



Book for service engineers

internal use only



9020

9030



markem·imaje

the team to trust



A **DOVER** Company



Contents



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Contents





Safety



Safety



Notes:

Safety



Notes:



■ Reminder

Please read all the safety instructions that appear in the manuals provided to customers.

■ Supplement for Markem-Imaje technicians

Responsibility

Markem-Imaje machines must not be modified by customers without the prior permission of Markem-Imaje. They must be used in accordance with the specifications in the operator's manual. Changes to non-Markem-Imaje machines must be performed by customers.

Health and Hygiene

The safety data sheet (SDS) on the following pages is provided as an example only.

Always read the SDS for consumables used by a customer carefully.



Ink-resistant gloves and safety glasses must be worn during filling and cleaning operations. Technicians are strongly advised to wear a protective mask in the absence of a specific ventilation system.



The electronic circuit boards pose an electrocution hazard if touched.

Fire prevention

Follow the instructions on the safety data sheet (SDS) for each consumable used to the letter.



Have a foam, CO2 or powder fire extinguisher placed in the immediate vicinity of the printer (distance of 10 meters maximum).

Do not use spark-producing equipment (drills, grinders, welders, etc.) within a 5 meter radius around the printer.)

Do not place electrical equipment (bulbs, etc.) within a 1 meter radius around the print head, particularly when performing maintenance and cleaning.

Safety



Always keep away from open flame. Never smoke near the printer. Place a sign with the words “NO SMOKING – FLAMMABLE INK” near the printer.

Containers of ink, additive and cleaning solution must be closed and stored in a ventilated room or a fireproof cabinet.

Environment

Take the necessary precautions if the printer is used in an electrostatic environment.

System

The printer must be connected to a single-phase grounded outlet with the cord provided with it. The standard wall outlet must be above the printer in an easy-to-access location.

Handling

If the printer contains consumables, move it vertically. Do not tip it over.

Drain the printer completely before moving it in a position other than vertical.

Servicing - troubleshooting

If a specific vapor exhaust system is not in use, wear the personal protective equipment mentioned earlier (mask).



Consumables

Consumables and the printer

The Markem-Imaje printer has been factory set for the ink type selected by the customer at ordering.

We strongly advise against changing the ink type.

Using another type of ink, additive or cleaning product will severely damage the printer.

Markem-Imaje equipment is guaranteed only if used with Markem-Imaje consumables.

Use of consumables

Refer to the safety data sheets (SDS) for the ink before using a consumable.

Consumables must be used before the expiration date on the label. Beyond this date, they are no longer 100% compliant with the original specifications for use.

Safety



Safety equipment for Markem-Image technicians

Code	Description	
A20281	Safety boots	Size 40 (7½ U.S.)
A20282	Safety boots	Size 41 (8 U.S.)
A20283	Safety boots	Size 42 (8½-9 U.S.)
A20284	Safety boots	Size 43 (9½-10 U.S.)
A20285	Safety boots	Size 44 (10½ U.S.)
A20286	Safety boots	Size 45 (11-11½ U.S.)
A10937	Latex gloves - CE marked (× 20)	Palm widths: 7-7.5 cm
A10936	Latex gloves - CE marked (× 20)	Palm widths: 8-8.5 cm
A38559	Latex gloves	Size XL
A12762	Markem-Image smock	Size 2 (medium)
A12763	Markem-Image smock	Size 3 (large)
A12765	Markem-Image smock	Size 4 (X-large)
A16820	Markem-Image smock	Size 5 (XX-large)
A18588	Respirator	
A16089	Polypox liquid soap	
A16091	Blick 1000 barrier cream	
A16092	Actilis topical cream	
A20853	Personal eyewash	
A12158	Eyewash station	
A20592	Ear plugs	
A20387	Wide vision safety glasses	
EN6771	Additive transport case	



Rules of conduct for Markem-Imaje technicians when visiting customers

Safety

Technicians must comply with the safety rules in effect at the customer's site:

Prevention plan: Technicians must request and examine the customer's prevention plan (where applicable) in advance or upon arriving at the customer's site.

- Traffic areas
- Authorization to use spark-producing tools
- Authorizations to perform work
- Necessary accreditation (chemical, electrical, etc.)

If the business being visited does not provide specific equipment, technicians must wear Markem-Imaje personal protective clothing at least (see list).

System

Neither the printer nor the maintenance stand should be located in a traffic area. The entire system must be easy to access. The print head must be at least 1 meter away from all electrical devices, flames, etc.

The following safety equipment must be installed near the printer:

- Eyewash
- Safety glasses
- Appropriate gloves
- Protective mask

Make sure the head, conduit and printer do not vibrate.

The conduit should be free of wear caused by rubbing.

Check the antistatic system (antistatic brush and grounding braid) used where plastic film is manufactured/converted, extrusion is performed, surfaces rub against each other, etc.

Markem-Imaje technicians are not permitted to modify the customer's electrical system. The customer is responsible for providing compressed air, electricity and other utilities.

All sources of electric power should be outside a 1 meter radius around the head of the machine while it is running and during cleaning/maintenance.

Safety



- Block drafts within the vicinity of the print heads.
- Check the condition of the machine power sources.
- Check the machine and stands for proper grounding.

A suitable fire extinguisher should be located no more than 10 meters from the machine.

Work

- Leave the area clean after completing maintenance.
- Pick up all cloths and clean all traces of ink on the console.
- Dispose of waste in the appropriate receptacles (check with customer).
- With the customer, go over any problems that may arise on account of the system's current configuration:
 - Training
 - Servicing
 - Changes
 - Installation
 - Maintenance tray accessibility and stability
 - Accessories
 - Etc.
- Make sure the doors on the printer close correctly.
- Follow up maintenance with a production check.
- If the printer is to be moved, obtain the customer's permission first and use the appropriate tools.



Reminder of the main safety pictograms



TOXIC



XI - IRRITANT



OXIDIZER



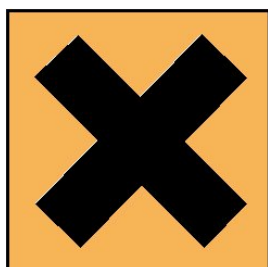
CORROSIVE



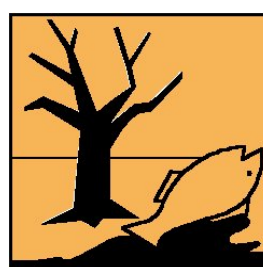
EXPLOSIVE



FLAMMABLE F, F+, F++



XN - HARMFUL



DANGEROUS FOR
THE ENVIRONMENT

Safety



Notes:



Printer Description



Printer description



Notes:



■ Introduction

Two printer versions are available:

Markem-Imaje 9020

Markem-Imaje 9030

9020 is available in one configuration:

mono-head, single jet, G type, IP54.

9020 strong points:

Ergonomic interface operator

Ergonomic and easy management of the consumable cartridges

PCMCIA/Compact Flash for back up

Logo creation

Up to 4 lines

Up to 100 messages

Large choice of barcodes, including Datamatrix

9030 is available in several configurations:

mono-head, single or twin-jet, G or M type, IP54 or IP65.

9030 strong points:

Ergonomic interface operator

Ergonomic and easy management of the consumable cartridges

PCMCIA/Compact Flash for back up

Logo creation

Up to 8 lines with twin jet configuration

Up to 880 messages

Large choice of barcodes, including Datamatrix

Ethernet connection (option)

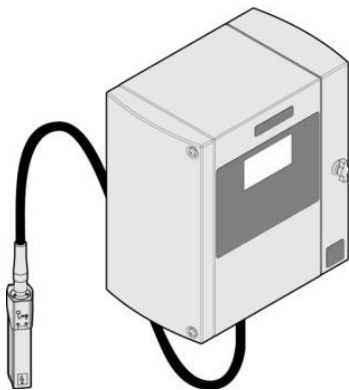
IP65 rating (option)

Printer description

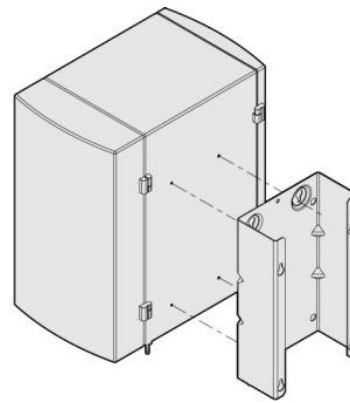


■ Cabinet

9020 and 9030 are composed of a cabinet and a print head linked by a 3 metre umbilical.



Front view



Rear view
(with printer holder)

The cabinet must be hung vertically by the fixing points located on the rear side

A minimum stand off of 90mm is necessary at the back of the printer to allow the door on the right side to be opened.

The cabinet is manufactured out of stainless steel (304L quality)

9020 meets the IP54 standards.

9030 meets the IP54 standards.

9030 meets the IP65 standards when the IP65 option is incorporated (it requires a connection to plant air).

Two doors, one on each side of the control panel, allow access to the following areas:

On the right side (facing the printer), access to the hydraulic compartment (consumable cartridges, ink circuit & PCMCIA slot).

On the left side, access to the electrical compartment (industrial interface, electronic boards & pressurisation kit if present).

Printer description



The cabinet is very compact, the dimensions are:

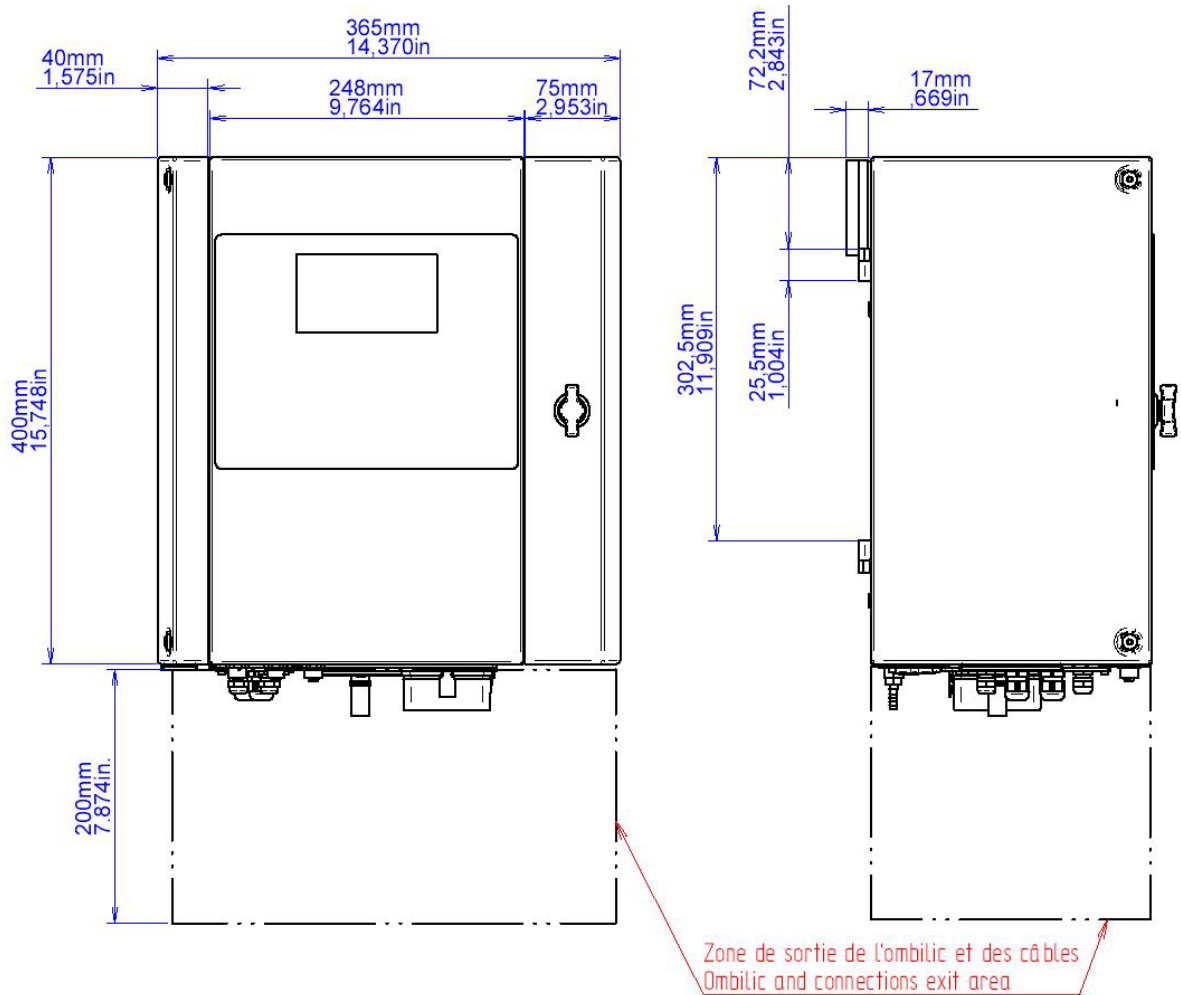
Height: 400 mm

Width: 367 mm

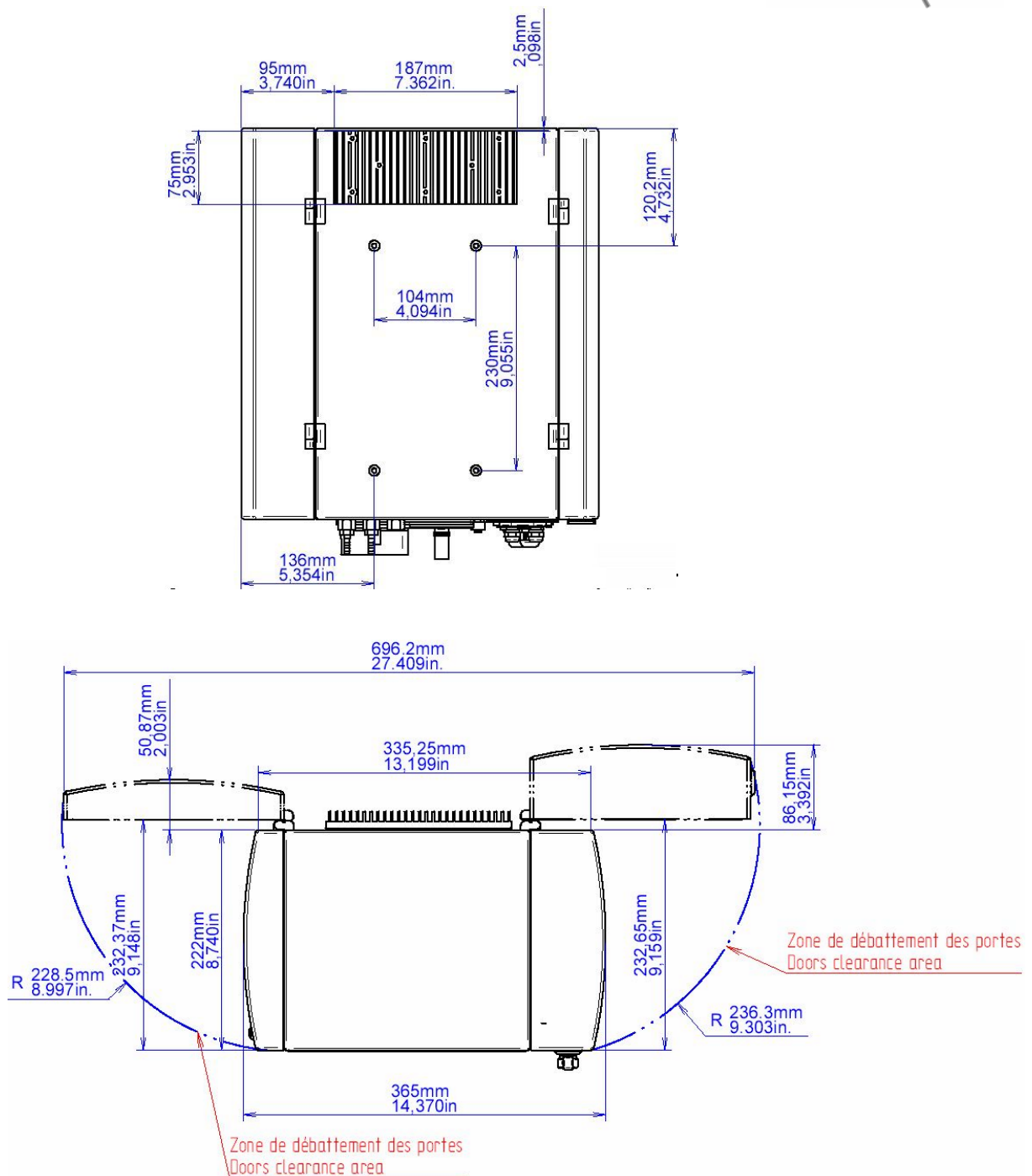
Depth: 239 mm

Volume 35 dm³ (35 litres)

Weight: is less than 20 kg (depending on options installed and cartridge status)



Printer description



The electrical connections (power supply, industrial inputs/outputs, V24...), pneumatic connections (air pressurisation, vapours extraction...) and umbilical are located at the bottom of the cabinet.

Important: The printer must run with the doors closed.



■ Operator Interface

The operator interface is user friendly thanks to

- A screen with icons for daily operations & consumable level indication
- Windows-type menu structure
- Help message to guide the operator through the different menu levels
- LED indicators which provide a quick indication of the printer status
- Large choice of operator languages

Operator Language

31 operator languages are available for the printer.

- | | | | |
|--------------|-------------|-------------|--------------|
| • English | • Swedish | • Hungarian | • Japanese |
| • French | • Danish | • Czech | • Chinese |
| • Italian | • Norwegian | • Polish | • Korean |
| • Spanish | • Finnish | • Croatian | • Thai |
| • Portuguese | • German | • Slovenian | • Taiwanese |
| • Greek | • Dutch | • Russian | • Vietnamese |
| • Hebrew | • Arabic | • Bulgarian | • Indonesian |
| • Turkish | • Iranian | • Brazilian | |

Keyboard

There are 4 keyboards available to facilitate the edition of message with non–latin alphabets.

- | | |
|----------|------------|
| • Latin | • Cyrillic |
| • Arabic | • Hebrew |

A Chinese keyboard is not available. Chinese characters are inserted during message creation/edition using the 'Pin Yin' method.

The Pin Yin method uses a Latin keyboard to type in the sound of the Chinese pronunciation, in order to obtain a list of characters corresponding to this pronunciation.

From this list, the operator selects the character that he wants.

Printer description



Edition is made by morpheme (or phoneme), that is to say the smallest linguistic segment having an independent meaning, therefore being able to be represented by a Chinese character.

Examples: beng, chan, li zao, etc.

This acquisition is incremental.

Examples:

- B results in 20 ideographs beginning with the sound [b],

- BE gives 10 ideographs beginning with the sound [be],

- BEN gives 5 ideographs beginning with the sound [ben].

There are some 410 morphemes by which one can enter the "PinYin engine", this corresponds with about 6700 different Chinese characters.



Printer description



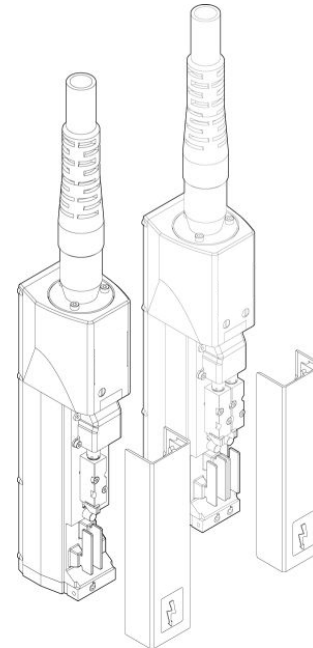
■ Print-Head & Umbilical

The print head is available in 2 versions: 1 or 2 jets

The print head is available in 2 different nozzle sizes:

- 72 μ for G head (nominal resolution : 2.8 dots/mm)
- 50 μ for M head (nominal resolution : 4.5 dots/mm)

Reminder: 9020 is only available in single jet, G type



For 9030 IP65 printer, the print head is protected by a stainless steel head protection accessory (except on bent umbilical).

Remark: This stainless steel head protection kit is available as an accessory for 9020.

Characteristics:

- 1 to 2 jets per head (unique on the market)
- Regulation of the jet speed
- One piece moulded head
- Unalterable head electrode alignment
- Head pressurization (the printer must be connected to the plant air) (option)
- Compound filled 3 meter umbilical
- Bent umbilical available in some configurations (refer to chapter 3 for more details)
- Maximum umbilical axial rotation on itself : 180° in static, 0° in dynamic (no dynamic torsion)
- Minimum bend radius of the umbilical: 115 mm dynamic, 100 mm static
- Water and Mek proof umbilical
- Compressible value of the umbilical: 10 bars during 30 seconds.
- Automatic nozzle cleaning system.

Printer description



Nozzle cleaning

During printer start-up & shutdown, make up solution is introduced into the modulation body to clean the cavity.

During these 2 phases, the gutter electro valve is rinsed as well.

Important: .The head level must be set correctly in the Preparation menu.
The nozzle cleaning sequence is optimised according to the head level parameter.



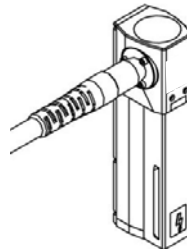
Umbilical configuration

The only umbilical length available is 3 metres

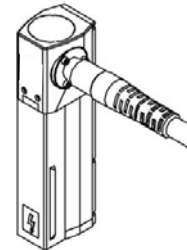
On the head end, the bent umbilical is available in several configurations.



