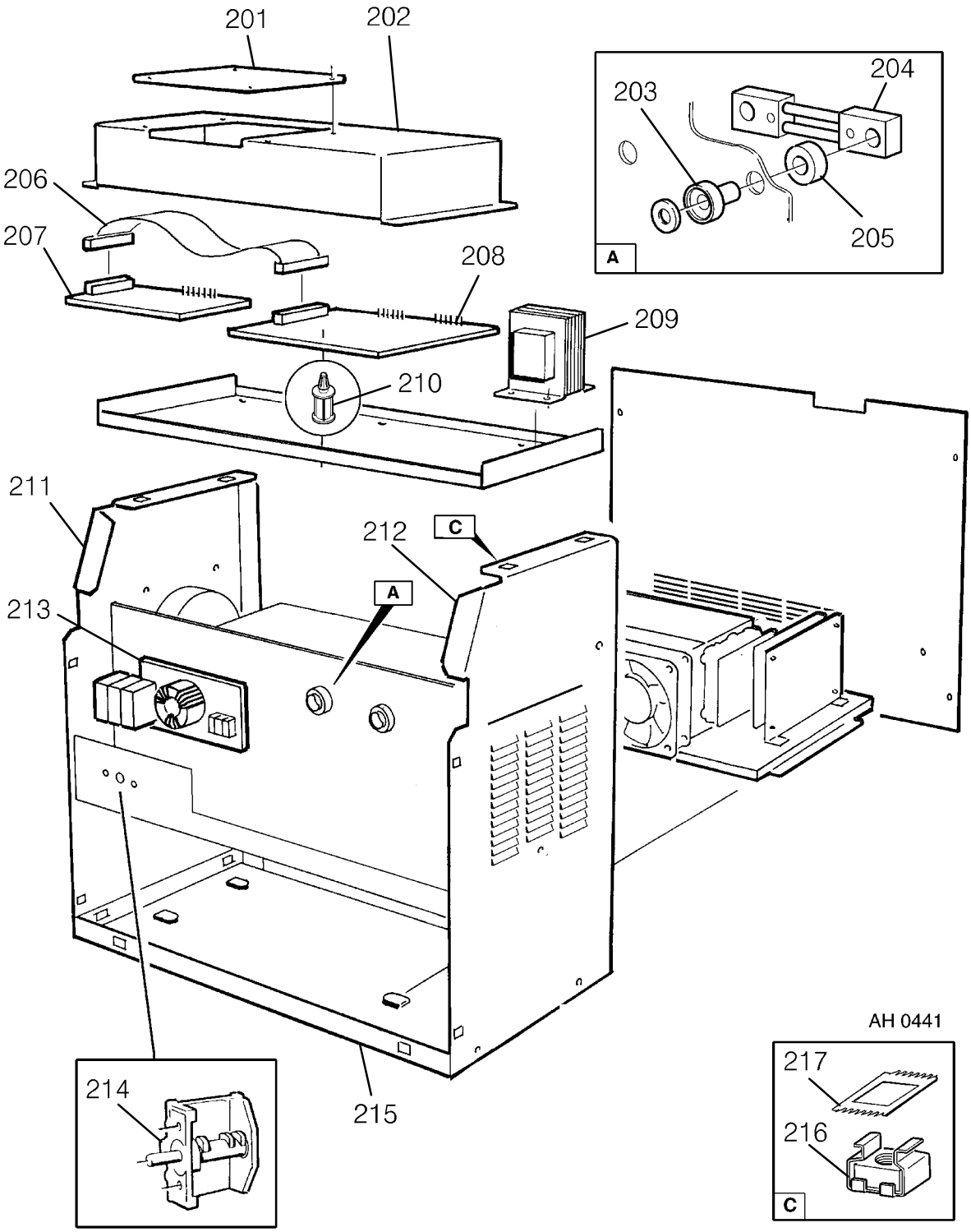
119
118
OKC
117
Central

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
201	1		Cover	Replaced by item 202	
202	1	0301 075 001	Screening box	New design with built-in cover, fits to all machines	
203	2	0162 414 001	Insulating tube		
204	1	0301 041 001	Shunt	250 A / 60 mV	RS01
205	2	0163 139 001	Bushing		
206	1	0193 700 401	Ribbon cable	Connectors AP01:XD and AP04:X1/XA are included	
207	1	0486 770 880	Circuit board	Replacing circuit board 0486 665 880, fits in all machines	AP04
	1	0193 260 153	Connector	5-pole	X4/XD
	1	0193 260 155	Connector	7-pole	X9/XB
208	1	0486 810 880	Circuit board	Replacing circuit board 0486 657 880	AP01
	1	0193 260 151	Connector	3-pole	XA
	1	0193 260 158	Connector	10-pole	XB
	1	0193 494 003	Ferrite ring core		L05
	3	0193 260 150	Connector	2-pole	XE, XF, XG
	1	0193 260 153	Connector	5-pole	XI
	2	0193 260 152	Connector	4-pole	XK, XL
209	1	0301 006 001	Control transformer		TC01
210	10	0192 790 103	Spacer		
211	1	0301 016 001	Side panel (left)		
212	1	0301 017 001	Side panel (right)		
213	1	0486 577 880	Circuit board	EMC filter	AP08
214	1	0366 295 004	Switch		QF01
215	1	0301 033 001	Base plate		
216	4	0192 562 105	Cage nut	M6	
217	4	0320 029 002	Ground stud		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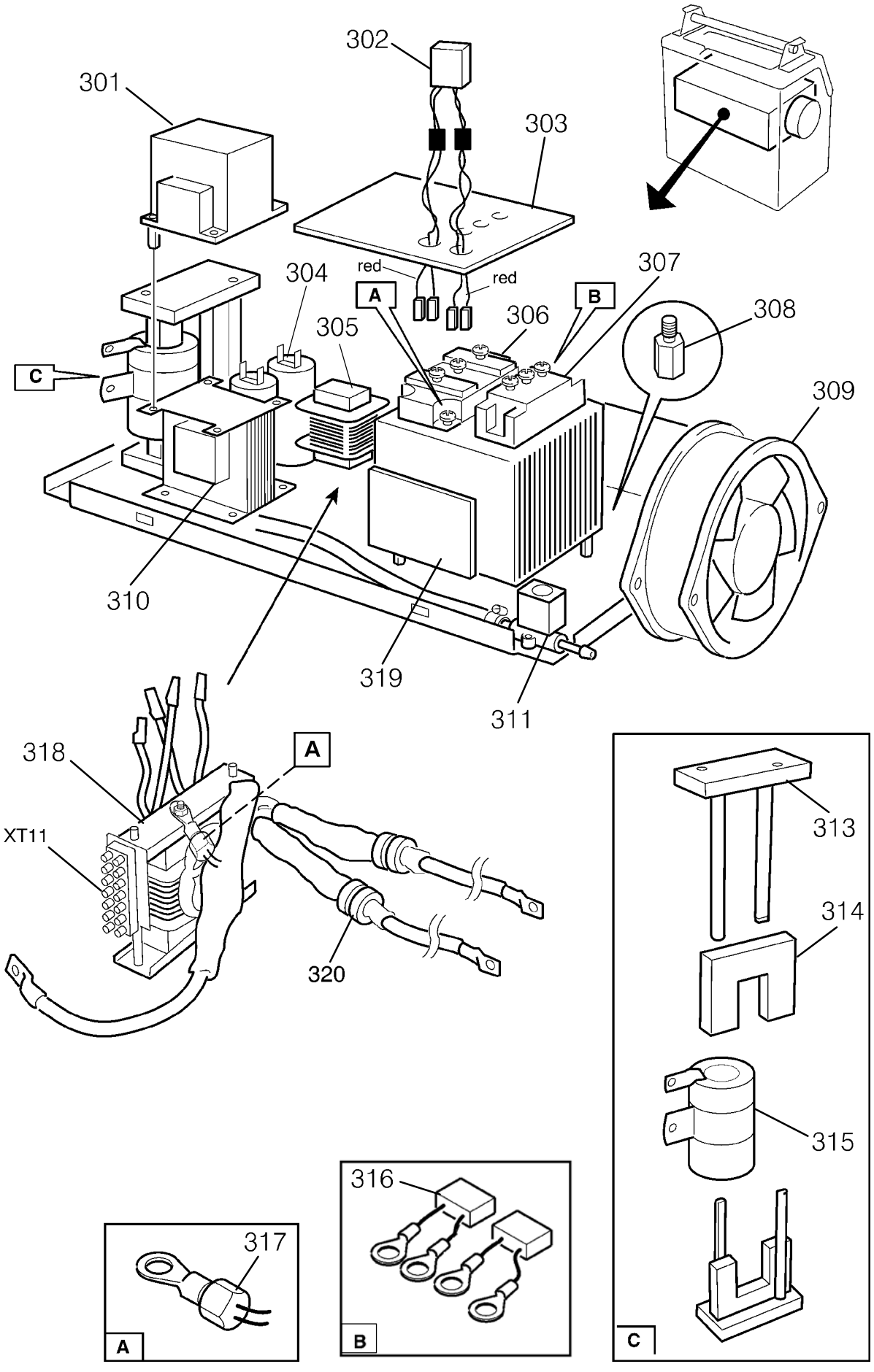
AH 0441