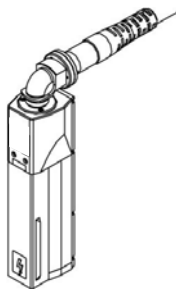
Normal configuration



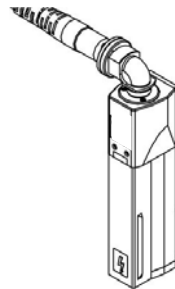
Option A35440



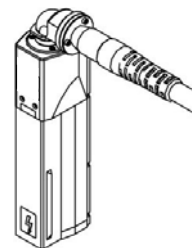
Option A35441



Option A35439



Option A35437

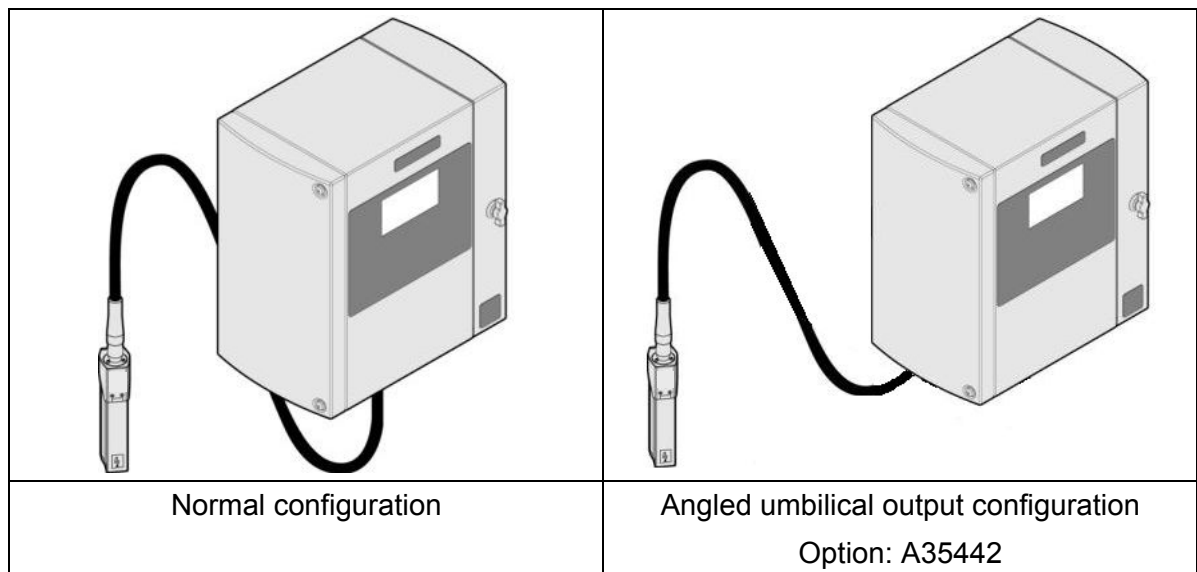


Option A35438

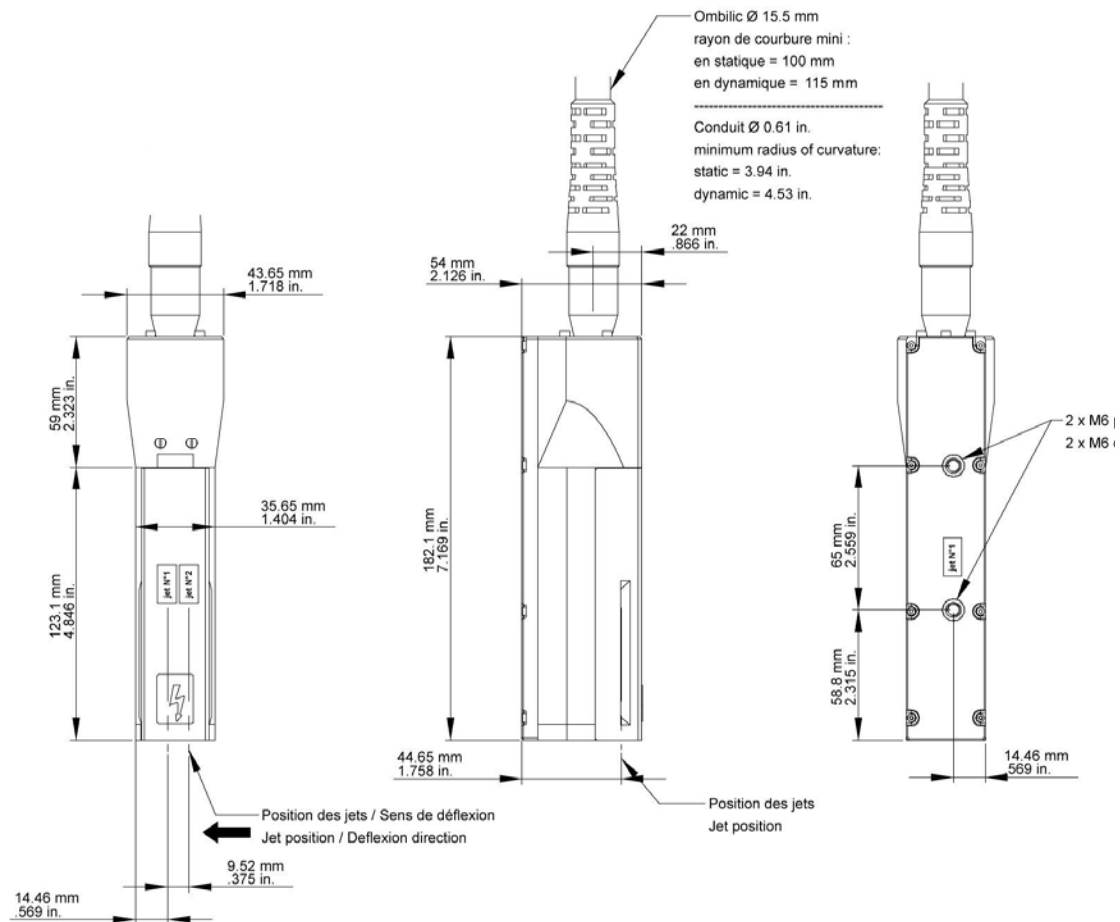
Printer description



On the cabinet side, the umbilical is available in 2 configurations:



Head dimension



Printer description

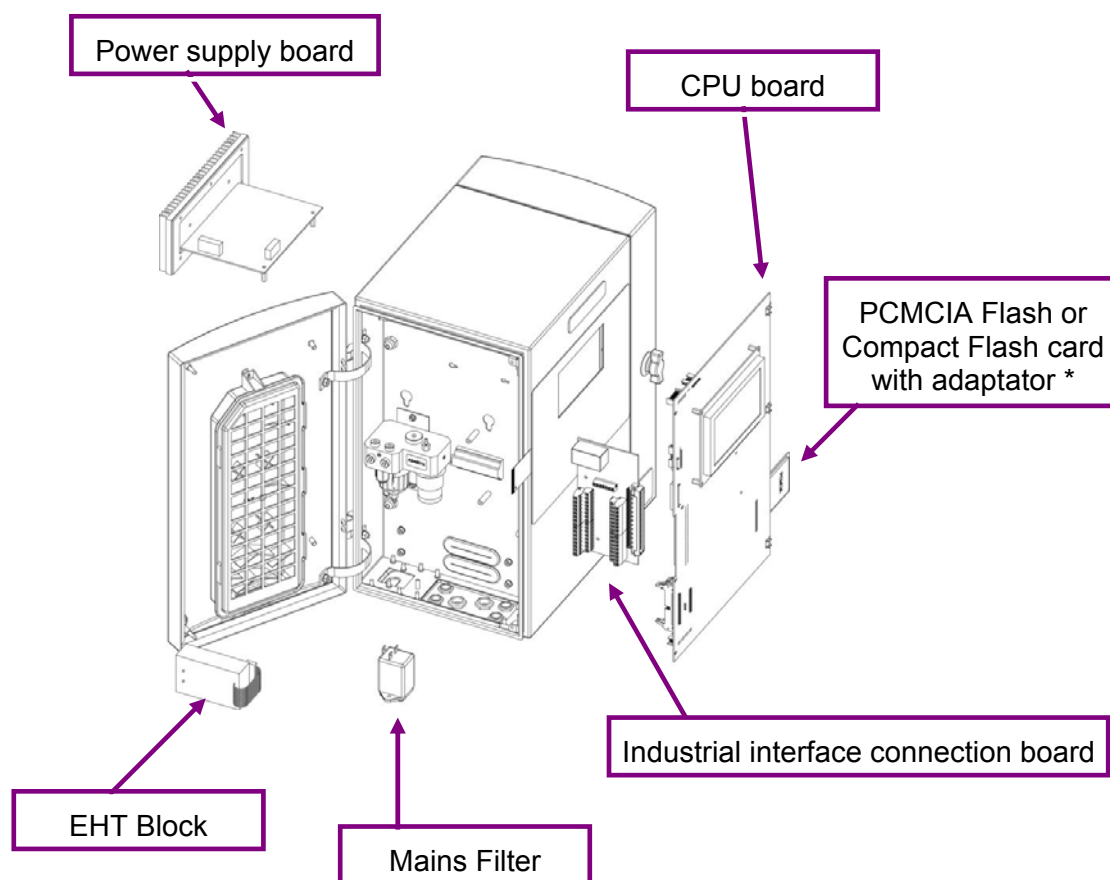


■ Electronic compartment

The electronic compartment is located on the left side of the printer.

The main electronic elements are:

- The mains filter (located in the bottom of the cabinet)
- The power supply board (located at the top of the cabinet)
- The CPU board (located just behind the operator keyboard)
- The EHT block (located just at the top of the air pressurisation kit)
- The industrial interface board (located under the EHT block)



* The PCMCIA slot is accessible from the right side of printer (Hydraulic compartment).

The location of the PCMCIA slot in the hydraulic compartment allows an operator (without any electrical experience or qualifications) to use the PCMCIA or Compact Flash card.

Printer description



CPU board

2 CPU boards are available.

- One version for 9020
Single jet only and less input/output functionality for the industrial interface board.
- One version for 9030
The same 9030 CPU board will drive single and twin jets, G or M 9030 printers.

The CPU and printing functions are located on the same board.

The backlit display is also mounted on the CPU board.

The following elements are connected to the CPU board:

- Power supply
- Industrial interface and accessories connectors
- EHT block
- Ink circuit
- Printing module
- Keyboard

Power supply board

This board supplies all voltages (24v, 15v, -15v, 5v, 3.3v) to all others elements.

Industrial interface connection board

The Industrial interface connection board allows the connection of external devices.

2 types of boards are available.

- Industrial interface connection board
- Ethernet Industrial interface connection board
(Industrial interface connection board + Ethernet connections)

	Industrial interface connection board	Ethernet Industrial interface connection board
9020	Optional with 9020	Not available
9030	standard with 9030 (but not mounted on the machine)	Optional with 9030

EHT block

The EHT block supplies the high voltage to the deflection plates on the print-head.

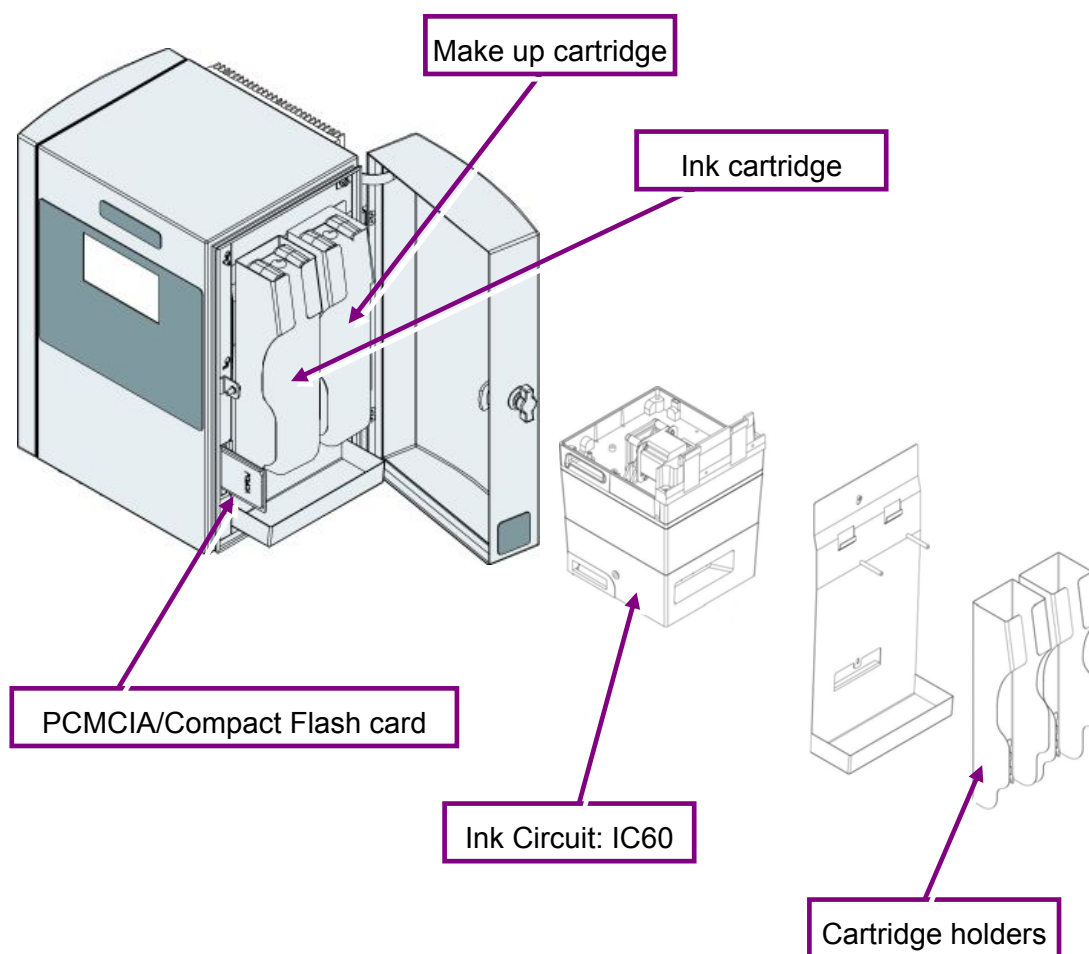
Printer description



■ Hydraulic compartment

The hydraulic compartment is on the right side of the printer.

When the operator opens the door on the right, he only has access to the consumable cartridges and the PCMCIA slot.



Printer description



■ Industrial Interface connection board

The industrial interface connection board is located in the electronic compartment, accessible via the left door.

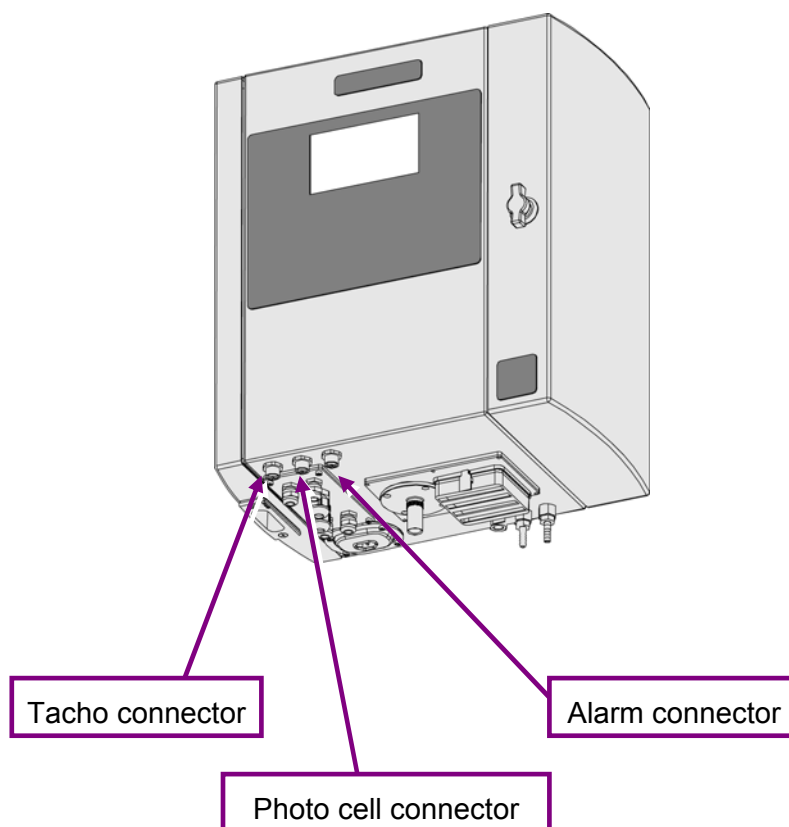
There are 2 ways to connect an external device to the printer.

For the basic and more common signals (photo cell, tacho & alarm), 3 IP65 external connectors are available to easy installation.

The Markem-Image photocells, tachometers and illuminated alarms are supplied with IP65 connectors.

For other signals, the connections are made on the industrial interface connection board through connector blocks.

External connectors



Printer description

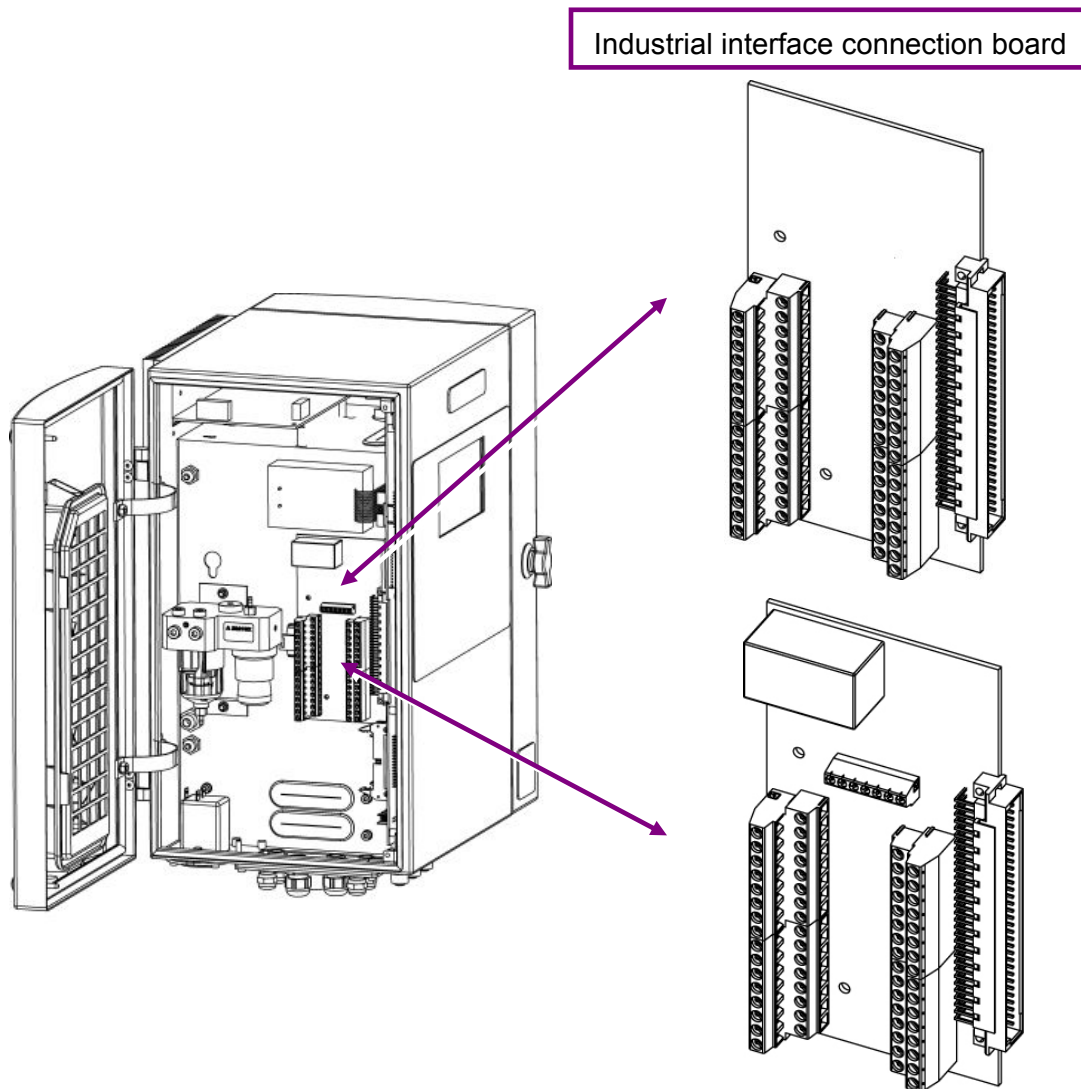


Industrial Interface connection board

The Industrial interface connection board allows the connection of external device.

2 types of boards are available.