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
301	1	0367 268 001	HF unit		AP13
302	1	0486 603 880	IGBT connection	Safety circuit boards with connectors	AP11, AP12
303	1	0486 613 880	Circuit board	IGBT	AP02
	4	0193 260 150	Connector	2-pole	XA, XB, XE, XF
304	2	0191 085 208	Capacitor	10 µF, 450 V AC	C04, C05
305	1	0365 591 882	Primary inductor		L01
306	1	0194 073 001	IGBT module		Q5
		0192 058 101	Thermal compound	For fitting of Q01 - Q04, Q05 and V07	
307	1		Diode module	See item 350	V07
308	4	0394 516 031	Spacer screw		
309	1	0466 109 001	Fan	230 V AC	EV01
310	1	0301 026 880	Secondary inductor		L02
311	1	0193 054 002	Solenoid valve	42 V AC	YV01
313	2	0467 755 001	Attachment		
314	2	0466 895 001	Ferrite core		
315	1	0457 841 880	HF coil		TV01
316	2	0320 805 887	Capacitor	0.01 µF, 1000 V	C10, C11
317	2	0194 050 001	PTC resistor	Thermal sensor	ST01, ST03
318	1	0301 007 880	Main transformer	Item 320 is included	TM01
319	1	0486 607 880	Circuit board	Mains rectifier	AP03
	1	0193 260 153	Connector	5-pole	XB
320	4	0193 494 004	Ferrite ring cores	Included in TM01	L03

SPARE PARTS SET

Item	Ordering no.	Denomination	Notes
350	0458 920 882	Diode module set	Includes item 307 diode module, thermal compound, roller and mounting instruction.
-	0458 910 002	Roller handle	For the roller in the spare parts set above.