- Industrial interface connection board
- Ethernet Industrial interface connection board
(Industrial interface connection board + Ethernet connections)



Printer description



Inputs / Outputs

		9020	9030
Object detection cell input 1	TOP1+	Standard (external connector)	Standard (external connector or Interface board)
	TOP1-		
Object detector inhibition input	INH TOP+	Option (Interface board)	Standard (Interface board)
	INH TOP-		
Tacky coders input	TACHY+	Standard (external connector)	Standard (external connector or Interface board)
	TACHY-		
Message sense inversion input	INVMES+	Option (Interface board)	Standard (Interface board)
	INVMES-		
Printer Start up/Printer Stop input	A/M+	Option (Interface board)	Standard (Interface board)
	A/M-		
Receive data RS232	RXDI	Option (Interface board)	Standard (Interface board)
Receive data RS422	RXD+	Option (Interface board)	Standard (Interface board)
	RXD-		
Transmit data RS232	TXDI	Option (Interface board)	Standard (Interface board)
Transmit data RS422	TXDI+	Option (Interface board)	Standard (Interface board)
	TXD-		
Alarm relay output	ALCONS R	Standard (external connector)	Standard (external connector or Interface board)
	ALCONS T		
	ALCONS C		
Fault relay output	ALDEF R	Standard (external connector)	Standard (external connector or Interface board)
	ALDEF T		
	ALDEF C		
Object detection cell input 2	TOP2+	Not Available	Standard (Interface board)
	TOP2-		
Reset counter input 1	RAZCPT1+	Not Available	Standard (Interface board)
	RAZCPT1-		
Increment counter input 1	INCCPT1+	Not Available	Standard (Interface board)
	INCCPT1-		
Reset counter input 2	RAZCPT2+	Not Available	Standard (Interface board)
	RAZCPT2-		
Increment counter input 2	INCCPT2+	Not Available	Standard (Interface board)
	INCCPT2-		
Parallel interface inputs	D0 to D7	Not Available	Standard (Interface board)
Common parallel interface input	COMPARA	Not Available	Standard (Interface board)
Message increment input	INCMES+	Not Available	Standard (Interface board)
	INCMES-		
Message increment sense input	SENSBIB+	Not Available	Standard (Interface board)
	SENSBIB-		
Printing status output	ETATIMP+	Not Available	Standard (Interface board)
	ETATIMP-		
Message synchronisation output	SYNCMES+	Not Available	Standard (Interface board)
	SYNCMES-		
Ethernet connection		Not Available	Option (Interface Ethernet board)



Terminals

J1

[illegible]

+24VP		①
A/M-	①	
A/M+		①
* IN1-	①	
* IN1+		①
TXDI	①	
RXDI		①
TXDI+	①	
RXD+I		①
TXD-I	①	
RXD-I		①
GND	①	
ALCONS R		①
ALCONS C	①	
ALCONS T		①
GND	①	

J4

* Not used

Printer description



■ General specification

Physical characteristics

- | | |
|----------------------------|--|
| Dimensions (mm) | ☐ Printer body.....400 x 355 x 215 |
| | ☐ Print head (straight).....182 x 36 x 43 |
| | ☐ Consumable cartridge250 x 55 x 55 |
|
Weight (kg) |
☐ Complete machineless than 20 kg |
| | ☐ Cartridgeless than de 0,8 kg |
|
Stainless steel |
☐ 304L |

Operating limits

- | | |
|------------------------------|---|
| Operating temperature | ☐ + 0°C à + 40°C.
(Use of certain ink can limit the temperature range, see ink technical data sheet). |
| Humidity | ☐ 10 à 90 % without condensation. |
| Altitude | ☐ 2000 m maximum. |

Installation details

- | | |
|---|---|
| Working position of the printer | ☐ Vertical for the printer cabinet |
| | ☐ Any position for print head |
|
Maximum height offset between head and Printer cabinet |
☐ Programmable, between -1,5 m & + 2 m (-60 & 78.75 inches). |
| | ☐ Umbilical length 3 m (118 inches). |

Printer description



Compliance with standard

Safety	☐	Conformity (self-certification): CE marking conforms with the machine directive, the electromagnetic compatibility directive and the low voltage directive: CEI 60950 (UL 60950, EN60950), CEI 60204-1 (EN60204-1).
	☐	Accreditations (third-party bodies): UL label according to UL 60950, CSA label according to CSA C.22.2.950, GS label according to EN 60204-1 and ZH 1/10* EX-RL/03.85.
Protection	☐	EN60529
Mechanical parts	☐	Vibrations NF EN 22247 NF EN 60068-2-29
	☐	Impacts (bare product) falls/impacts NF EN22248
Electromagnetic compatibility		NFH00 -60 NFH00-41, 47, 58, 59
	☐	Emissions EN 61000-6-4
	☐	Immunity EN 61000-6-2

Printer description



■ Energy

- 100 - 120V 0.5A alternative (Automatic switching).
200 - 240V 0.3A alternative (Automatic switching).
Frequency 50 or 60 Hz
Power 60 VA.
Main fuse 1.25 AT
- ☐ Air pressurised (for 9030 IP65)

Specifications	Value
Air quality	Max: 0.12 grams of water/m ³ (0.15 oz. of water/cubic foot) – 1 PPM of oil and size of particle < 5µ
Filtration	> 90% (particle > 0.1µm)
Required air input flow rate	800 NI/hour (0.47 scfm) for a IP54 version equipped with air pressurisation at 7 bar (101 PSI)
	1600 NI/hour (0.94 scfm) for a 9030 IP65 printer at 7 bar (101 PSI)
Nominal air supply pressure	5 < P < 10 bar (72.5 < P < 145 PSI)
Service temperature	0 < T < 60°C (32 < T 140°F)

- No adjustment of the air input pressure is necessary
- Little maintenance (one filter change every 6 months or 4000hr)
- Permanent draining of the water (through a pipe connected of the bottom of the cabinet).
- Possibility to connect the air drying kit

Printer description



Notes:



Installation



Installation



Notes:

Installation



■ OOBCL

Date:	MARKEM-IMAJE	Page: 1/1	C.S.Q.A.
Out Of Box Checking List. OOBCL (to be filled by MARKEM-IMAJE technicians)			
Customer:	Service engineer:	File name:	
New printer or secondhand printer:	Ink:	QAG-127 A	
Serial Number:	Type:	SCP	
Manufacturing date:	Printer start up on:		
1- RECEPTION: SHIPMENT & PACKING CHECK (mark-up if yes)			
Did you make a Logistic Complaint ?		☐	
<i>In case of Logistic Problem, please refer to QAG-101</i>			
2- STARTING UP: (Mark-up if yes)			
Start-up<15mn ?		☐	
(from on/off to ready to print)			
Description of problems		Remarks	
Canon problem			
Jet not centered in the gutter			
Unstabled jet			
Canon blocked			
Exchange necessary			
ELV / valve problem			
ELV / valve blocked			
Exchange necessary			
Pressure or vacuum problem			
Blockage			
Leakage			
Ink module or pump exchange			
Motor speed or autocalibration problem			
Electronic or electric problem			
Electronic part exchange			
Break-off point setting problem			
Poor printing quality			
EHT Defaults/open cover/vacuum/levels			
Accessories problem			
3- CONTRACT REVIEW (for local analysis)			
Internal complaint		Remarks	
Difference between the offer and customer needs			
Difference between offer and order			
Difference between order and acknowledge of receipt			
Remarks			
4- REMARKS		Time for starting up hour	
		Time for complete installation hour	



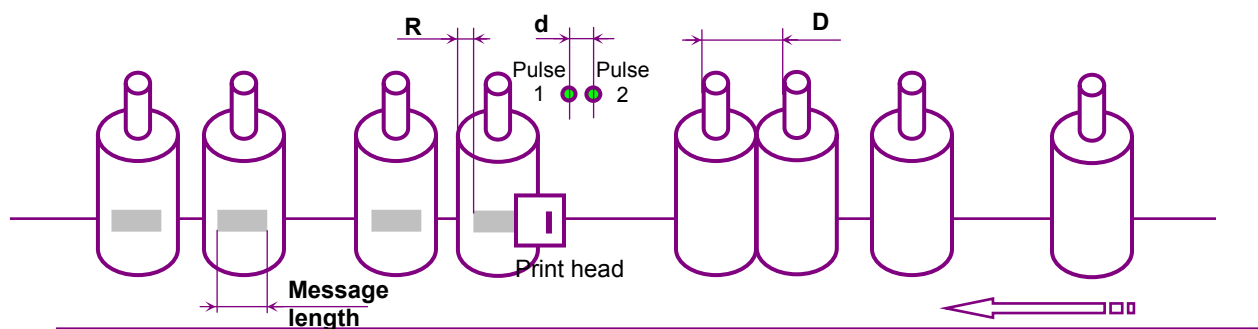


■ Installation of two cells

NEW: Two object detection cells may be installed on 9020 and 9030 printers to measure the speed at which objects to be printed are conveyed and adjust the printing speed accordingly.

IMPORTANT: the industrial interface board must be installed on the printer.

Diagram:



Principle

The two cells are spaced apart at a distance of “d” with “Pulse 2” first and “Pulse 1” last. This distance must be set in the printer to the nearest millimeter.

ATTENTION: The minimum programmable distance between cells is 10 mm.

The printer measures the time the object takes to travel distance “d” between “Pulse 2” and “Pulse 1”.

The speed of movement of the object is calculated by:

$$S = d/\text{time}$$

Installation



NOTE: This speed is an average.

The calculation time is masked in the “margin” (Delay: R)

The minimum margin is 3 mm.

The margin is calculated based on the set speed programmed in the printer, not the calculated speed.

The cell “pulses” that appear while the message is being printed are not taken into consideration.

The following rule must always be used when installing the system:

$$D > d + \text{margin} + \text{message length}$$

D: minimum space between objects

d: distance between cells

Margin: Time between “Pulse 1” and the start of marking. The mechanical offset of the cell with the print head is not to be taken into account.

TIP: Position the print head mechanically in order to program the narrowest margin possible (3 mm).



■ Starting the printer for the first time

- Plug the AC power cord provided with the printer into an electrical outlet (do not modify it):

- Female plug into printer and rubber blanking cap

- Male plug into a standard outlet (2 pole, grounded)

- Take the factory-fitted protective caps off the inputs and outputs

- Cartridge holder tips

- Condenser vent outlet

- Head pressurization air intake

- Air handling filter condensate outlet

- Insert the ink and additive cartridges in their respective slots.

- Press the On/Off button twice then press ENTER to confirm.

- Set the head height difference in 50 cm stages (Menu “Printer Preparation - Initialization - Printer - Difference”).

This is the difference between the level of the head (in the working position) and the ink module. In practice, the difference in level between the head and the bottom of the console can be measured.

Enter a negative value if the head is lower than the console.

WARNING: *To avoid affecting the concentration of the ink, do not operate the jet for more than 5 minutes on the maintenance stand if the stand is not level with the manufacturing stand.*

The jet starts up automatically when the condition of the ink is optimal.

When the green “Head Status” LED is lit steady (after a total time of approx. 8 minutes), the jet has finished starting and the printer is ready to print.



■ Operator Information

Daily start-up

- ☐ Press the On/Off button (press twice if screen is off).
- ☐ Press ENTER to confirm.

The ink circuit and the jet start up automatically.

The printer is ready to print when the green “Head Status” LED is lit steady.
Starting time: approx. 1 min.

Installation



Shutting off the printer for a period of less than three weeks

- ☐ Press On/Off.
- ☐ Press ENTER to confirm.

The printer shuts off in approx. 30 seconds even if the jet is operating.

Shutting off the printer for more than three weeks

If the printer is to be shut off for a period of more than three weeks, it must be drained and rinsed (see Draining and Rinsing section).

Once drained and rinsed, the printer can be stored away for up to two months.

If the printer is to be stored away for longer than two months, drain and rinse it once every two months.

COMMENT: Remove the cartridges and place the caps back on the tip holders after draining and rinsing.



Head operations

Starting and stopping the jet

The jet only needs to be stopped when performing maintenance on the print head. Turn the jet back on after maintenance is completed.

IMPORTANT: *Turning off the jet does not turn off the machine.*

Cleaning the head

- ☐ Turn off the jet.

The recovery solenoid valve is closed the entire time the jet is stopped to prevent any ink being drawn into the recovery gutter.

- ☐ Place the head vertically on its maintenance stand with the conduit up.
- ☐ Clean the head (modulation chamber, charge electrode, deflection electrodes and gutter) with the cleaning flask of additive or cleaning solution.

If the head cover is dirty (inside or outside), hold it above the maintenance tray and clean it with the cleaning flask of additive or cleaning solution.

- ☐ Dry the head and cover with the blower bulb.
- ☐ Start the jet.
- ☐ Check the head then place it on its manufacturing stand.
- ☐ Acknowledge any faults.

Installation



Unblock Nozzle

Use this function (Production – Maintenance – Jet maintenance) when there is no jet or the jet is deflected.

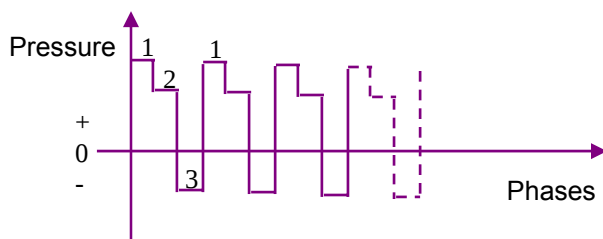
States of the head solenoid valves during this function

	Ink SV (A)	Drain SV (B)	Additive SV (C)	Rinsing SV (D)	Recovery SV (E)
Phase 1	Open	Closed	Closed	Closed	Closed
Phase 2	Open	Open	Closed	Closed	Closed
Phase 3	Closed	Open	Closed	Closed	Closed

A cycle is made up of three phases, each lasting approx. one-third of a second.

These phases follow each other automatically and the cycles repeat themselves as long as the “Unblock Nozzle” cycle is on.

Diagram of pressure levels in the resonator block:



Procedure

- ☐ Select “Unblock Nozzle”.
- ☐ Stop the jet as soon as it appears.
- ☐ Activate “Check Jet Stability” for approx. 30 seconds

COMMENT: If the jet does not appear within one minute of selecting “Unblock Nozzle”, stop the jet and select “Intro. Cleaning Solution”.

Installation



Intro. Cleaning Solution

Use this function (Production – Maintenance – Jet maintenance) when the jet is deflected.

States of the head solenoid valves during this function

	Ink SV (A)	Drain SV (B)	Additive SV (C)	Rinsing SV (D)	Recovery SV (E)
Phase 1	Closed	Open	Closed	Closed	Closed

This function has only one phase and does not have a time limit.

The pressure in the modulation chamber is negative the entire time the function is on.

Procedure

- ☐ Activate “Intro. Cleaning Solution”.
- ☐ Using the cleaning flask, spray cleaning solution on the nozzle for 5 seconds.
- ☐ Stop spraying for 5 seconds.
- ☐ Repeat both steps three times.
- ☐ Turn off the jet.
- ☐ Activate “Check Jet Stability” for approx. 30 seconds.

NOTE: The suction can be checked in the bleed hose (blue hose in the ink circuit compartment). Bubbles of air, additive and ink should flow from the conduit to the ink circuit.



Check Jet Stability

Use this function (Production – Maintenance – Jet maintenance) when the jet is unstable.

States of the head solenoid valves during this function

	Ink SV (A)	Drain SV (B)	Additive SV (C)	Rinsing SV (D)	Recovery SV (E)
Phase 1	Open	Open	Closed	Closed	Open
Phase 2	Open	Closed	Closed	Closed	Open

This two-phase function does not have a time limit.

The resonator block is always supplied with ink. The opening and closing of the drain solenoid valve makes the pressure in the resonator block change abruptly, helping to expel the air bubbles and stabilize the position of the jet in the gutter.

Procedure

- ☐ Activate “Check Jet Stability” for 30 seconds.
- ☐ Turn off the jet.
- ☐ Clean dry the head and the head cover.
- ☐ Start the jet, close the head cover and place the head back on its manufacturing stand.
- ☐ Acknowledge any faults



General comments regarding head operations

If a problem arises when the jet is turned on (unstable jet or no jet), all four operations (Unblock Nozzle, Intro. Cleaning Solution, Check Jet Stability and Head Cleaning) may be need to be performed to correct it.

If the problem persists despite repeating the sequence three times in a row, turn off the printer before removing or changing its parts.

Doing so will ready the printer for disassembly (resonator block rinsed, tanks not under pressure, etc.).

REMINDER: *The accumulator remains inflated at its operating pressure (2.5 to 3 bar) after the jet is turned off.*

Installation



Notes:



After sales service policy



After sales service policy



Notes:

After Sales Service Policy



■ ACCESS maintenance agreement

Purpose: List of points to be checked during ACCESS maintenance agreement 9020 / 9030

1 - General information

Customer name: _____ Date : _____
Town : _____ Printer serial no. : _____
Contact name : _____ Visit report no. : _____
Contract no. : _____ Service engineer : _____

2 - Printer information before maintenance

Type of printer: ☐ 9020 ☐ 9030 IP54 ☐ 9030 IP65
Head type: ☐ 1.1 ☐ 1.2 ☐ G ☐ M
Reference of the ink: _____ Reference of the make up: _____
Total hours: _____ hrs
Active hours: _____ hrs
Software version CPU Appli: _____ IMP Appli: _____
Boot: _____ Boot: _____
Printer cabinet: ☐ Securely mounted ☐ No leakage
☐ No mechanical damage ☐ No door sealing damage
Comments: _____
Print module ☐ securely mounted ☐ No leakage ☐ No mechanical damage
Comments: _____

3 - Installation

Accessory adjustment (cell, tacho., etc.) ☐ Checked
Installation to MARKEM-IMAJE specifications (temperature, console/head distance) ☐

Printer connected to suitable power supply and correctly grounded ☐ _____
No vibrations on head(s) ☐ _____
Head/object distance as specified ☐ _____
Position of umbilic (no vibrations, radius of curvature > 150 mm) ☐ _____
Correct grounding of cabinet, head and stand ☐ _____

After Sales Service Policy



4 – Operational check before maintenance

	OK	Not OK	Comments
Operator interface functioning	☐	☐	
Printer start-up	☐	☐	
Jet centered and stable	☐	☐	
No gutter overflow	☐	☐	
Break-off point setting	☐	☐	
Jet speed differential jet1 to jet 2 < 1m/s	☐	☐	

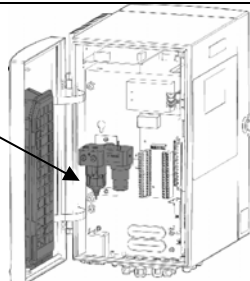
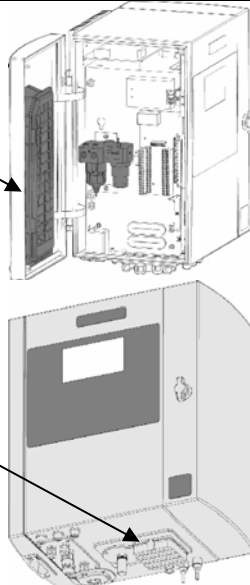
Pref: _____b Pacc: _____b T: _____°C Ptamp: _____b

MANUAL PRINT TEST SAMPLE (or comments in case the printer does not function properly)

After Sales Service Policy



5 – Parts replaced

Pressurization kit filter	Part	Location	
<u>Part number:</u> ENM16203 <u>Location:</u> left side of the printer cabinet <u>Replacement:</u> 6 months * * depends on the quality of the air and can be adjusted accordingly <u>Quantity:</u> 1			☐ Part replaced
Air filters **	Part	Location	
<u>Part number:</u> A36022 includes to filters <u>Location:</u> left side of the printer cabinet and under the cabinet <u>Replacement:</u> 1 year or 8 000 Hrs* (total hours counter) * depends on the quality of the air and can be adjusted accordingly <u>Quantity:</u> 1	 		☐ Part replaced

** not applicable in case of IP65 printer

After Sales Service Policy



6 – Printer rinsing

The printer must be rinsed every two years

Last printer rinsing date: ____ / ____ / ____

Rinsing: required ☐ Yes ☐ No

Rinsing: complete ☐ OK ☐ Not OK

Comments: _____

7 – Parts replaced (other than those included in the maintenance agreement)

Parts replacement ☐ Yes ☐ No

Part number	Description	Comments
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

8 –Software update

Software update available	☐ Yes ☐ No	Comments
Software update performed	☐ Yes ☐ No	_____

Software versions after update	CPU	Appli: _____	IMP	Appli: _____
		Boot: _____		Boot: _____

9 –Operational test after parts replacement and update

Printer start-up	☐ OK ☐ Not OK	Comments
No ink leakage	☐ OK ☐ Not OK	_____
Ink type setting	☐ OK ☐ Not OK	_____
Head level setting	☐ OK ☐ Not OK	_____
Autocalibration	☐ OK ☐ Not OK	_____
(only if the ink circuit has been changed)		

Faults checking	OK	Not OK	Comments
Cover fault	☐	☐	_____
Recuperation fault	☐	☐	_____
EHT fault	☐	☐	_____

Once the printer is ready to print:	OK	Not OK	Comments
Jet centered and stable	☐	☐	_____
No gutter overflow	☐	☐	_____
Break-off point setting	☐	☐	_____
Jet speed differential jet1 to jet 2 < 1m/s	☐	☐	_____

Pref: _____b Pacc: _____b T: _____°C Ptamp: _____b

MANUAL PRINT TEST SAMPLE

After Sales Service Policy

10 User

<u>10-User</u>	Yes	No	Comments
The user knows the safety rules	☐	☐	
Printer documentation is available	☐	☐	
The user knows basic maintenance procedures	☐	☐	
The user knows how to use the operator interface	☐	☐	
The user needs training	☐	☐	

11 Maintenance report

	Yes	No	Comments
Maintenance complete	☐	☐	

Action to be taken by Markem-Imaje by ____ / ____ / ____^α	Action to be taken by customer by ____ / ____ / ____ α α α α α
Service engineer Name: Signature:	Customer Name: Signature:

After Sales Service Policy



Appendix: Time schedule

We have tried to estimate the time you need for each section.
This sheet is for the Markem-Imaje network, but can be given to the customer on request.

§	Section	Approx time (min)	Comments
1	General information		To be filled in before service
2	Printer information before maintenance	5	
3	Installation	5	
4	Operational check before maintenance	5	
5	Parts replaced	20	Air filter replacement
6	Printer rinsing	45	Every two years only
7	Parts replaced (other than those included in the maintenance agreement)	-	Related to the part changed
8	Software update	5	
9	Operational test after parts replacement and update	20	
10	User	10	
11	Maintenance report	5	
	Total	120	Does not include the software update

After Sales Service Policy



■ STANDARD maintenance agreement

Purpose : List of points to be checked during STANDARD maintenance agreement 9020 / 9030

1 - General information

Customer name: _____ Date : _____
Town : _____ Printer serial no. : _____
Contact name : _____ Visit report no. : _____
Contract no. : _____ Service engineer : _____

2 - Printer information before maintenance

Type of printer: ☐ 9020 ☐ 9030 IP54 ☐ 9030 IP65
Head type: ☐ 1.1 ☐ 1.2 ☐ G ☐ M
Ink reference: _____ Make up reference: _____
Total hours: _____ hrs
Active hours: _____ hrs
Software version CPU Appli: _____ IMP Appli: _____
Boot: _____ Boot: _____
Printer cabinet: ☐ Securely mounted ☐ No leakage
☐ No mechanical damage ☐ No door sealing damage
Comments: _____
Print module ☐ securely mounted ☐ No leakage ☐ No mechanical damage
Comments: _____

3 - Installation

Accessory adjustment (cell, tacho., etc.) ☐ Checked
Installation to MARKEM-IMAJE specifications (temperature, console/head distance) ☐
Printer connected to suitable power supply and correctly grounded ☐
No vibrations on head(s) ☐
Head/object distance as specified ☐
Position of umbilic (no vibrations, radius of curvature > 150 mm) ☐
Correct grounding of cabinet, head and stand ☐

After Sales Service Policy



4 – Operational checks before maintenance

	OK	Not OK	Comments
Operator interface functioning	☐	☐	
Printer start-up	☐	☐	
Jet centered and stable	☐	☐	
No gutter overflow	☐	☐	
Break-off point setting	☐	☐	
Jet speed differential jet1 to jet 2 < 1m/s	☐	☐	

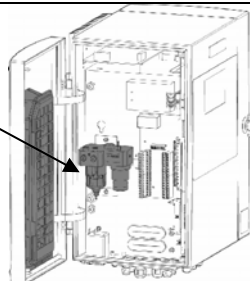
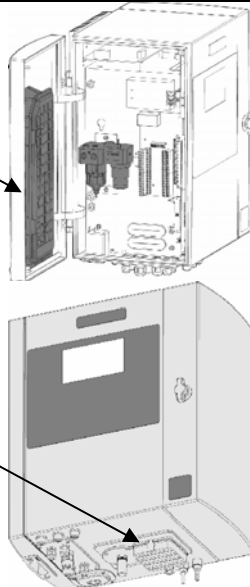
Pref: _____b Pacc: _____b T: _____°C Ptamp: _____b

MANUAL PRINT TEST SAMPLE (or comments in case the printer does not function properly)

After Sales Service Policy



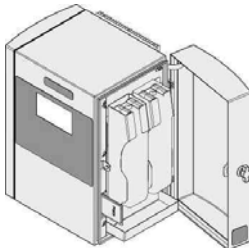
5 – Parts replaced

Pressurization kit filter	Part	Location	
<u>Part number:</u> ENM16203 <u>Location:</u> left side of the printer cabinet <u>Replacement:</u> 6 months * * depends on the quality of the air and can be adjusted accordingly <u>Quantity:</u> 1			☐ Part replaced
Air filters **	Part	Location	
<u>Part number:</u> A36022 includes to filters <u>Location:</u> left side of the printer cabinet and under the cabinet <u>Replacement:</u> 1 year or 8 000 Hrs* (total hours counter) * depends on the quality of the air and can be adjusted accordingly <u>Quantity:</u> 1	 		☐ Part replaced

**: not applicable in case of IP65 printer

After Sales Service Policy



Ink circuit**	Part	Location	
<u>Part number:</u> related to the ink base <u>Location:</u> accessible from the right door <u>Replacement:</u> 8 000 Hrs (active hours counter) or 4 years <u>Quantity:</u> 1			☐ Part replaced

** : the printer must be rinsed before changing the ink circuit

6 – Printer rinsing

The printer's ink circuit must be rinsed every two years only if the ink circuit has not been changed.