302
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red
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306
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308
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XT11
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314
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316
317
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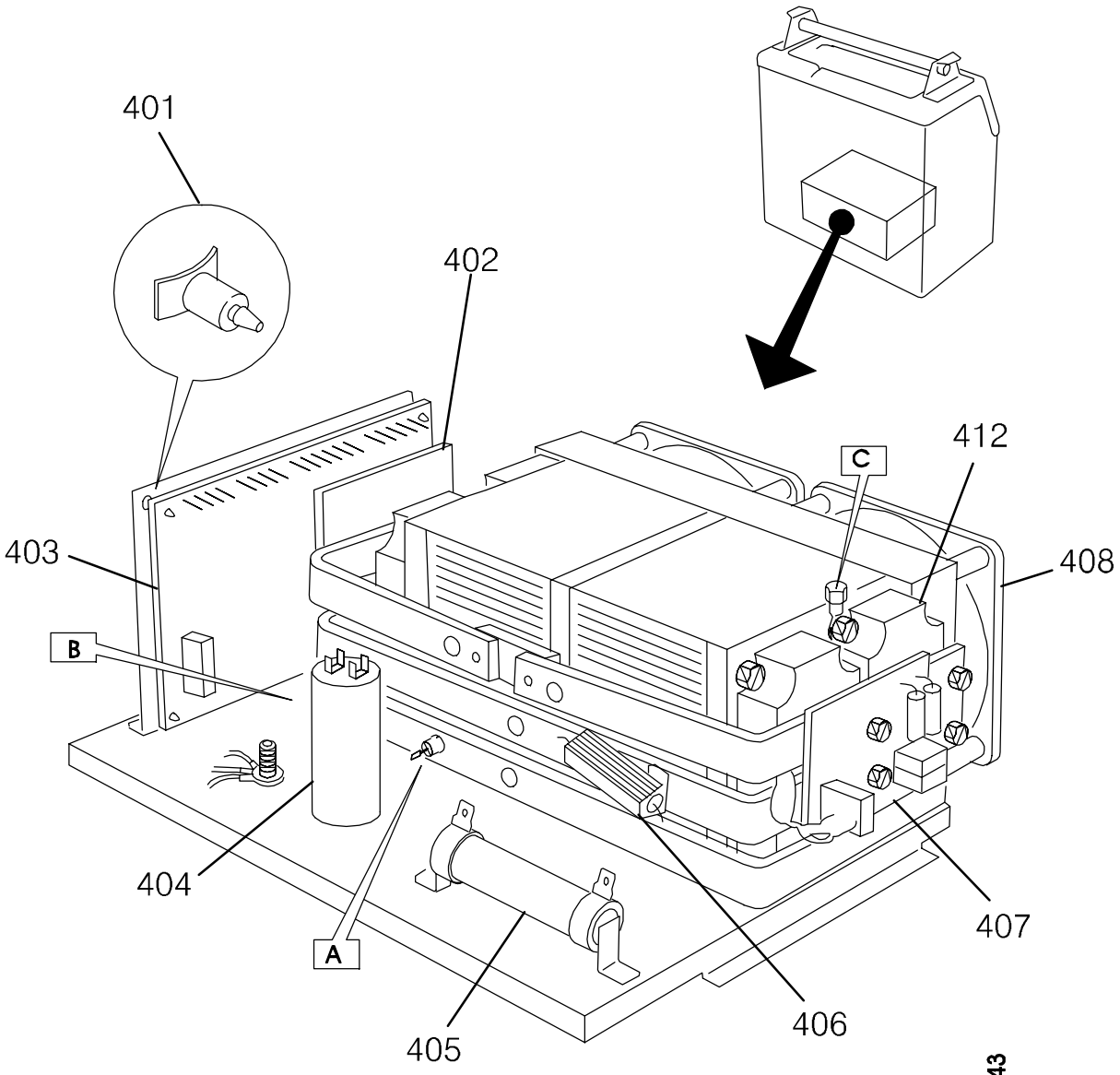
C