Last printer rinsing date: ____ / ____ / ____
(in case the ink circuit has not been changed)

New ink circuit ☐ Yes ☐ No
(in this case, rinsing is not required)

Rinsing: required ☐ Yes ☐ No

Rinsing: complete ☐ OK ☐ Not OK
Comments: _____

7 – Parts replaced (other than those included in the maintenance agreement)

Parts replacement ☐ Yes ☐ No

Part number	Description	Comments
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

8 – Software update

Software update available ☐ Yes ☐ No
 Software update performed ☐ Yes ☐ No
 Comments _____

Software versions after update CPU Appli: _____ IMP Appli: _____
 Boot: _____ Boot: _____

After Sales Service Policy



9 –Operational test after parts replacement and update

	OK	Not OK	Comments
Printer start-up	☐	☐	_____
No ink leakage	☐	☐	_____
Ink type setting	☐	☐	_____
Head level setting	☐	☐	_____
Autocalibration	☐	☐	_____
(only if the ink circuit has been changed)			

Fault checking

	OK	Not OK	Comments
Cover fault	☐	☐	_____
Recuperation fault	☐	☐	_____
EHT fault	☐	☐	_____

Once the printer is ready to print:

	OK	Not OK	Comments
Jet centered and stable	☐	☐	_____
No gutter overflow	☐	☐	_____
Break-off point setting	☐	☐	_____
Jet speed differential jet1 to jet 2 < 1m/s	☐	☐	_____

Pref: _____ b Pacc: _____ b T: _____ °C Ptamp: _____ b

MANUAL PRINT TEST SAMPLE

10 User

	Yes	No	Comments
The user knows the safety rules	☐	☐	_____
Printer documentation is available	☐	☐	_____
The user knows basic maintenance procedures	☐	☐	_____
The user knows how to use the operator interface	☐	☐	_____
The user needs training	☐	☐	_____

	Yes	No	Comments
Maintenance complete	☐	☐	



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After Sales Service Policy



Appendix: Time schedule

We have tried to estimate the time you need for each section.
This sheet is for the Imaje network, but can be given to the customer on request.

§	Section	Approx time (min)	Comments
1	General information		To be filled in before service
2	Printer information before maintenance	5	
3	Installation	5	
4	Operational check before maintenance	5	
5	Parts replaced	20	Air filter replacement
		45	Rinsing
		30	Ink circuit replacement
6	Printer rinsing	45	Only if the ink circuit has not been changed
7	Parts replaced (other than those included in the maintenance agreement)	-	Related to the part changed
8	Software update	5	
9	Operational test after parts replacement and update	20	
10	User	10	
11	Maintenance report	5	
	Total	150	Does not include the software update and includes only one rinsing

After Sales Service Policy



Notes:



Maintenance



Maintenance



Notes:

Maintenance



■ Preventive and proactive maintenance table

Frequency	Action	Duration	Comments
When clogging causes the printer to malfunction or to produce poor quality print.	Clean the print head	5 min.	See "User manual".
4000 hours* or every 6 months	Change the filter of the air treatment unit (for pressurized head and console IP65)	10 min.	* Number of hours when the printer is connected to the compressed air.
8000 hours* or every year	Change the air intake filters (console IP54)	10 min.	* Number of hours when the printer is connected to the power supply.
8000 hours or every 5 years	Change the Ink Circuit IC60	30 min.	Number of hours when the printer is ON.
Before a shut-down lasting for more than 21 days and Before changing of the Ink Circuit IC60 or of the Print Module	Rinse the printer	45 min.	For a shut-down lasting for more than 2 months, rinse every 2 months.



■ Three reasons why 9020/30 printers require maintenance

Ink circuit

Mechanical components in the hydraulic system wear down due to repetitive movements (solenoid valves, pumps), rubbing, chemical attack (seals) and temperature variations.

Narrow passages (nozzle, leaks or calibrated passages) can become partially clogged with ink particles or dust entering the ink circuit.

Air filters can become fouled by dusty, humid air contaminated with oil vapors.

Ink filters can become clogged by dust drawn in by the recovery gutter.

Ink

The ink used is a quick-drying, active chemical that can degrade when exposed to contaminants in the air and surrounding environment.

Ink/machine pair

During printing, the ink is subjected to extreme variations in high and low pressure.



■ To sum up

Ink Circuit

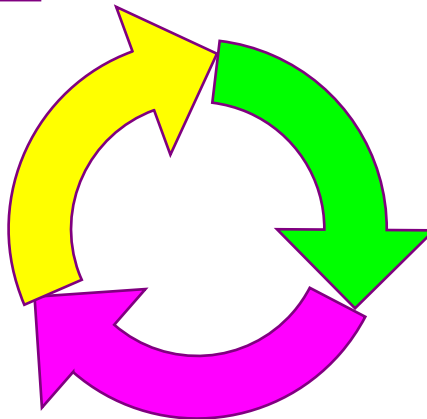
Moving parts

- Presence of wear parts
 - Solenoid valves
 - Seals
 - Pumps
- Micro-conduit
 - Restrictors
 - Nozzle
- Filters
 - Main filter
 - Grids

Ink

Active chemical

- Limited life
- Fast drying
- Sensitive to temperature variations



Ink/printer

Ink preparation

- Pressure
 - Ink compressed
 - Ink forced through calibrated passages
- Negative pressure:
 - Ink expands
 - Intake of dust

Maintenance is mandatory

Maintenance



Notes:



Troubleshooting



Troubleshooting



Notes:

Troubleshooting



■ Abbreviations table used in this chapter

Abbreviation	Signification
Accu	Accumulator
Algo	Algorithm
IC	Ink Circuit
CPU	Central Process Unit
CRC	Cyclic Redundancy Control
PM	Print Module
Piezo	Piezoelectrique Resonator
ASS	After Sales Services





■ Troubleshooting.

The first thing to do is to read the help message displayed on the printer.

The table on the following pages provides details regarding the alarm or fault displayed.

The first column gives the number (in ascending order) and type of alarm or fault:

A: alarm, printing may continue

D: fault, printing disabled

The third column lists checks, causes, remedies and solutions by order of probability. There is, usually, only one cause of a fault.

Maintenance procedures for solving several faults are described in detail on the pages following the table.

These procedures are:

Solenoid valve test

Releasing solenoid valve 0

Partial drain

Full drain

Rinsing the ink circuit IC60

Auto-calibration

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
2 D	CRC EEPROM Ink circuit incorrect	The CRC calculated when the printer is switched on is different from the CRC stored. Consequences: The IC60 time counter information is lost, but the module continues to run as usual.	
3 D	CRC EEPROM CPU incorrect	The CRC calculated when the printer is switched on is different from the CRC stored. Consequences: Ink type data is lost. The IC60 stops and printing is disabled.	1- Re-enter the ink type parameter values. 2- Perform the auto-calibration procedure. 3- If the fault reappears, change the CPU board.
4 D	CRC Flash memory error (print)	The software upgrade did not install properly. Consequences: Unreliable printer operation. The printer may crash.	1- PCMCIA/Compact Flash card reader defective Reinstall the software 2- PCMCIA/Compact Flash card Insert another card 3- Upgrade file Check the files on the card. Load another file.
8 D	CRC Flash memory error (Algorithm)	The CRC calculated when the printer is switched on is different from the CRC stored. Consequences: The algorithm data is unusable because the flash memory was written incorrectly.	1- PCMCIA/Compact Flash card reader defective Reinstall the software 2- PCMCIA/Compact Flash card Insert another card 3- Upgrade file Check the files on the card. Load another file.
10 A	External communication timeout	The serial communication between a processor and the printer was interrupted. Consequences: The data sent to the printer may be wrong.	1- Check wiring and connections 2- Check the printer configuration (transmission rate, etc.)



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
11 D	Internal communication timeout	The dialogue between the CPU processor and the Printing processor was interrupted at start-up. Consequences: Printing is disabled.	1- Restart the printer 2- CPU
14 D	Incorrect external data received	The data received from the external connection is wrong. Consequences: Printing is disabled.	Check the value of the check byte and whether the identifiers used to communicate with the printer exist.
17 D	CRC(RAM) incorrect for algorithms	This fault may appear in the following two cases: - The CRC calculated when the printer is switched on is different from the CRC stored. - Contents of PCMCIA/Compact Flash card are incorrectly written to the printer. Consequences: Inconsistent data.	Reload the *.HEM files on the PCMCIA / Compact Flash card into the printer. Check the data in the "View Algos" menu. Check the *.HEM file loaded.
18 D	Font used in message not available	The message selected or sent over the serial link contains a font number not available in the printer Consequences: The message cannot be printed.	Check the available fonts and load the missing ones in the *.HEM file.
19 D	CRC(RAM) incorrect for fonts	This fault may appear in the following two cases: - The CRC calculated when the printer is switched on is different from the CRC stored. - Contents of PCMCIA/Compact Flash card are incorrectly written to the printer. Consequences: Inconsistent data.	Reload the *.HEM files on the PCMCIA /Compact Flash card into the printer. Check the data in the "View Algos" menu. Check the *.HEM file loaded.



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
21 A	Duplicate print not authorized	Three conditions are required for this fault to appear: - the serial link is used. - the "Print-out no double up" option must be selected. - two consecutive attempts must be made to print the same message. Consequences: The message is printed only once.	Check timing of sending of messages and Dtop.
22 D	CRC(RAM) message memory lost	The CRC calculated when the printer is switched on is different from the CRC stored. Consequences: The messages in the library are lost.	1- Reprogram the messages. 2- Check the position of the battery jumper on the CPU. 3- Check the voltage of the CPU battery. 4- Replace the CPU.
25 D	FPGA impossible to program	When printer switched on. Consequences: The printer cannot print.	Replace the CPU.
26 D	CRC message library incorrect	The CRC calculated when the printer is switched on is different than the CRC stored. Consequences: The messages in the library are lost.	1- Reprogram the messages. 2- Check the position of the battery jumper on the CPU. 3- Check the voltage of the CPU battery. 4- Replace the CPU
27 A	Timeout speed measurement (20sec)	If the object traveling speed is measured by 2 cells (without a tachometer), the pulse from the second cell (TOP 1) was not received by the printer. (time > 20s) Consequences: The message is not printed.	1- Check the cell connections and their operation. 2- Check the distance between the cells. 3- Check the conveyor speed.
28 D	No signal for speed measurement	If the object traveling speed is measured by 2 cells (without a tachometer), the pulse from the first cell (TOP 2) was not received by the printer. Consequences: The message is not printed.	1- Check the cell connections and their operation. 2- Check the distance between the cells. 3- Check the conveyor speed.



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
30 D	CRC(RAM) Ink Incorrect	Appears after the CPU is reset. Consequences: Stored data (IC60 time counter, etc.) is lost. The printer remains ready.	1- Check the position of the battery jumper on the CPU. 2- Check the voltage of the CPU battery. 3- Replace the CPU
31 D	CRC(RAM) Print Incorrect	Appears after the CPU is reset. Consequences: Stored data (date, time, etc.) is lost. The printer remains ready.	1- Check the position of the battery jumper on the CPU. 2- Check the voltage of the CPU battery. 3- Replace the CPU
32 D	CRC(RAM) Print Incorrect	Appears after the CPU is reset. The HIJRI timestamp values are incongruous. Consequences: The printer cannot print the timestamp.	Reprogram with consistent values.
33 A	Incompatible software versions	The versions of the ink and printing software are incompatible after the printer is switched on for the first time. Consequences: Unreliable printer operation.	1- Check the versions of the software 2- Install the correct versions
34 D	Incorrect or no compressed air	IP65 printers only. Consequences: The printer does not start or it stops.	1- Compressed air supply: Minimum pressure: 4 bar Minimum flow rate: 400 l / h 2- Air conditioner: filter, pressure switch and connections. 3- CPU
35 D	Cooling fan failure	The fan rotation is monitored at all times. Consequences: If the fan does not operate, the printer does not start or it stops.	1- Make sure nothing is blocking the fan blades. 2- Connections. 3- Fan. 4- CPU.



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
38 A	Read/write error on Ink Cir EEPROM	impossible to read or write to the IC60 EEPROM during operation. Consequences: The IC60 counter values are no longer saved. The printer continues to operate as normal.	1- IC60 2- CPU
39 A	Read/write error on CPU EEPROM	impossible to read or write to the CPU EEPROM during operation. Consequences: The ink management parameters are no longer saved. Printer operation disrupted.	CPU
40 A	Print speed above specifications	This alarm appears after printing to indicate that the tachometer speed (after division) is too high for the algorithms used in the message. Consequences: Excessively wide marking, but printing remains possible.	Change the tachometer division or select algorithms best suited to the application. The alarm may be disabled if the speed is rarely exceeded and the print quality remains acceptable.
45 A	Message contains an option that is not valid	The message selected contains an option not supported by the printeror the option requested via the V24 / RS-232 interface is not available in the printer. Consequences: The message selected cannot be printed.	Use the available options.
46 D	CRC Flash memory incorrect (Font)	The CRC calculated when the printer is switched on is different from the CRC stored. Consequences: The font data is unusable because the flash memory was written incorrectly.	1- PCMCIA / CompactFlash card reader defective Reinstall the software 2- PCMCIA / CompactFlash card Insert another card 3- Upgrade file Check the files on the card. Load another file.



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
48 D	Algorithm not available	The message selected or sent over the serial link contains an algorithm number not available in the printer. Consequences: The message cannot be printed.	Check the algorithms available and load the missing ones in the *.HEM file.
50 A	LOW INK level. Prepare new cartridge	The ink level in the cartridge is calculated by the software using the negative pressure value and the number of times the cartridge has been pumped. Warning: The indication given by pictogram F6 may be distorted if the cartridge has not been correctly replaced (full cartridge, cartridge with sufficient capacity, etc.).	1- Cartridge - Small amount of ink remaining in cartridge - Correctly positioned in cartridge holder - Properly perforated tip 2- Ink solenoid valve 0 - Test - Replace the IC60 3- Clogged hollow needle Remove the tip holder and clean the needle with clean make up or replace the tip holder.
51 A	LOW MAKE UP. Prepare new cartridge	The level of make up in the cartridge is calculated by the software using the negative pressure value and the number of times the cartridge has been pumped. Warning: The indication given by pictogram F7 may be distorted if the cartridge has not been correctly replaced (full cartridge, cartridge with sufficient capacity, etc.).	1- Cartridge - Small amount of make up remaining - Correctly positioned in cartridge holder - Properly perforated 2- Make up solenoid valve 1 - Test - Replace the IC60 3- Clogged or bent hollow needle Remove the tip holder and clean or replace it.
52 A	EMPTY INK Cartridge	After several attempts to pump ink from the cartridge, the printer indicates that the cartridge is empty. Consequences: Printing is still possible but only until the ink in the accumulator runs out.	1- Cartridge - Not empty - Correctly positioned in cartridge holder - Properly perforated 2- Ink solenoid valve 0 - Test - Replace the IC60 3- Clogged hollow needle Remove the tip holder and clean the needle with clean make up or replace the tip holder.



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
53 A	EMPTY MAKE UP Cartridge	After several attempts to pump make up from the cartridge, the printer indicates that the cartridge is empty. Consequences: Printing is still possible but the ink concentration will be affected by the lack of make up to compensate for evaporation.	1- Cartridge - Not empty - Correctly positioned in cartridge holder - Properly perforated 2- Make up solenoid valve 1 - Test - Replace the IC60 3- Clogged or bent hollow needle Remove the tip holder and clean or replace it. 4- CPU
54 D	Full waste cartridge	The pressure inside the waste cartridge is too high during draining or rinsing. The cartridge is indicated as being full. Consequences: Draining stops.	1- Cartridge - Full or filled with air - Hollow needle blocked by unperforated cartridge 2- Ink solenoid valve 0 locked closed - Test - Replace the IC60 3- Clogged or bent hollow needle Remove the tip holder and clean or replace it. 4- CPU board connector 5- CPU
60 A	U0: Ink Valve malfunction	The pressure measured is too high when ink is pumped from the cartridge or is too low when the ink is pumped back to the buffer tank. Consequences: Printing is still possible but only until the ink in the accumulator runs out.	1- Cartridge - Empty - Hollow needle blocked by unperforated cartridge 2- Ink solenoid valve 0 locked closed - Test - If OK: pressure sensor (replace IC60) - If not OK: IC60 or CPU or IC60 / CPU connections 3- Clogged or bent hollow needle Remove the tip holder and clean or replace it.

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
61 A	U1: Make up Valve malfunction	The negative pressure measured while make up is being pumped from the cartridge is too high Consequences: Printing is still possible but the ink concentration will be affected by the lack of make up to compensate for evaporation.	1- Cartridge - Empty - Hollow needle blocked by unperforated cartridge 2- Make up solenoid valve 1 locked closed - Test - If OK: pressure sensor (replace IC60) - If not OK: IC60 or CPU or IC60 / CPU connections 3- Clogged or bent hollow needle Remove the tip holder and clean or replace it.
62 D	U2: Buffer Valve malfunction	Incorrect pressure levels measured when ink flows from buffer tank to accumulator at start-up or during operation. Depending on the results, the software knows that the malfunction is on U2. Consequences: The IC60 stops and printing is disabled.	Test solenoid valve 2: - If OK: pressure sensor or blocked tube (replace IC60) - If not OK: IC60 or CPU or IC60 / CPU connections
63 D	U3: Accumulator valve malfunction	Incorrect pressure levels measured when ink flows from buffer tank to accumulator at start-up or during operation. Depending on the results, the software knows that the malfunction is on U3. Consequences: The IC60 stops and printing is disabled.	Test solenoid valve 3: - If OK: pressure sensor or blocked tube (replace IC60) - If not OK: IC60 or CPU or IC60 / CPU connections
64 A	U4: Condenser Valve malfunction	Incorrect pressure levels measured when ink flows from condenser to accumulator at start-up or during operation. Consequences: Printing remains possible, but malfunctions will occur.	Test solenoid valve 4: - If OK: pressure sensor or blocked tube (replace IC60) - If not OK: IC60 or CPU or IC60 / CPU connections

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
70 A	Ink concentration out of specifications	During printing the working pressure required for proper jet speed is outside the $P = f(T)$ curve. This alarm may be caused by too much or too little make up in the ink. Consequences: Poor print quality.	1- Check the following parameters: Ink Head height difference Ink and make up reference and use-by date. 2- Check the reference pressure (PRef) against the actual pressure measured in the accumulator (PAcc). If $PAcc < PRef$: There is too much make up in the ink. Avoid stopping and starting the printer repeatedly. Let the printer adjust the concentration itself. If $PRef < PAcc$: There is too little make up in the ink. Check the make up cartridge Let the printer adjust the concentration itself. 3- Auto-calibration
71 D	Ambient pressure measurement failed	The atmospheric pressure is measured via solenoid valve 4 and the condenser each time the printer is started. If, after 3 attempts, the value measured is not $0 \text{ bar} \pm 300 \text{ mb}$, the pressure sensor is defective. Consequences: The IC60 stops and printing is disabled.	1- Test solenoid valve 4 2- Check the condenser vent 3- IC60
72 D	Motor synchronisation incorrect	The printer does not detect sufficient difference in pressure between the pump top dead center and the bottom dead center at start-up and during operation. Consequences: The IC60 stops and printing is disabled.	1- Test solenoid valves 0, 1, 2, 3, 4, 5, 6 and 10. 2- Make sure there is no ink in the air pump. (Kapsto 6) 3- Make sure the motor is running. 4- IC60.