C = component designation in the circuit diagram

Item	Qty	Ordering no.	Denomination	Notes	C
401	6	0455 226 004	Spacer		
402	1	0486 622 880	Circuit board		AP09
	2	0193 260 153	Connector	5-pole	XA, XB
	1	0193 260 155	Connector	7-pole	XC
403	1	0486 829 880	Circuit board	Replacing circuit board 0486 648 880	AP07
	1	0193 260 158	Connector	10-pole	XA
	1	0193 260 067	Connector	8-pole	XB
	1	0193 260 153	Connector	5-pole	XC
	1	0193 260 159	Connector	12-pole	XD
404	1	0191 085 208	Capacitor	10 µF, 450 V AC	C09
405	1	0349 061 004	Resistor	120 Ω, 80 W	R03
406	1	0192 579 206	Resistor	1 Ω, 50 W	R05
407	1	0486 628 880	Circuit board		AP10
	1	0193 260 153	Connector	5-pole	XA, XB
408	2	0365 539 001	Fan	230 V AC	EV02, EV03
409	1	0194 065 001	Diode		V05
410	1	0193 045 011	Terminal block		XT23
411	1	0194 050 001	PTC resistor	Thermal sensor	ST02
412	4	0194 083 001	IGBT module		Q01 - Q04
		0192 058 101	Thermal compound	For fitting of Q01 - Q04, Q05 and V07	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402
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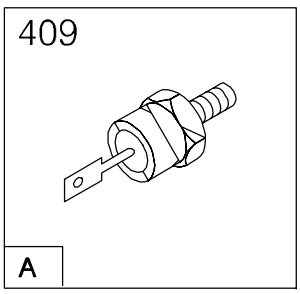
AH 0443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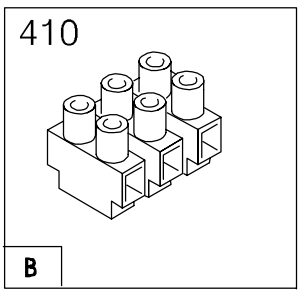
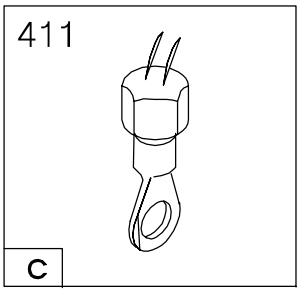
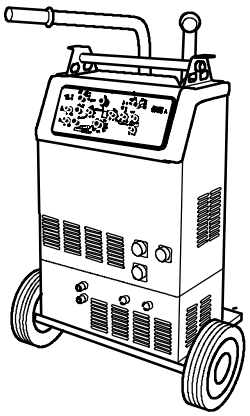
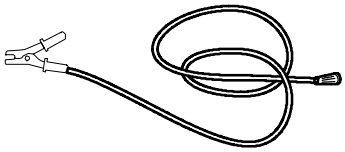

410
B


411
C

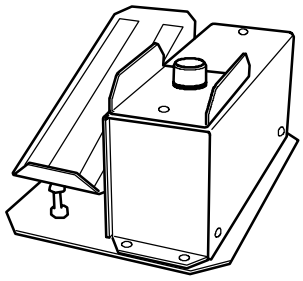
Accessories



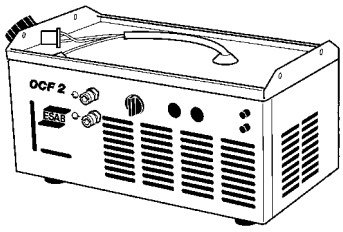
Trolley (with room for gas bottle) 0301 100 880



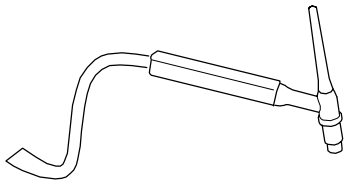
Return cable 0369 857 888



Foot control FS 002 . . . . . 0349 090 886



Cooling unit OCF 2D 0457 216 881



TIG torches

HW 26 R, 4 m with OKC connection 0588 000 738
HW 26 R, 4 m with central connection 0588 000 740
HW 20, 4 m with OKC connection 0588 000 744
HW 20, 4 m with central connection 0588 000 746

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