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
73 D	Ink transfer timeout	The time needed at start-up and during operation for the condenser to drain to the accumulator via SVs 4 and 3, or for the accumulator to drain to the buffer tank via the umbilic, is too long. Consequences: The IC60 stops and printing is disabled.	1- Condenser vent. Clean 2- Test solenoid valves 2, 3 and 4. 3- Test solenoid valves 11, A and B. 4- 200 µ leak along entire modulation assembly. Clean or replace the modulation assembly 5- Drain or pressure hose folded between IC60 and umbilic.
74 A	Air inflation timeout	The time needed to pump air into the accumulator during start-up, draining or rinsing is too long. Consequences: The printer remains ready. If the air pocket is too small, the pressure fluctuates and the print quality varies and drops.	1- Test solenoid valves 3 and 4 2- Condenser vent. 3- Make sure the motor is running 4- Make sure there is no ink in the air pump. (Kapsto 6)
75 A	Air pocket management incorrect	The difference in pressure in the accumulator is too high or too low during operation. Consequences: The print quality is inconsistent and drops.	1- Test solenoid valves 3 and 4 2- Condenser vent. 3- Drain the printer 4- IC60
76 A	Jet refreshment timeout	At the end of jet start-up, the pressure in the accumulator must drop below a determined value during refreshment. Consequences: The printer remains ready.	1- Test solenoid valves 11, A and B 2- 200 µ leak along entire modulation assembly. Clean or replace the modulation assembly 3- Drain or pressure hose folded between IC60 and umbilic. 4- 14 µ filter between accumulator and solenoid valve 11. Rinse and drain the printer. 5- IC60

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
77 A	Pump performance incorrect	The ink pump compression ratio is insufficient. Consequences: No direct consequences. The printer remains ready.	1- Test solenoid valves 0, 1, 2, 3 and 4 2- IC60
78 D	Printer empty. No more ink available	The accumulator, buffer tank and ink cartridge are empty during printing. Consequences: The jets stop.	1- This fault follows alarms 50 and 52 The printer immediately stops 2- IC60 3- CPU
79 D	Condenser overflow	This fault appears during operation if fluids remain in the condenser after 10 consecutive pumping cycles. Consequences: The IC60 stops and printing is disabled.	Partially drain the ink in the printer and measure the amount collected. <i>Reminder: This will drain the buffer tank.</i> 1- If ink collected < 200 cc The overflow is caused by a crack in the ink pump diaphragm. Ink has flowed to the condenser via the air pump (ink overflow). Replace the IC60. 2- If ink collected > 200 cc The overflow is caused by too much make up in the ink. Restart the printer. Check the auto-calibration.
81 D 82 D	Drop detection jet1 (left) Drop detection jet2 (right)	Faulty drop charge check. Consequence: The printer cannot print.	1- Cleaning - Clean the head and the cover - Clean the modulation assembly (Jet tip, SV intro., Stab. check) 2- Ink quality - Dust, moisture, use-by date (rinse, refill with new ink) 3- Electronics - Break-off point (piezo, piezo board, Print Module, CPU) - Charge signal (Print Module, CPU) - Detection signal (ADP board, Print Module, CPU, cover, bonding between cover and CPU)

Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
83 D	Ink concentration out of range	The pressure during operation is far outside of tolerance from the curve $P = f(T)$ ($P < 1.5$ bar or $P > 4$ bar) This fault follows alarm 70, the ink quality continues to drop. The ink may be too thin or too thick. Consequences: The printer cannot print.	1- Check the faults 53 and 70 in this table 2- Rinse the printer. 3- Check the ink type make up used on the cartridges. Make sure that these are the appropriate consumables. 4- Check the ink and head height difference parameters. 5- Auto-calibrate 6- CPU
84 D	Head cover absent	For reasons of safety, the EHT is cut when the cover is removed. Consequences: The printer cannot print.	1- Cover, magnet 2- Print Module Connections, cut wire in umbilical 3- CPU
85 D	Recovery not detected. Jet out of gutter.	The recovery detector did not detect the jet in the gutter or the detection was too weak during jet start-up or during operation. Consequences: The jet stops.	1- Jet Presence (Pressure, pressure SV, 'A' head SV, modulation assembly or jet obstructed) Stability (cleanliness of modulation assembly and jet) Centered in gutter (nozzle cleanliness, gutter adjustment) 2- Intake Gutter blockage (recovery assembly) Gutter SV stuck Negative pressure (Ptamp: xxmb) If Ptamp ≈ -0.3 b: head If Ptamp ≈ 0.02 b: IC60 3- Electronics Recovery assembly (broken pin) Gutter SV (control) Print Module, CPU 4- Ink Concentration (ink parameters, head height difference, auto-calibration) Quality (dust, moisture), use-by date
86 D	High Voltage supply failure	Unwanted EHT detected on the deflection plates by the printer. Consequences: The jet stops. Printing is disabled.	1- EHT block 2- CPU



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
87 D	High Voltage insulation failure	The printer detected an insulation fault on the EHT lines during operation (current leak of more than 10 µA). Consequences: EHT cut. Printing is disabled.	1- Cleanliness of deflection plates Cleaning with soapy water and letting dry may solve the problem. 2- Cleanliness inside head Open the rear cover. Clean away any traces of ink or moisture and dry. Locate and eliminate the source of the leak. 3- EHT block 4- Print Module
88 D	Jet speed measurement timeout	The printer cannot calculate the jet speed at start-up and during operation. Consequences: Printing is disabled.	1- Cleaning - Clean the head and the cover - Clean the modulation assembly (Jet tip, SV intro., Stab. check) 2- Ink quality - Dust, moisture, use-by date (rinse, refill with new ink) 3- Electronics - Break-off point (piezo, piezo board, Print Module, CPU) - Charge signal (Print Module, CPU) Detection signal (ADP board, Print Module, CPU, , bonding between cover and CPU)
90 A	Head temperature out of range	The temperature measured inside the head is outside the limits of 0-45°C (32-113°F). Consequences: Adverse effects on the electronics and behavior of the ink.	1- Room temperature 2- Temperature sensor on ADP board 3- CPU board
91 D	Temp. inside console > 60°C-140°F	The temperature measured inside the console is above 60°C (140°F). Running the printer under these conditions may damage its components. Consequences: The IC60 stops. Printing is disabled.	1- Room temperature too high 2- Poor console ventilation -IP54 air intake filter clogged -Flow of compressed air flow on IP65 too low or too warm 3- Temperature sensor on CPU board



Troubleshooting



A / D No.	Description	Context Consequences	Check / Cause / Remedy / Solution
92 D	Pressure servo control	If the air pocket is too small during operation, the pressure inside is disrupted when ink is added, making jet speed control impossible. Consequences: The IC60 stops. Printing is disabled.	1- Test solenoid valves 3 and 4 2- IC60





■ Maintenance procedures

Solenoid valve test.

The “Test solenoid valves” function makes it possible not only to know (by listening) whether a solenoid valve responds to a command signal, but also to release a stuck solenoid valve by actuating it several times.

WARNING: *Ink or make up may splash out during the procedure. Take precautions, and wear gloves and safety glasses.*

All the ink circuit IC60 and head solenoid valves are accessible via this function and can be individually operated.

WARNING: *Some combinations are prohibited. Example: U3 and U1 open at the same time.*

COMMENT: *On an ink circuit IC60 using one-way valves, solenoid valves 5 and 6 are replaced by these one-way valves. Operating U5 and U6 therefore does not function (no clicking).*



Releasing solenoid valve 0

WARNING: Ink or make up may splash out during the procedure. Take precautions, and wear gloves and safety glasses.

COMMENT: It is not necessary to remove the IC60 from the console to release solenoid valve 0.

Turn the printer On and select “Test ink solenoid valve U0”.

Open the right side door.

Remove the ink and make up cartridges.

Remove the cartridge support plate.

Remove the ink tip holder and check the needle for any blockages. Clean if necessary with make up.

Protect the inside of the console under the IC60 with absorbent paper or a cloth.

Using the cleaning flask, insert make up into the solenoid valve conduit while actuating it (press and hold “test solenoid valve” until the valve releases).

Clean and dry the tip holder, change the O-ring and put the holder back in place.



Partial drain

This will empty the ink in the buffer tank without rinsing it.

A depressurized empty cartridge is necessary.

Follow the instructions that appear on the screen.

WARNING: Follow the instructions carefully to avoid spilling any fluid. Wear gloves and safety glasses.

Full drain

This will drain all the ink out of the printer without rinsing it.

A depressurized empty cartridge is necessary.

Follow the instructions that appear on the screen.

WARNING: Follow the instructions carefully to avoid spilling any fluid. Wear gloves and safety glasses.

Rinsing the ink circuit IC60

Rinse the ink circuit IC60 in the following cases:

- ☐ before a protracted period of non-use
- ☐ to correct certain faults
- ☐ before replacing the IC60 (where possible)

This procedure drains the printer completely then rinses it with make up. Two depressurized empty cartridges are necessary.

Follow the instructions that appear on the screen.

WARNING: Follow the instructions carefully to avoid spilling any fluid. Wear gloves and safety glasses.



Auto-calibration.

■ When to perform auto-calibration

- ☐ After replacing the Print Module
- ☐ After replacing the CPU
- ☐ After replacing the IC60

■ Why perform auto-calibration

The jet speed control ensures print quality over time. The control depends on the ink type and several printer components (such as the printing module and the ink circuit IC60 IC60).

Once the printer is assembled and filled with ink, the auto-calibration procedure calibrates the control system.

■ Performing auto-calibration

After checking the installation parameters (head height difference), calibrate using ink with the appropriate concentration.

When the jet reaches its rated speed, the auto-calibration validation positions the curve $\text{Pressure} = f(\text{Temperature})$.

■ Procedure

Printer empty and stopped.

Connect a new ink cartridge at the same temperature as the printer.

Remove the make up cartridge.

Start the printer (faults 51 and 53 appear).

Check or enter the head height difference and ink type parameters.

WARNING: The head height difference must match the actual difference during auto-calibration.

REMINDER: The head height difference is the distance between the middle of the head and the middle of the console.

Troubleshooting



NOTE: *If the head is not at the auto-calibration position when the head is placed in the working position, the head height difference must be changed and adjusted.*

Do not let the head and jet operate for too long on its maintenance stand if the stand is not at the working position.

Confirm "Auto-calibration: No".

Start the jet. Wait 10 minutes or so (regardless of the ink type) for the ink temperature to be even.

Enter adjustment mode, check the break-off point and adjust it if necessary.

COMMENT: *In adjustment mode, the pressure in the accumulator is at the theoretical value along the reference curve if the ink $P = f(T)$.*

Start the jet as if you were going to print. Close the head cover. The jet must be ready to print (green "Jet status" LED lit steady).

COMMENT: *Acknowledge all faults and alarms before confirming auto-calibration.*

When the jet speed is at its nominal value, confirm "Auto-calibration: Yes". Check that the reference pressure is the same as the actual pressure.

The printer is now calibrated.

Put the make up cartridge back in place and perform the printing tests.

IMPORTANT: *If necessary, adjust the head height difference so that it is the same as the working position.*



■ List of special spare parts for Markem-Imaje technicians

Sale of the parts in the table below is reserved for Markem-Imaje technicians.

Part number	Description	Comments
ENM35809	Kit electrical cable 9020/30	No SPS
ENM35470	Recovery solenoid valve	See corresponding SPS
ENM34044	4 solenoid valve block	See corresponding SPS
ENM28629	ADP board	See corresponding SPS
ENM34030	Main power filter	No SPS
ENM28572	Industrial Interface plate without hole	No SPS
ENM28309	Piezo board (twin jet)	See corresponding SPS
ENM36675	CPU board 9020 RoHS	
ENR36675	CPU board 9020 RoHS	
ENR34024	CPU board 9020 Non RoHS	See corresponding SPS
ENM36676	CPU board 9030 RoHS	
ENR36676	CPU board 9030 RoHS	
ENM27781	CPU board 9030 Non RoHS	See corresponding SPS
	Screen	See corresponding SPS
ENM34702	Bracket plate-conduit IP54	No SPS
ENM34703	Bracket plate-conduit IP65	No SPS
A36045	CPU Programming tool	No SPS
A36056	Seal kit-Print module-9020/9030	See the SPS of the corresponding part.
A36066	Screw kit-Print module-9020/9030	See the SPS of the corresponding part.
ENM5836	O-Ring-Tip holder (EPT 18,72 x 2, 62)	No SPS





- List of the spare parts for customers with spare parts sheets available in this chapter.

Description	Comments
Industrial Interface Board	2 available types. See ref in the spare parts catalog. See SPS for replacing.
Keyboard	Several available types. See ref in the spare parts catalog. See SPS for replacing.
Modulation assembly	2 available types (G or M) See ref in the spare parts catalog. See SPS for replacing.
Recovery unit	2 available types (mono or twin jet). See ref in the spare parts catalog. See SPS for replacing.
Print module	Several available types. See ref in the spare parts catalog. See SPS for replacing.
Ink Circuit IC60	Several available types. See ref in the spare parts catalog. See SPS for replacing.
Plate Umbilical IP54 Equip	Ref A34509. See SPS « Replacing the Print Module»
Gutter adjustment tool	Ref A34438 See Adjustment Sheet « Recovery gutter adjustment »



■ Spare parts sheets

INTRODUCTORY NOTE: *The Spare Parts Sheets (SPS) in this section were written with preventive maintenance in mind.*

During curative maintenance it is not always possible to follow the recommended procedures in full (e.g. it might not be possible to drain the ink circuit IC60 if a solenoid valve is stuck). In such cases we recommend taking all possible precautions to avoid spilling or splashing ink or make up.

Whenever parts with gaskets are disassembled, new gaskets must always be fitted even if the parts are not replaced.



Replacing a modulation assembly

Tools:

1.5 mm Allen key

CAUTION: Turn off the printer and unplug it from its AC outlet.

Residual ink may pour out, take appropriate precautions.

Perform this operation in a dust-free environment.

Disassembly:

- ☐ Open the head cover. Remove the resonator protective cover. Disconnect the resonator wires.
- ☐ Unscrew the two screws holding the modulation assembly and remove it. Take care with the seals (two O-rings).

Reassembly:

- ☐ Clean the seal mating surface with make up, remove the old O-rings and fit two new O-rings in their locations on the head.
- ☐ Place the new modulation assembly in position then tighten the two mounting screws.
- ☐ Reconnect the resonator wires and reinstall the protective cover.

Testing:

- ☐ Start the printer.
- ☐ "Check jet stability" is required. Gutter adjustment may be necessary.



Replacing a resonator

Tools:

1.5 mm Allen key; resonator clamping/loosening rod.

CAUTION: Turn off the printer and unplug it from its AC outlet.

Residual ink may pour out, take appropriate precautions.

Perform this operation in a dust-free environment.

Disassembly:

- ☐ Open the head cover. Remove the resonator wire protective cover. Disconnect the resonator wires.
- ☐ Unscrew and gently remove the resonator clamping sleeve.
- ☐ Pull the resonator out of its housing. Take care with the seal (one O-ring).

Reassembly:

- ☐ Clean the inside of the modulation chamber with make up. Remove the old O-ring.
- ☐ Fit the new O-ring on the resonator before reassembling it. Tighten the clamping sleeve.
- ☐ Reconnect the resonator wires and reinstall the protective cover.

Testing:

- ☐ Start the printer.
- ☐ “Check jet stability” and break-off point adjustment are required.



Replacing the 4 solenoid valve block

Tools:

1.5 mm Allen key.

CAUTION: Turn off the printer and unplug it from its AC outlet.

Position the head higher than the printer console.

Residual ink may pour out, take appropriate precautions.

Perform this operation in a dust-free environment.

Disassembly:

- ☐ Open the rear head cover
- ☐ Unscrew the two screws holding the 4 solenoid valve block and remove the block.
Take care with seals (one rectangular 3-hole gasket, one square 4-hole gasket)

Reassembly:

- ☐ Use solvent to clean the mating surface on the 4 solenoid valve block and the contact board.
- ☐ Replace the seals (2 flat gaskets) then replace the solenoid valve block.

Testing:

- ☐ Restart the printer before closing the rear cover. Check that there are no leaks.

CAUTION: The solenoid valve block must be replaced if there are any ink leaks (risks of short-circuits on the integrated control ribbon cable).

- ☐ Close the rear head cover.
- ☐ "Check jet stability" is required.



Replacing the recovery unit

Tools:

2.5 mm flat-bladed screwdriver

CAUTION: Turn off the printer and unplug it from its AC outlet.

Residual ink may pour out, take appropriate precautions.

Disassembly:

- ☐ Remove the four screws at the corners of the recovery assembly and remove it. Pay attention to the seals (O-rings around pins).
- ☐ Clean the mating surface between the head and the recovery unit using make up.

Reassembly:

- ☐ Replace the O-ring on the recovery solenoid valve tip.
- ☐ Fit new O-rings around the pins (2 seals for a single-jet head (3 seals for a twin-jet) and fit the new recovery assembly, taking care not to damage the fragile recovery pins. Tighten the four screws.

Testing:

- ☐ Restart the printer.
- ☐ Adjust the recovery gutters (see settings sheet).



Replacing a gutter

Tools:

0.9 mm Allen key, Markem-Imaje gutter adjustment tool.

CAUTION: *The jet must be stopped.*

Residual ink may pour out, take appropriate precautions.

Disassembly:

- ☐ Loosen the grub screw on the same side as the gutter to be replaced, by half a turn.
- ☐ Use the gutter adjustment tool to extract the gutter to be replaced.
- ☐ Use make up to clean the port on the recovery unit.

Reassembly:

- ☐ Insert the new gutter in the orifice on the recovery assembly unit and push it fully in.

Testing and adjustment:

- ☐ Set the jet to "adjustment" mode.
- ☐ Use the adjustment tool to adjust the gutter (jet in center of gutter).
- ☐ Tighten the pressure screw moderately.



Replacing the recovery solenoid valve

Tools:

1.5 mm Allen key; 2.5 mm flat-bladed screwdriver; 7 mm box wrench

CAUTION: Turn off the printer and unplug it from its AC outlet.

Position the head higher than the printer console

Residual ink may pour out, take appropriate precautions.

Disassembly:

- ☐ Remove the rear head cover.
 - ☐ Remove the 4 solenoid valve block. Take care with seals (one rectangular 3-hole gasket, one square 4-hole gasket)
 - ☐ Remove the ground braid screw from the body of the recovery solenoid valve.
 - ☐ Disconnect the solenoid valve rinsing hose.
 - ☐ To avoid damaging the recovery assembly, loosen the four screws in the corners of the assembly by one full turn (do not loosen the central screw), detach the recovery assembly (a notch on the side, allows to detach it with the screwdriver), remove the four screws and gently remove the recovery assembly by pulling it free in line with the head axis. Pay attention to the seals (O-rings around pins).
-

CAUTION: The recovery detection pins and contacts are very fragile.

- ☐ Remove the nut (7 mm across flats) then withdraw the recovery solenoid valve.
- ☐ Unsolder the electrical control wires.
- ☐ Slide the holding sleeve away before pulling the intake tube free of the solenoid valve. Remove the solenoid valve.

Troubleshooting



Reassembly:

- ☐ Solder the control wires to the new solenoid valve.
- ☐ Connect the intake hose and slide the sleeve back.
- ☐ Fit new seals (two O-rings) to the new solenoid valve.
- ☐ Position the solenoid valve in its housing (check that it is oriented correctly) then retighten the nut.
- ☐ Connect the rinsing hose.
- ☐ Screw the two ground lugs back on.
- ☐ Use solvent to clean the mating surface on the recovery assembly then replace the seals (O-rings around pins) and replace it.
- ☐ Use solvent to clean the mating surface on the 4 solenoid valve block then replace the seals (two gaskets) and replace it.

Testing:

- ☐ Restart the head before closing the rear cover. Check that there are no leaks.
- ☐ A "stability check" is required.



Replacing the print module

Tools:

2 mm, 2.5 mm and 4mm Allen keys.

CAUTION: *Rinse and drain the printer then turn it off and unplug it from its AC outlet.*

Residual ink may pour out, take appropriate precautions.

Disassembly:

- ☐ Open the door on the right and remove the ink and make up cartridges.
- ☐ Unscrew the two cartridge guide rods. Loosen the top screw, remove the bottom screw from the cartridge support plate and remove this plate.
- ☐ Uncouple the multi-way hydraulic connector and fit the stopper on the umbilic side.

CAUTION: *Residual ink may pour out, take appropriate precautions.*

- ☐ Open the door on the left. Disconnect the head connector from the CPU board, the EHT connectors and unscrew the umbilic ground wire lug.
- ☐ Underneath the printer, dismount the umbilic and ventilator plate and withdraw the wires and hoses.
- ☐ Disconnect the ventilator
- ☐ Dismount the umbilic from the stainless steel plate.
Take care with the seal (one O-ring).

Troubleshooting



Reassembly:

- ☐ Fit a new O-ring on the attachment plate then reassemble and connect the umbilic (electrical and hydraulic connectors and ground wire).
- ☐ Position the stainless steel plate.

CAUTION: *the hoses must not obstruct the fan.*

- ☐ Reassemble the cartridge support plate.

Testing:

- ☐ Restart the printer.
- ☐ Autocalibration is required (see procedure).



Replacing the ink circuit IC60

Tools:

2.5 mm, 4mm and 5 mm Allen keys.

CAUTION: *Rinse and drain the printer then turn it off and unplug it from its AC outlet.*

If you are unable to use the automatic "Drain/rinse" function due to problems on the ink circuit IC60 you may use the procedure below to drain the ink circuit IC60 manually.

Disassembly:

- ☐ Open the right door and remove the ink and make up cartridges.
- ☐ Remove the cartridge support plate.
- ☐ Position the print head lower than the ink circuit IC60.
- ☐ Remove the hydraulic connector from the console without uncoupling it and place it above a retention tray.
- ☐ Uncouple the hydraulic connector. Place a stopper in the umbilic side of the half-connector.

CAUTION: *If the "drain/rinse" function has not been performed, take appropriate precautions as a large quantity of residual ink may pour out from the ink circuit IC60 side half-connector. This ink will flow out of the buffer vessel by gravity.*



CAUTION: *If the "drain/rinse" function has not been performed, the accumulator may contain ink under pressure. Take particular precautions when draining it.*

Connect the printer to the electrical supply, hold the hydraulic half-connector on the ink circuit IC60 side in an appropriate receptacle (500 cm³, half-closed) and manually open solenoid valve "U11, Accu. pressure".

(Test solenoid valves function).

Wait until the pressure in the accumulator is released, close U11 then disconnect the printer from the electrical supply

- Open the left side door. Disconnect the motor control connector from the CPU board and move the wires clear.
- Loosen but do not remove the two screws holding the ink circuit IC60
- Via the hydraulic compartment, lift the ink circuit IC60 to release the two screws and the two bottom mounts.
- Remove the ink circuit IC60 from its place and hang it at the place of the cartridge support plate (2 holes provided).
- Disconnect the ribbon cable from the CPU board (below the ink circuit IC60) while holding the module, then disconnect the condenser venting hose. Take out the IC60.



Reassembly:

- ☐ Fit the two screws to the new ink circuit IC60.
- ☐ Hang it at the place of the cartridge support plate in order to connect the venting hose and the CPU ribbon cable.
- ☐ Bring up the new ink circuit IC60 at its definitive place. Insert the two screws into the corresponding slots and the two bottom mounts in their brackets.
- ☐ Tighten the two mounting screws.
- ☐ Clean the mating surface on the multi-way hydraulic connector, remove the old O-rings and fit five new O-rings. Tighten the three screws. Place the connector in the console.

CAUTION: *the hoses must not obstruct the fan.*

- ☐ Pass the motor control wires back through the grommet and reconnect the connector to the CPU board.
- ☐ Reassemble the cartridge support plate.

Testing:

- ☐ Restart the printer.
- ☐ Autocalibration is required (see procedure).



Replacing the EHT block

Tools:

2 mm, 2.5 mm and 4mm Allen keys.

CAUTION: Turn off the printer and unplug it from its AC outlet.

Disassembly:

- ☐ Open the left door.
- ☐ Disconnect the two connectors from the EHT wires and the EHT control connector.
- ☐ Open the right door and remove the ink and make up cartridges.
- ☐ Unscrew the two cartridge guide rods. Unscrew the top screw, remove the bottom screw from the cartridge support plate and remove the plate.
- ☐ Unscrew the two screws from the EHT block and remove it.

Reassembly:

- ☐ Position the two screws on the new EHT block. Bring up the EHT block and tighten the screws.
- ☐ Reassemble the cartridge support plate and the ink and make up cartridges.
- ☐ Plug the connectors back in.



Replacing the industrial interface card

Tools:

2.5 mm and 4mm Allen keys ; 2.5 mm flat-bladed screwdriver.

CAUTION: *Unplug the printer from its AC outlet.*

Disassembly:

- ☐ Open the left door.
- ☐ Disconnect all the wires connected to the industrial interface board terminal blocks (cell, tachometer, etc.).

CAUTION: *Identify the wires before removing them.*

- ☐ Remove the 2 attachment screws and disconnect the industrial interface board from the CPU board.

Reassembly:

- ☐ Fit the new industrial interface board on the connector on the CPU board and reassemble the two mounting screws.
- ☐ Reconnect all the wires to the terminal blocks.



Replacing the CPU board

Tools:

2.5 mm and 4mm Allen keys.

CAUTION: *If possible, save the messages to a PCMCIA/Compact Flash card.*

Unplug the printer from its AC outlet.

Disassembly:

- ☐ Open the printer's left side door. Remove the two screws then disconnect the industrial interface board from the CPU board without removing the wires connected to it.

- ☐ Disconnect all the connectors from the CPU board:
 - Head
 - Ink circuit IC60
 - Tacho, cell, alarms
 - EHT controls
 - Power supply
 - Fan
 - Motor
 - Keyboard ribbon

- ☐ Remove the four screws from the CPU board.

- ☐ Open the right door. Loosen the three CPU retaining screws.

- ☐ Remove the CPU board by releasing the screws on the right side and sliding it gently to the left.

- ☐ Remove the display (see the "Replacing the display" sheet)



Reassembly:

- ☐ Before inserting the new board, check that jumper S32 is in the ON position.
- ☐ Connect the display to the new CPU board (see the "Replacing the display" sheet).
- ☐ Insert the three screws on the right side of the board but do not tighten them.
- ☐ Slide the new board into its slot, engage the three screws on the right side then insert the four attachment screws on the left side and tighten them moderately.
- ☐ Adjust the position of the PCMCIA/ compact Flash card reader. Tighten the three screws on the right side. Close the right side door.
- ☐ Reconnect all the connectors.
- ☐ Reconnect the industrial interface board and put the screws back in. Tighten moderately.
- ☐ Close the left side door.
- ☐ Plug the printer into its AC outlet.
- ☐ Start the printer by pressing "ON/OFF".
- ☐ Transfer the messages from the PCMCIA card to the printer.



Replacing the display

Tools:

2 mm and 4mm Allen keys.

CAUTION: *Unplug the printer from its AC outlet.*

Disassembly:

- ☐ Remove the CPU board (see the "Replacing the CPU board" sheet).
There is no need to store the messages.
- ☐ Remove the four attachment screws.
- ☐ Disconnect the display.

Reassembly:

- ☐ Connect the new display.
- ☐ Replace the four screws. Tighten moderately.
- ☐ Replace the CPU board (see the "Replacing the CPU board" sheet). There is no need to reload the messages.
- ☐ Adjust the display contrast (ALT +  or  keys).



Replacing the PSU board

Tools:

2.5 mm and 4mm Allen keys.

CAUTION: *Unplug the printer from its AC outlet.*

Do not lay the printer down.

Disassembly:

- ☐ Open the left side door.
- ☐ From the outside of the printer, unscrew the three screws that hold the power supply board to the radiator. Withdraw the board.
- ☐ Disconnect the two connectors from the board.

Reassembly:

- ☐ Place the new power supply board in the vicinity.
- ☐ Connect the two connectors.
- ☐ Position the board on the radiator and replace the three attachment screws. Tighten moderately.



Replacing the ADP board

Tools:

1.5 mm Allen key; 2.5 mm flat-bladed screwdriver; tweezers.

CAUTION: Turn off the printer and unplug it from its AC outlet.

Disassembly:

- ☐ Remove the rear head cover
- ☐ Unscrew the two screws from the ADP board and withdraw it from its housing.
- ☐ Disconnect the multi-pin connector.
- ☐ Unsolder the three mounting points from the shielding cover.
- ☐ Unsolder the electrical wires from the board.

Reassembly:

CAUTION: Before reassembly, check that all items are clean and wipe off any traces of ink or make up.

- ☐ Solder the wires to the new board.
- ☐ Relocate the shielding cover and solder the three mounting pins.
- ☐ Plug the connector back in.
- ☐ Position the ADP board in its slot and screw it in.
- ☐ Replace the rear head cover.



Replacing the piezo board

Tools:

1.5 mm Allen key ; 2.5 mm flat-bladed screwdriver ; 4 mm and 7 mm box wrench ; tweezers.

CAUTION: Turn off the printer and unplug it from its AC outlet.

The head must be rinsed (partial drain of the printer).

Place the head higher than the ink circuit IC60.

Perform this operation in a dust-free environment.

Residual ink or make up may pour out, take appropriate precautions.

Disassembly:

- ☐ Disassemble the rear head cover.

- ☐ Disassemble the 4 solenoid valve block. Take care with seals (one rectangular 3-hole gasket, one square 4-hole gasket)

- ☐ Unscrew the two screws from the ADP board and withdraw it from its housing without disconnecting it.

- ☐ Unscrew the two screws from the "contacts" board of the 4 solenoid valve block and withdraw it without disconnecting it.

- ☐ Unscrew the two screws from the 4 solenoid valve block bracket. Note that the two screws are not identical. Carefully note where the wires and hoses pass. Disconnect the intake hose from the recovery solenoid valve. Withdraw the bracket without disconnecting the hoses. Take care with the seals (two O-rings).



OPTIONAL BUT RECOMMENDED FOR BETTER ACCESS TO THE PIEZO BOARD:

Unscrew the screw holding the two ground braids attached to the body of the recovery solenoid valve.

Remove the recovery assembly.

To avoid damaging the assembly, loosen the four screws in the corners of the assembly one full turn (do not loosen the central screw), detach the recovery assembly (little notch, on the right side), remove the four screws and gently remove the recovery assembly by pulling it free in line with the head axis.

CAUTION: O-rings are located around the pins.

CAUTION: The recovery detection pins and contacts are very fragile.

Unscrew the nut (7 mm across flats) from the recovery solenoid valve and withdraw it from its housing without unsoldering the electrical wires and without disconnecting the recovery hose.

- ☐ Unscrew the three nuts from the piezo board (4 mm across flats)
- ☐ Withdraw the board from its slot.
- ☐ Disconnect the multi-way connector and unsolder the electrical wires.



Reassembly:

CAUTION: Before reassembly, check that all items are clean and wipe off any traces of ink or make up.

- ☐ Solder the wires onto the new board and plug the connector back in.
- ☐ Put the board back in place, taking care to engage the control screws correctly in the corresponding potentiometers.
- ☐ Replace all seals if they were disassembled. Clean the solenoid valve and the recovery assembly then put them back in place.
- ☐ Replace the seals and put the solenoid valve block bracket back in place.
- ☐ Put the contacts board back on the solenoid valve block.
- ☐ Put the ADP board back in place.
- ☐ Replace the seals and put the solenoid valve block back in place.

Testing:

- ☐ Start the printer before closing the rear head cover. Check that there are no leaks.
- ☐ Start the jet and perform unblock nozzle, solvent intro and stability checks.
- ☐ The break-off point must be adjusted for each jet.
- ☐ If the recovery assembly was disassembled it may be necessary to adjust the gutter.



Air intake filter cartridge and seal (on air pressurisation kit).

Tools:

4mm Allen key; 2.5 mm flat-bladed screwdriver.

CAUTION: *The printer must be disconnected from the power supply and the compressed air network.*

Disassembly:

- ☐ Open the left door.
- ☐ For easier access, disconnect the quick couplings on the three hoses then withdraw the air pressurization assembly.
- ☐ Push the filter housing down slightly and turn it counterclockwise by one eighth of a turn (as far as it will go) and pull out.
- ☐ Unscrew the filter cartridge and the grid.
- ☐ Use a small flat screwdriver to pries the O-ring out of its groove.

Reassembly:

- ☐ Clean the grid and the inside of the tank with cleaning solution.
- ☐ Install the new O-ring. Install the new cartridge and grid; tighten moderately.
- ☐ Place the housing in its seat and turn it clockwise one eighth of a turn (as far as it will go).
- ☐ Put the air conditioner back in place and reconnect the hoses.



Replacing the keyboard

Tools:

4mm Allen key.

Bottle of make-up, alcohol or acetone. Absorbent paper.

CAUTION: *Unplug the printer from its AC outlet.*

Disassembly:

- ☐ Open the left door and disconnect the keyboard ribbon cable from the CPU board.
- ☐ Detach the keyboard by pulling from an angle.

CAUTION: *Its recommended to dismount the CPU board in order do not destroy the screen with the cleaning liquid.*

- ☐ Clean the console surface (with make-up, alcohol or acetone) to eliminate traces of adhesive.

Reassembly:

- ☐ Remove the protective film from under the new keyboard in the central zone in order to reveal the screen and ribbon cable cut-out.
- ☐ Pass the ribbon cable through the slit in the console and center the keyboard.
- ☐ Remove the protective film from the sides and finish sticking the keyboard down.
- ☐ Connect the ribbon cable to its connector on the CPU board.
- ☐ Restart the printer.



■ Adjustment sheets

Break-off point adjustment

Tools:

Magnifying glass (eyepiece) ; 2,5 mm Allen key.



Preparation:

- ☐ Place the head on its maintenance stand.
- ☐ Turn on the jet(s) for at least 30 minutes.
- ☐ Remove the head cover.

Adjustment:

To adjust the break-off point, look at the jet in front of the charge electrode (stroboscopic LED) through the eyepiece (see Figure 1)

- ☐ Start by turning the potentiometer to the left until it stops. The jet is no more modulated.

Note: each jet on a multi-jet head has its own potentiometer (right jet - right potentiometer, etc.).

- ☐ Slowly turn to the right until the jet break-off point is in the center of the charge electrode. The adjustment is correct when 3 complete drops are present at the base of the charge elect

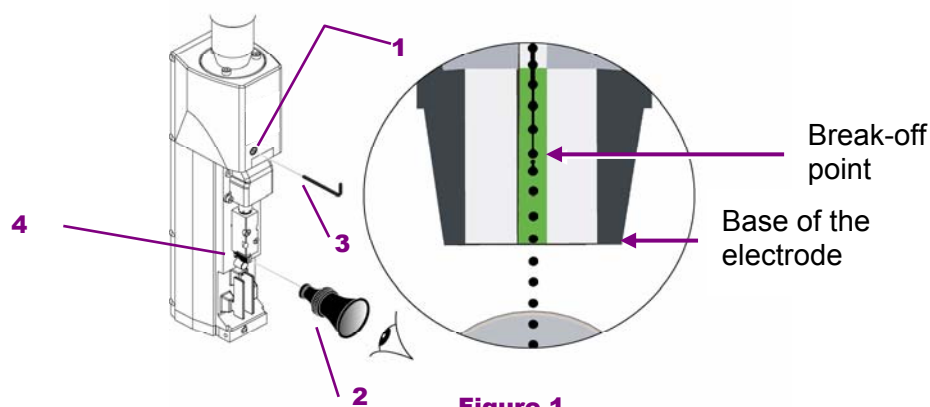


Figure 1

1	Potentiometer
2	Magnifier
3	Allen key
4	Charge electrode

Troubleshooting



- Figure 2 shows how a properly adjusted break-off point should appear. Look only at the shape of the drops just under the break-off point.

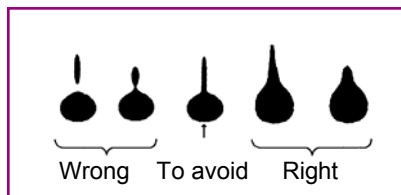


Figure 2

Adjust the potentiometer with care to avoid damaging it.

Checks and tests:

- Close the head cover. Clear any faults with  key.
- Perform some printing tests and readjust if necessary.



Recovery gutter adjustment

Tools:

- Safety glasses and gloves; 0.9 mm Allen key; gutter adjustment tool.

Preparation:

- Place the head on its maintenance stand.
- Confirm the ▶ Production / Maint / Jet maintenance / **Adjust jet** function.
- Remove the head cover.

Adjustment:

- Loosen the gutter grub screw on the side under the head (one on either side on twin-jet heads).



- Hold the gutter with the gutter adjustment tool.
- Adjust the position of the gutter by moving it back and forth or right and left until the jet centered in the gutter.
- Retighten the screw moderately.
- Clean the head. Exit the **Adjust jet** function.

Troubleshooting



Notes:



Hydraulics



Hydraulics



Notes:



■ Solenoid valve hydraulic circuit (Printer stopped)

This circuit is equipped with solenoid valves on the air pump (U 5 and U 6).

This ink circuit can be installed in a IP54 console (figure 1) or in a IP65 console (figure 2).

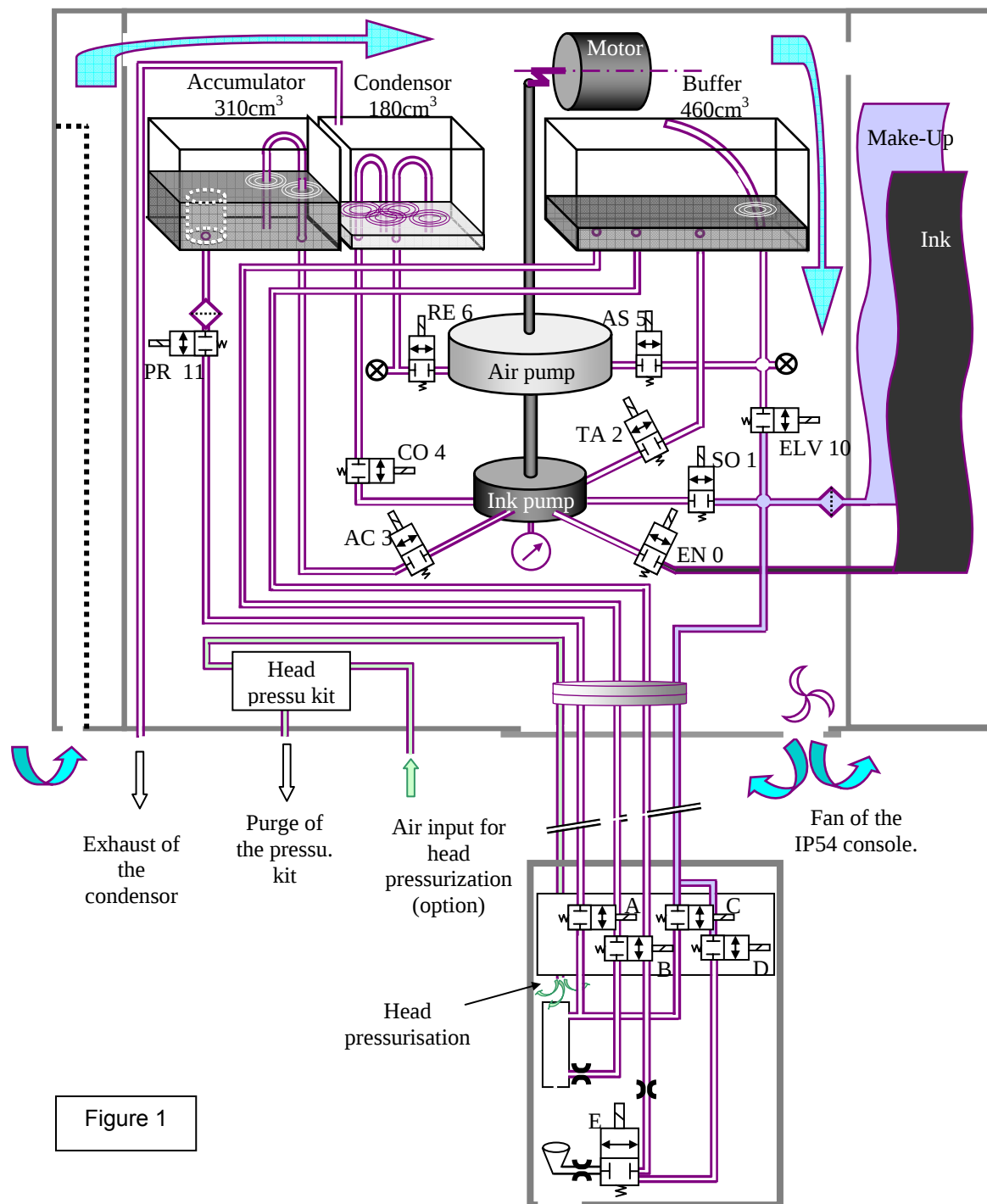


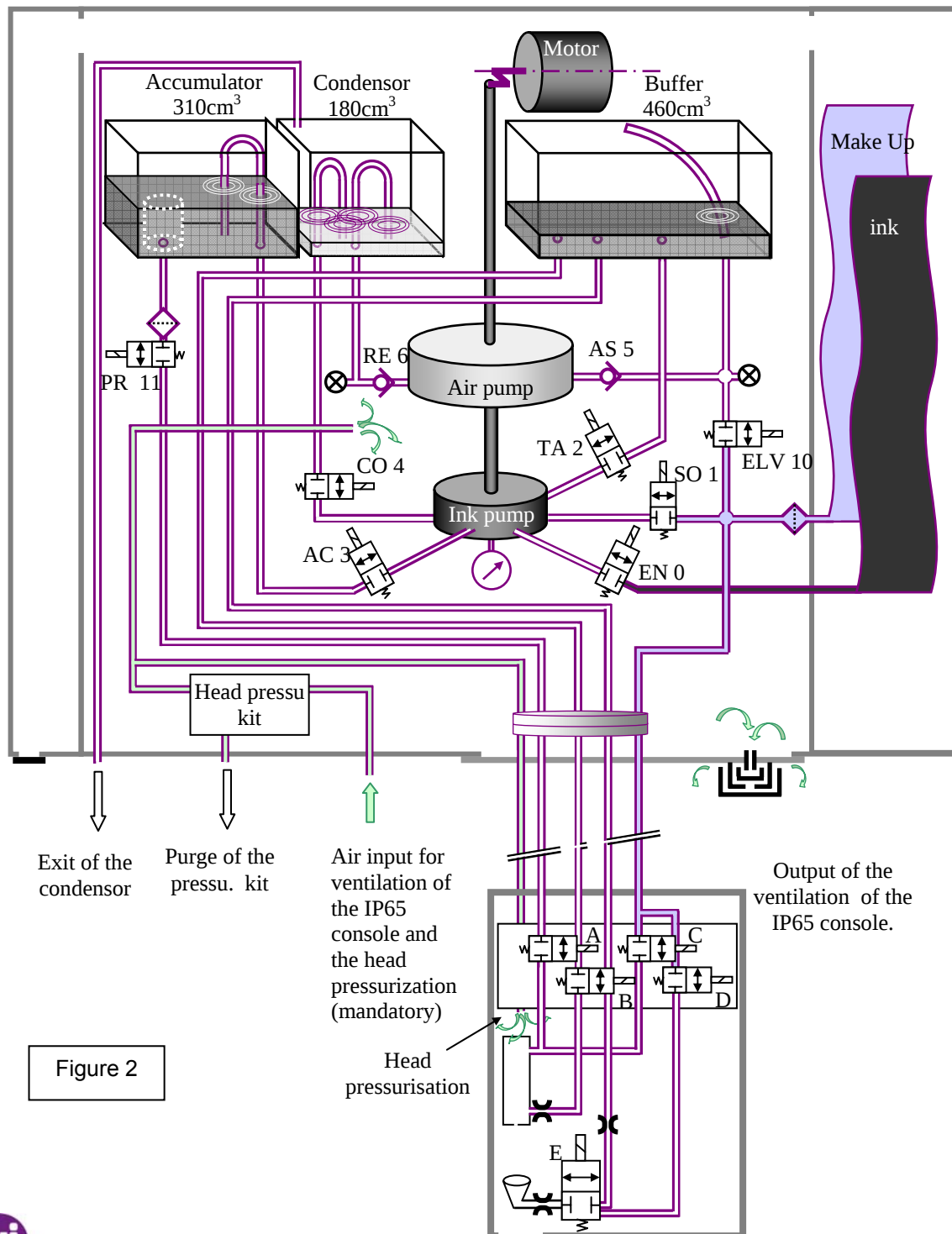
Figure 1



■ Non return valve hydraulic circuit (Printer stopped)

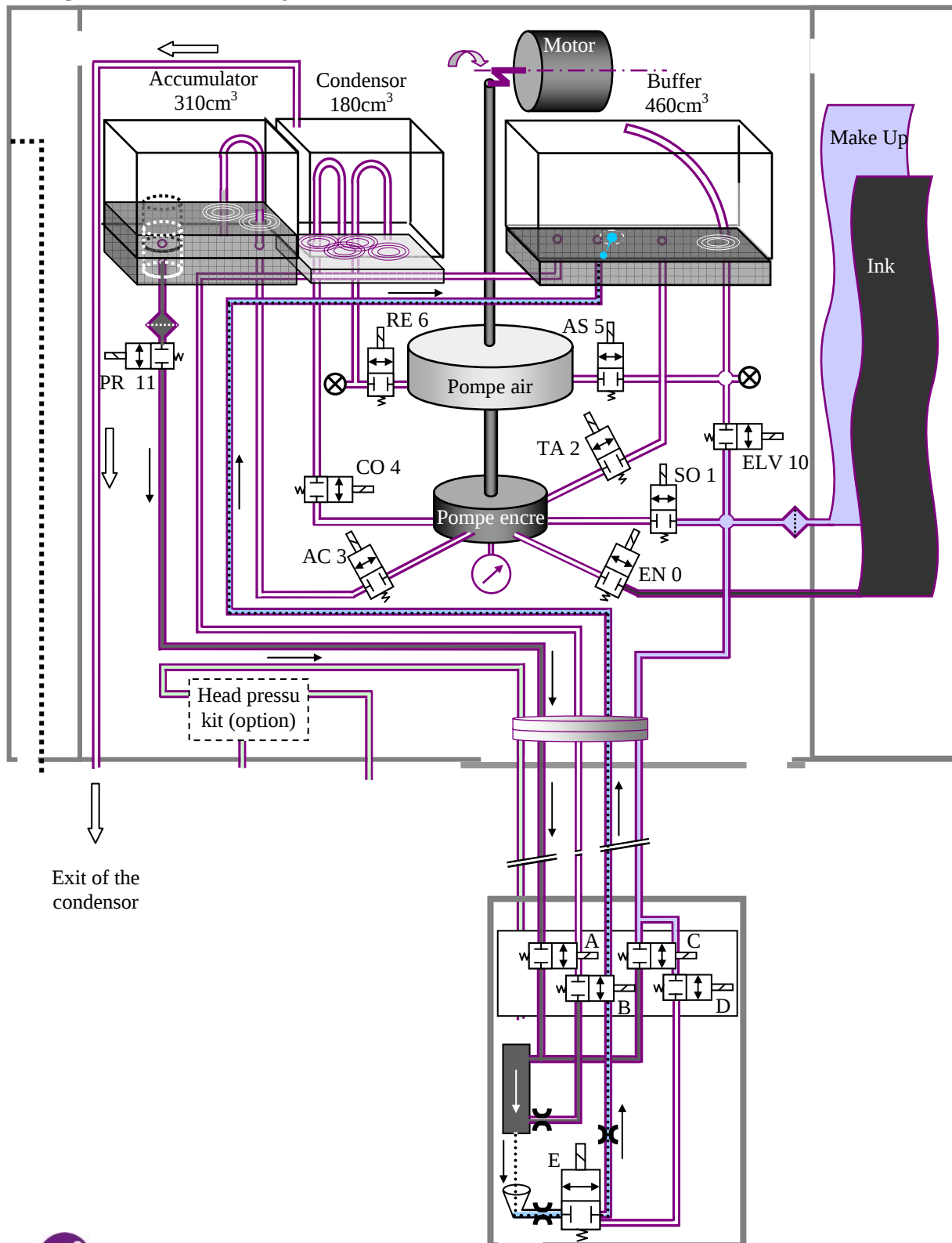
This circuit is equipped with non return valves on the air pump (U 5 and U 6).

This ink circuit can be installed in a IP54 console (figure 1) or in a IP65 console (figure 2).



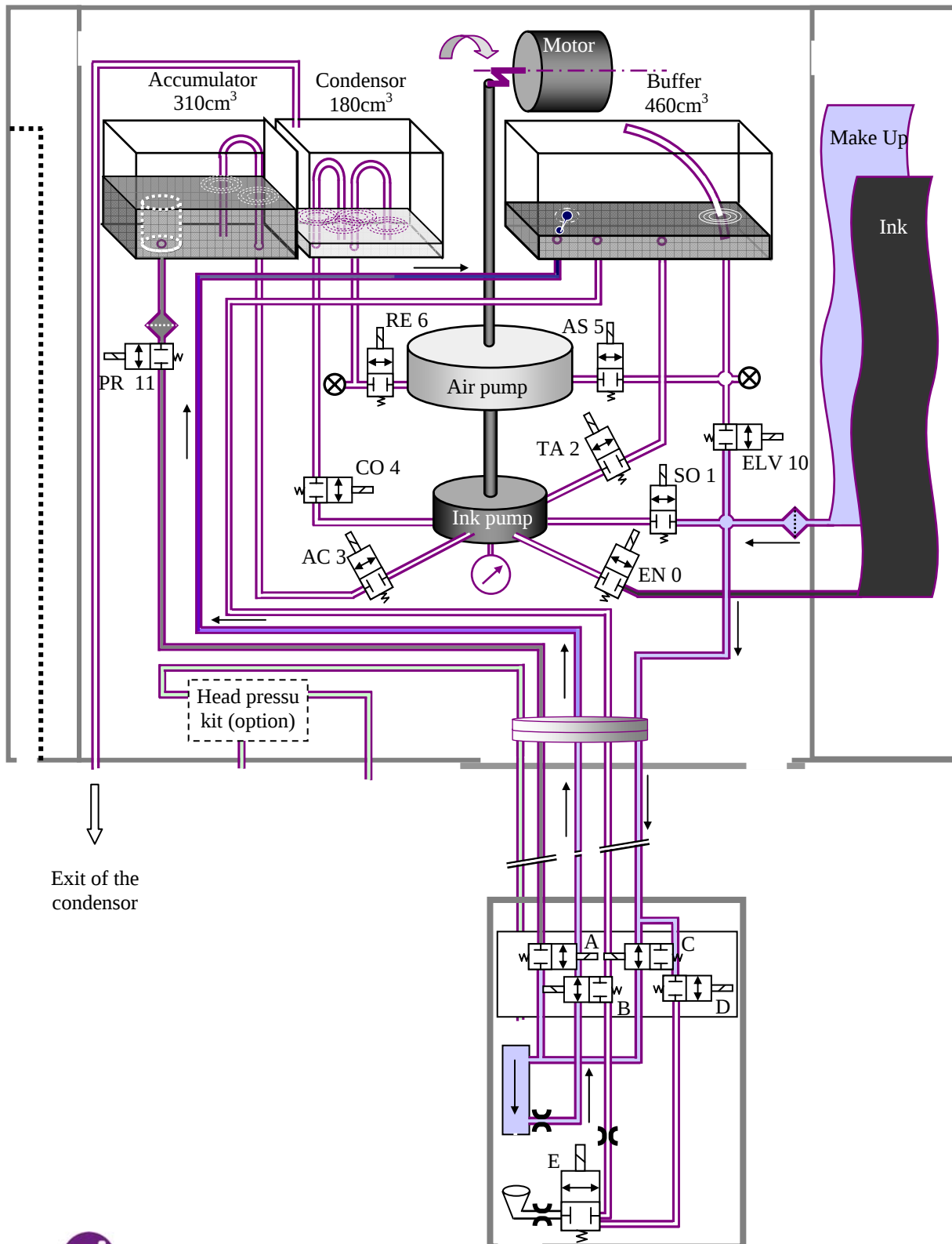


■ Diagram of the hydraulic circuit (Normal operation)





■ Diagram of the hydraulic circuit (Jet stopped with make up)





■ Ink circuit: principle of operation

The core of this ink circuit comprises of two separate diaphragm pumps operated by a single motor. Nine solenoid valves located around these pumps (controlled by software) transfer fluids between the various tanks.

The "air pump" is primarily used to generate a negative pressure in the buffer tank. This negative pressure generates suction in the recovery gutter and is also used to draw up make up when starting and stopping the jet in order to rinse the modulation assembly and the head solenoid valves.

The "ink pump" pressurizes the ink in the accumulator and handles all transfers of fluid between the various tanks.

As the two pumps use a single motor/piston, if only one value of the positive or negative pressure must be changed, the software manages the opening and closing of the solenoid valves in order to correct one value without changing the other

EXAMPLE: *If the negative pressure needs to be increased but the pressure value is correct:*

- during the common intake stroke of the pumps
 - open solenoid valve AS 5 (air intake in buffer tank)
 - open solenoid valve TA 2 (ink intake in buffer tank)
- during the common discharge stroke of the pumps
 - close AS 5 and open RE 6 (discharge air into condenser)
 - leave TA 2 open (discharge ink in buffer tank)

NOTE: *A pump cannot operate if all the solenoid valves connected to it are closed.*

NOTE: *All the solenoid valves may be tested manually.*



■ Print head

The print head on the Markem-Imaje 9020 and Markem-Imaje 9030 has five solenoid valves. Four of them are grouped in a "solenoid valve block" (solenoid valves A, B, C and D) and the fifth stands alone (solenoid valve E).

Name and role of each solenoid valve:

- solenoid valve A: pressure solenoid valve, used to allow ink into the modulation assembly.
- solenoid valve B: purge solenoid valve, used to allow ink to circulate quickly through the modulation assembly.
- solenoid valve C: rinse solenoid valve, used to rinse the modulation assembly with make up.
- solenoid valve D: gutter rinsing solenoid valve, used to allow make up through the suction pipe and gutter solenoid valve.
- solenoid valve E: gutter solenoid valve, used to automatically open and close the gutter.

Specific feature of solenoid valve E:

This solenoid valve (two ports, one channel) can take in make up through a third port in order to rinse its seat and core. Make up can only be drawn in to rinse solenoid valve E if solenoid valve D is opened.

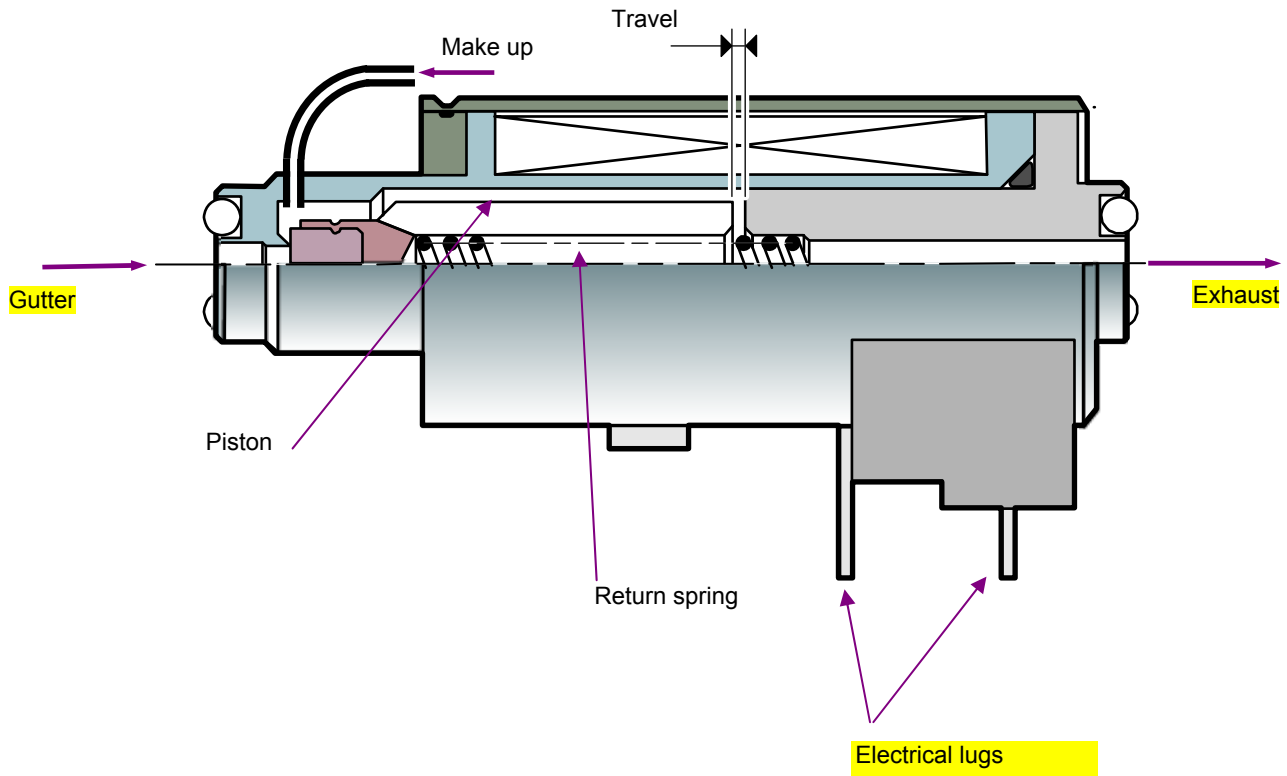
Solenoid valve E may be open, closed or toggling while make up flows.

See diagram below.

NOTE: All the solenoid valves may be tested manually.



■ Diagram of recovery gutter solenoid valve E.



■ Recovery gutter

The gutter is open when solenoid valve E is activated (powered) and closed when it is idle (unpowered). During maintenance procedures the software automatically changes the gutter status (open or closed) depending on the command.

EXAMPLE: During the function “Intro cleaning solution”, the gutter is closed (solenoid valve idle).

During the function “Check jet stability”, the gutter is open (solenoid valve powered).

Hydraulics



Notes:



■ Principle of transfers

Each transfer can be broken down schematically into six phases:

- Phase 1:

With the motor stopped, one solenoid valve on each pump is opened.

- Phase 2:

The motor rotates by half a turn, raising the double piston and generating suction (intake) through the open solenoid valves, then stops.

- Phase 3:

With the motor stopped, the intake solenoid valves are closed.

- Phase 4:

With the motor still stopped, the discharge solenoid valves are opened.

- Phase 5:

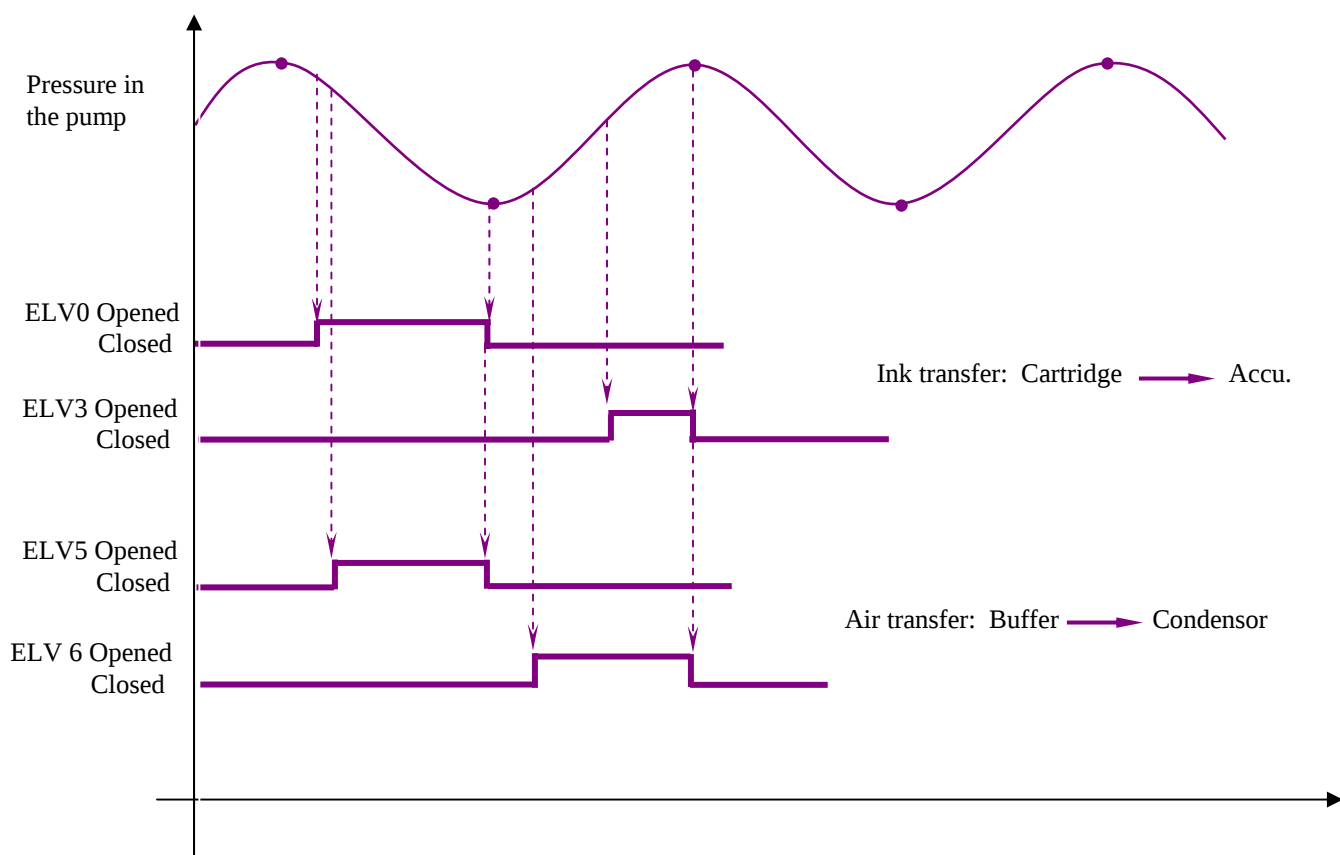
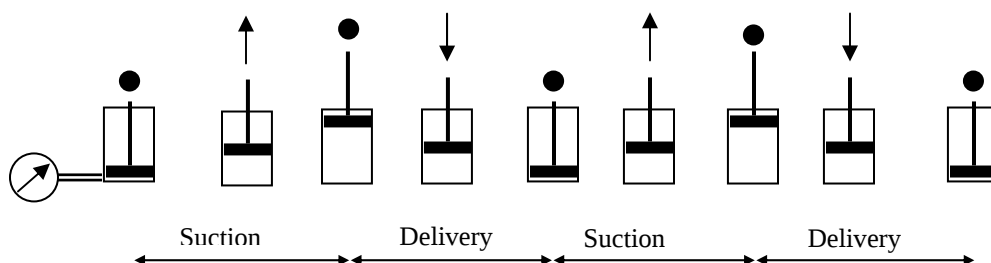
The motor rotates by half a turn, pushing the double piston and generating a pressure (discharge) through the open solenoid valves, then stops,

- Phase 6:

The solenoid valves are closed.

In reality, depending on the transfer, phases 1 and 2 may be combined, as may phases 4 and 5. In order to avoid disturbing the pressures (or negative pressures) in the tanks, the pressures on each side of a solenoid valve must be identical before the valve is opened. See diagram below.

Hydraulics





■ Ink filters

The primary filter is inside the accumulator on the ink circuit. It cannot be changed.

To reach the 14 μ grid filter on the SV 11 inlet, remove the solenoid valve's support bell. Removing the filter is not recommended (risk of ink circuit contamination).

■ Make up filter

In order to filter the make up which is directly aspirated out of the cartridge during the head rinsing, a 5 μ filter screen is located between the make up tip holder and the ink circuit. To reach the filter screen, remove the tip holder.

■ Calibrated restrictors

The hydraulic system has three restrictors located in the print head.

The first is in the hose exiting the recovery gutter solenoid valve. This restrictor optimizes the recovery signal. It is able to be changed if necessary.

WARNING: *The restrictors have a diameter of:*

- 0.7 mm for 1.1G, 1.2G and 1.2M printers
 - 0.5 mm for 1.1M printers
-

A second restriction measuring 0.6 mm is built in to the gutter in order to reduce the air intake and thereby optimize make up consumption. The entire gutter is interchangeable.

The third restriction is located at the refreshment exit of the modulation chassis. Its diameter depends on the modulation assembly type. The modulation chassis is interchangeable.



■ Constant ink concentration principle

The printer uses the "constant concentration" principle.

The ink temperature is measured continuously in the print head, using a temperature sensor on the ADP board. The jet speed is also measured continuously.

Depending on the temperature measured, the ink type, and head type, a theoretical pressure is defined to obtain the correct jet speed.

If the pressure required to obtain this speed is different from the theoretical pressure, the ink concentration must be incorrect.

The computer corrects the ink concentration by adding make up.



■ Jet speed calculation and adjustment

For high quality printing, the jet must be at a constant speed. The software continuously measures the speed and adjusts it if necessary.

Jet speed calculation

$$\text{Speed} = \text{Distance} / \text{Time}$$

The principle used to measure the speed is as follows: A sequence of seven consecutive drops is charged with a specific, precise amount of charge when it passes through the charge electrode. The speed is measured in the detection electrode located immediately below the charge electrode. The software measures the elapsed time between the point when the detection electrode detects the specific electrical charge and the point when it disappears from the detection electrode. As the distance traveled across the detection electrode is known the software can calculate the jet speed.

The speed measured is then compared to the speed set point.

Automatic jet speed adjustment

Three cases can arise:

- ☐ Speed measured > Speed set point

In this case the pressure in the accumulator must be reduced. The software controls the opening and closing of solenoid valves AC3 and TA2 so as to reduce this pressure and very quickly return the speed to the set point.

- ☐ Speed measured < Speed set point

In this case the pressure in the accumulator must be increased. The software causes ink to be taken from the buffer tank or the cartridge and added to the accumulator.

- ☐ Speed measured = Speed set point

Nothing needs to be changed; the printer is ready to print.



■ Negative pressure measuring and adjustment

Measuring of the negative pressure

The negative pressure is measured with the pressure sensor underneath the ink pump, when transferring ink into the buffer tank. This measured value is compared to a set point value.

Adjustment of the negative pressure

Three cases can arise:

Measured value < Set point value (weak suction and a risk of the gutter overflowing)

Air pumping is reactivated to increase the negative pressure in the buffer tank (suction in buffer tank, backflow in condenser).

Measured value > Set point value (strong suction but excess make up consumption)

Vacuum pumping (suction and backflow in buffer tank)

Measured value = Set point value

Air pumping to maintain negative pressure without exceeding the set point value.

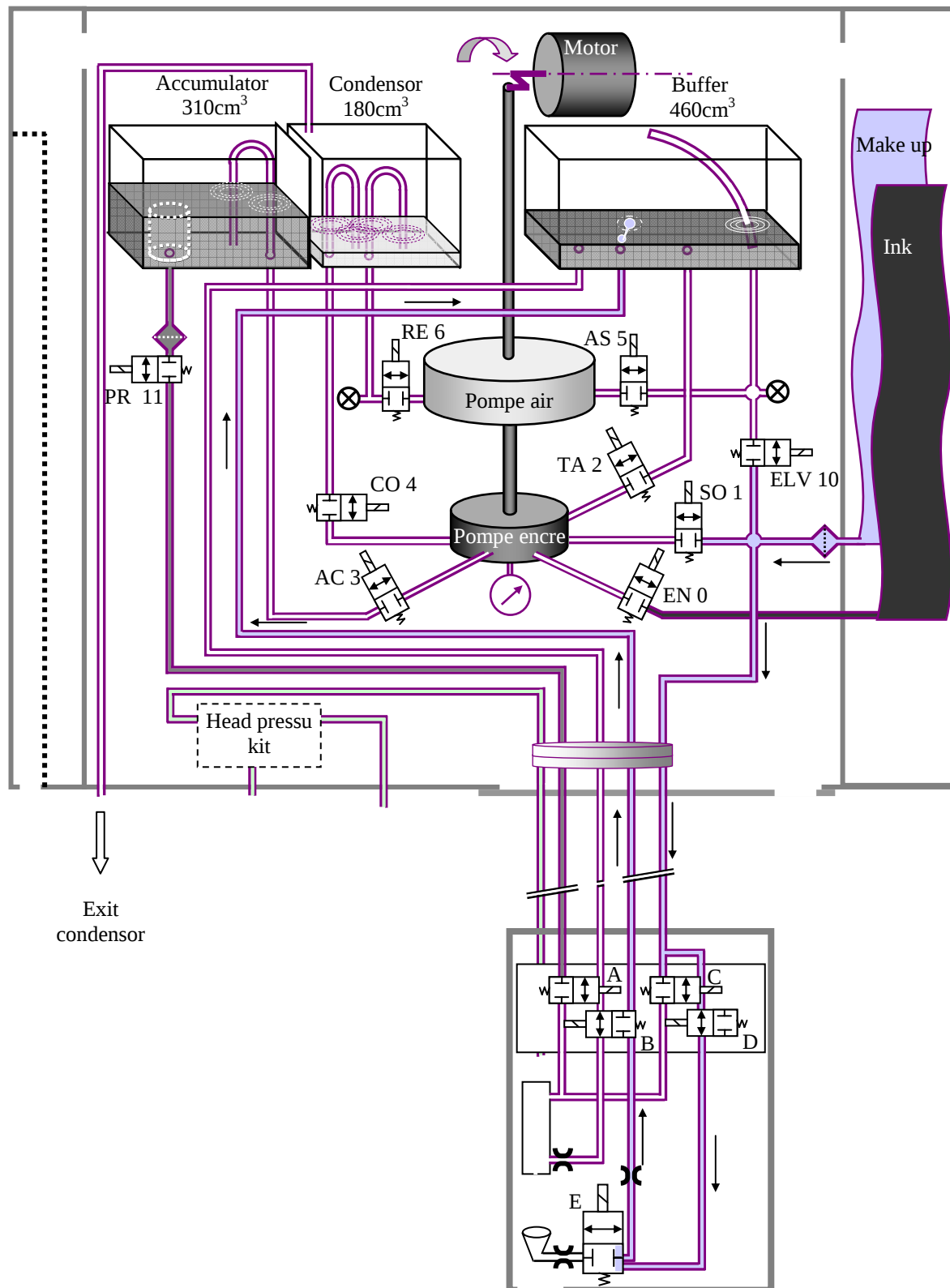
Vacuum pumping if value exceeded.



■ Gutter solenoid valve rinsing

At the end of the “Stop printer” procedure the gutter solenoid valve is rinsed. Solenoid valve D delivers make up to clean the seat, core and spring in solenoid valve E. During this phase the solenoid valve is opened and closed in order to properly clean it and the pipe leading back to the buffer tank.

See diagram on the following page.



Hydraulics



Notes:

Hydraulics



Notes:



Electronics

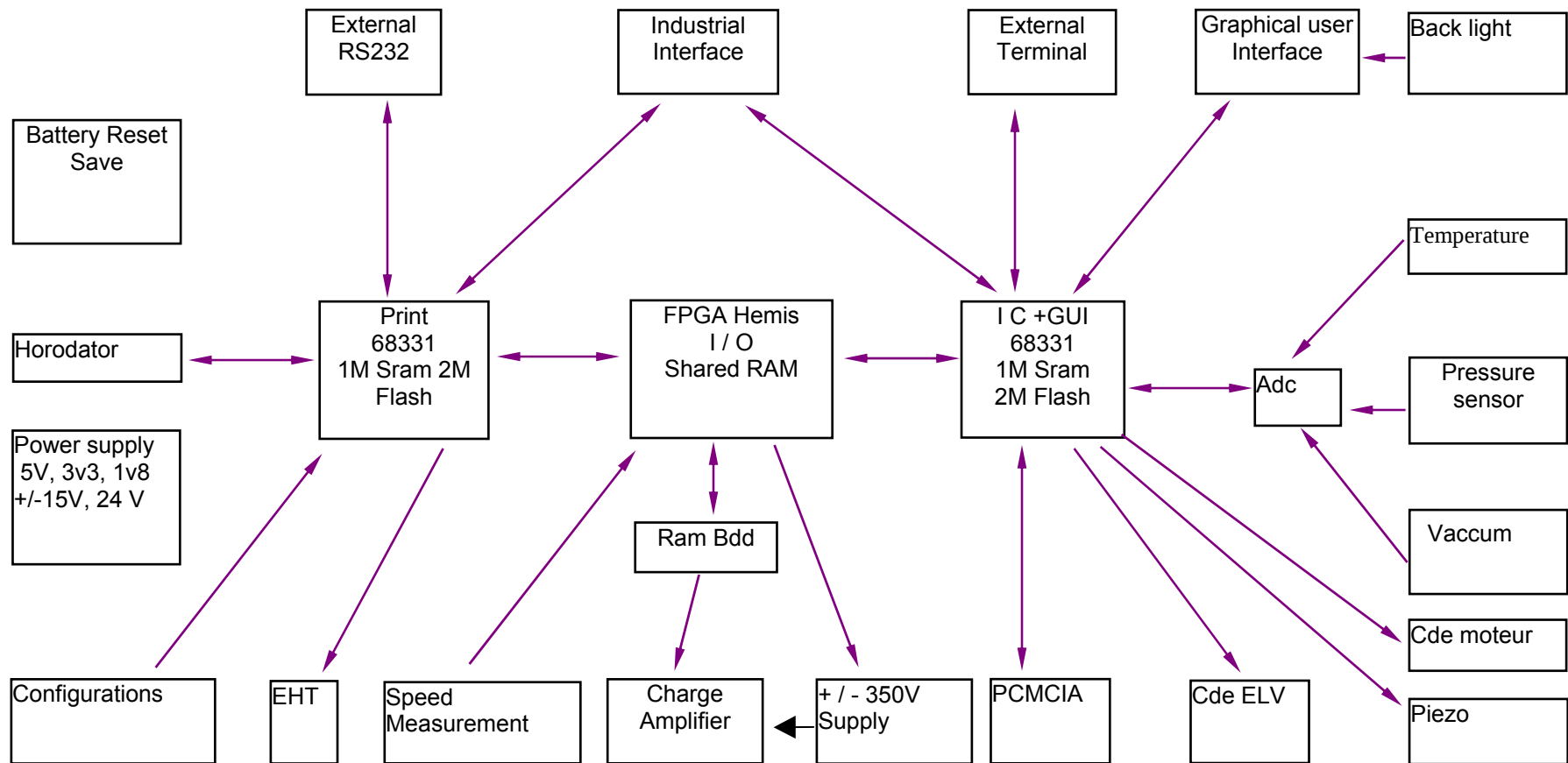




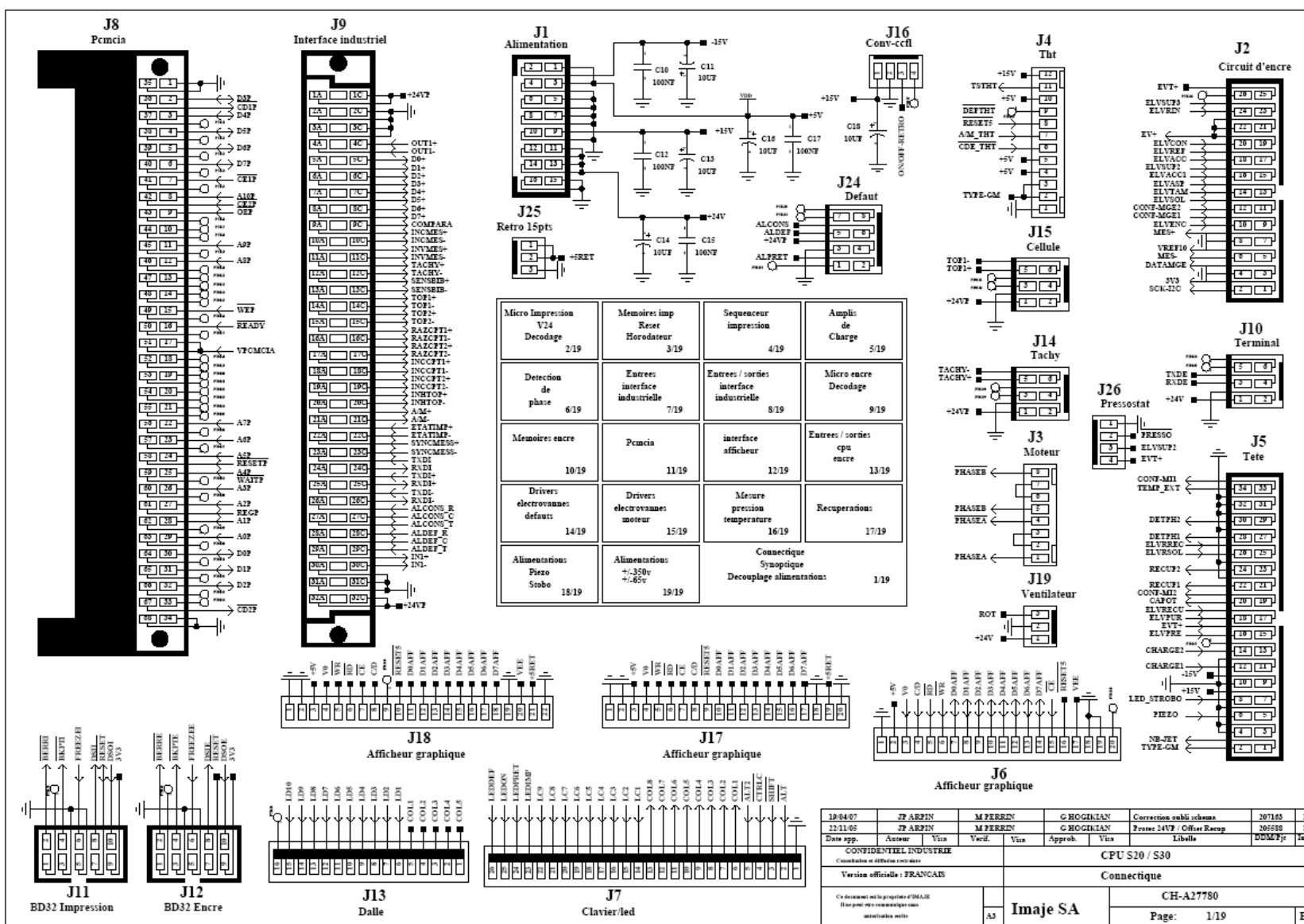
Notes:



■ 9020/9030 Electronic Architecture

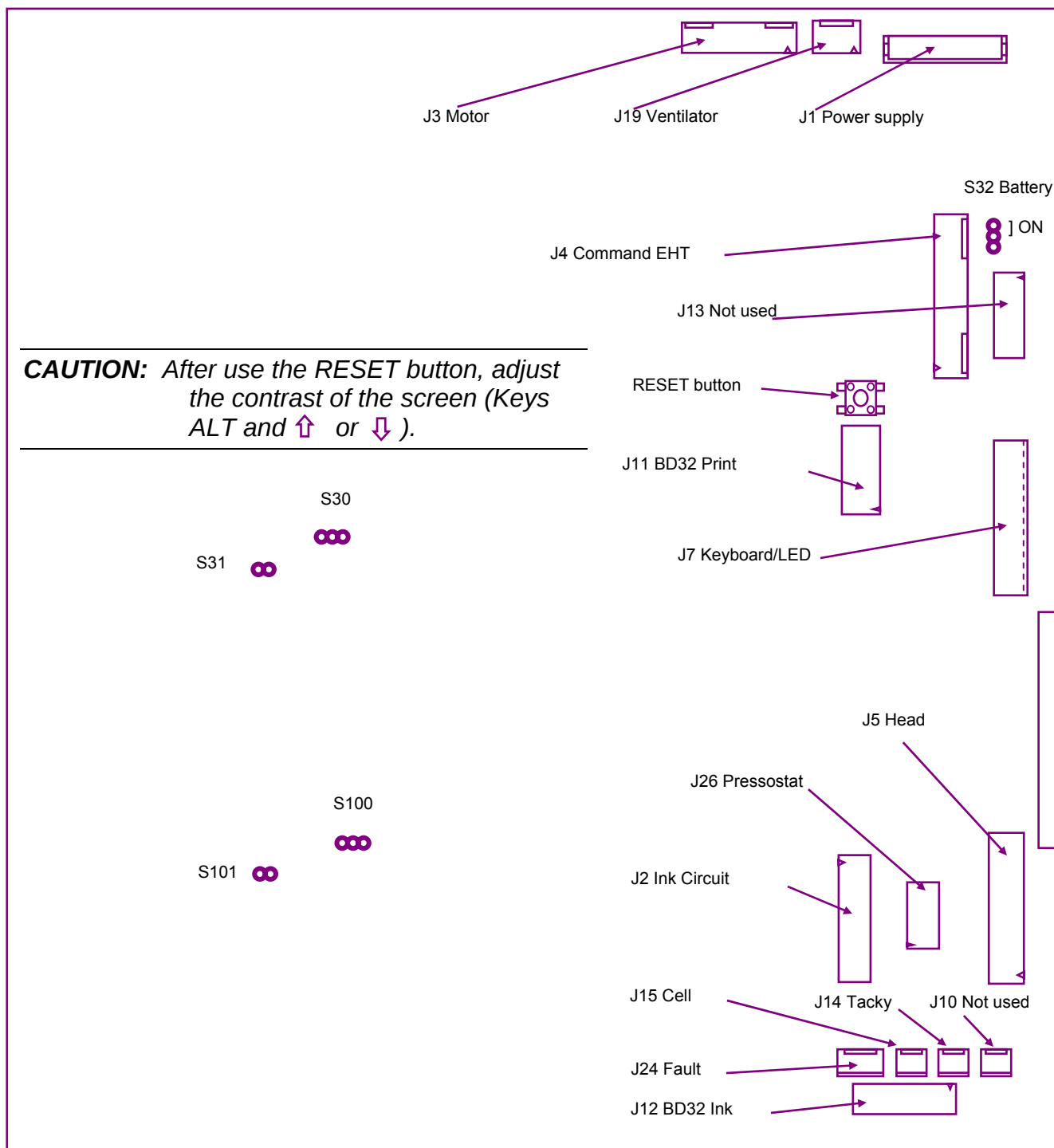


■ CPU Connections





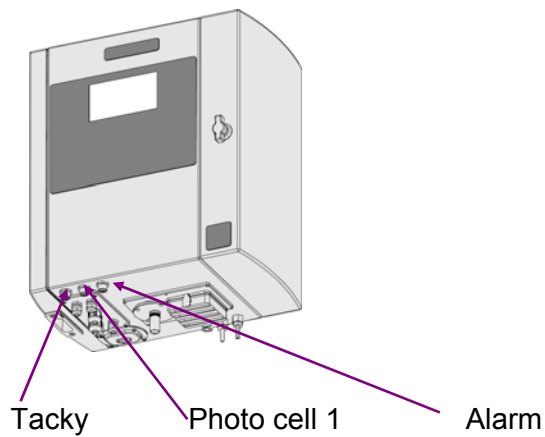
■ Connectors on CPU board



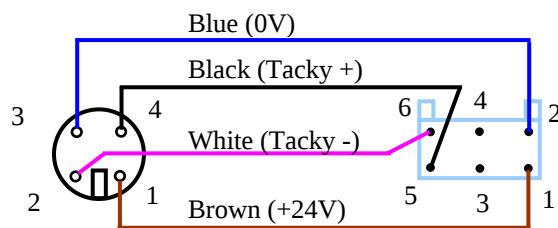
J3 **J4**



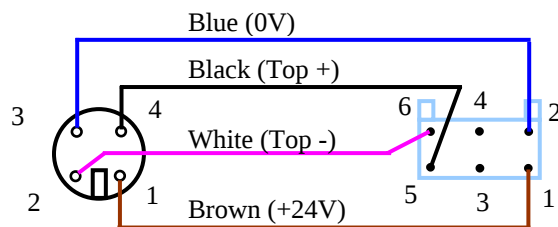
■ External connectors



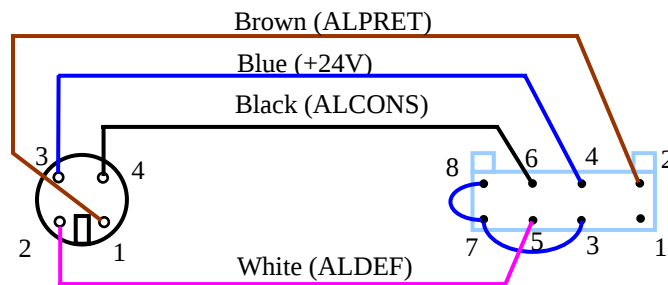
Tacky connector (blue mark)



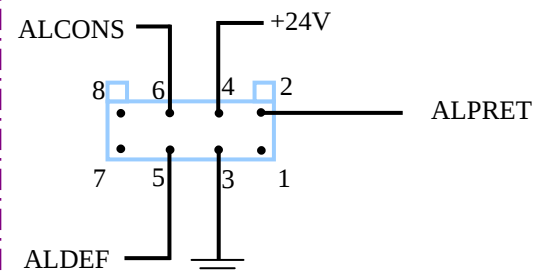
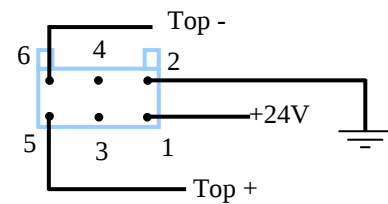
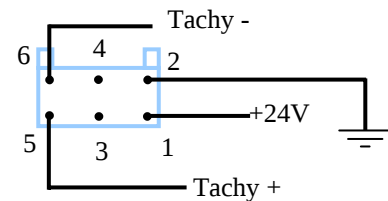
Cell 1 connector (black mark)



Alarm Connector (Yellow mark)



CPU





Notes:



General information



General information



Notes:

General information



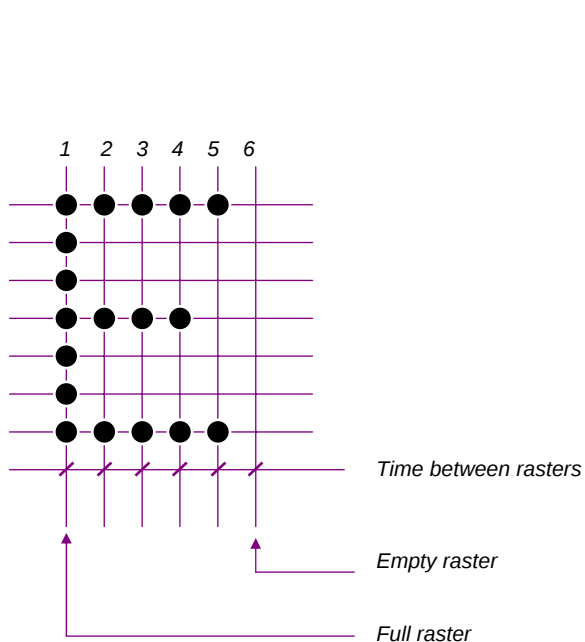
■ Ink jet printing

Ink jet printing is a non-contact method of marking a product to identify, date or customize it.

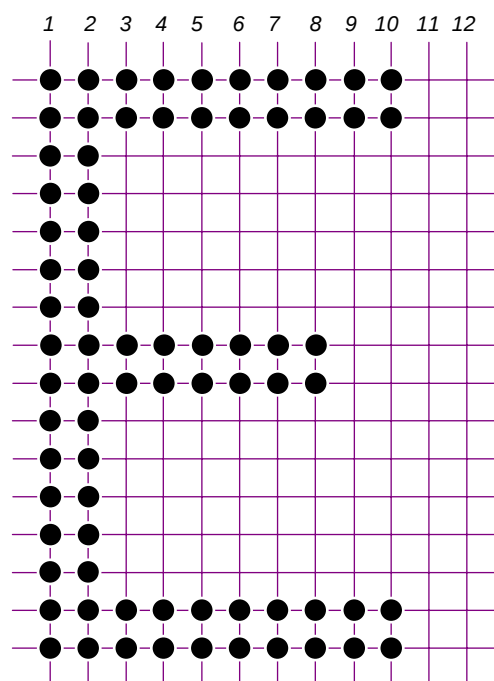
Markem-Image 9020 and 9030 printers use the continuous ink jet principle, writing in a conventional matrix layout.

■ Matrix printing

Each symbol is defined in a rectangular area, divided into columns known as rasters. The number of points in a raster and the number of rasters define the matrix.



7 × 6 matrix



16 × 12 matrix



■ Deviated continuous ink jet

The print head is supplied with ink under pressure.

This ink is ejected from the modulation assembly (1) via the nozzle (2), in the form of a jet (3). The jet is stimulated by a piezo-electric resonator in order to create consistent drops of ink.

All these drops are directed towards a recovery gutter (4).

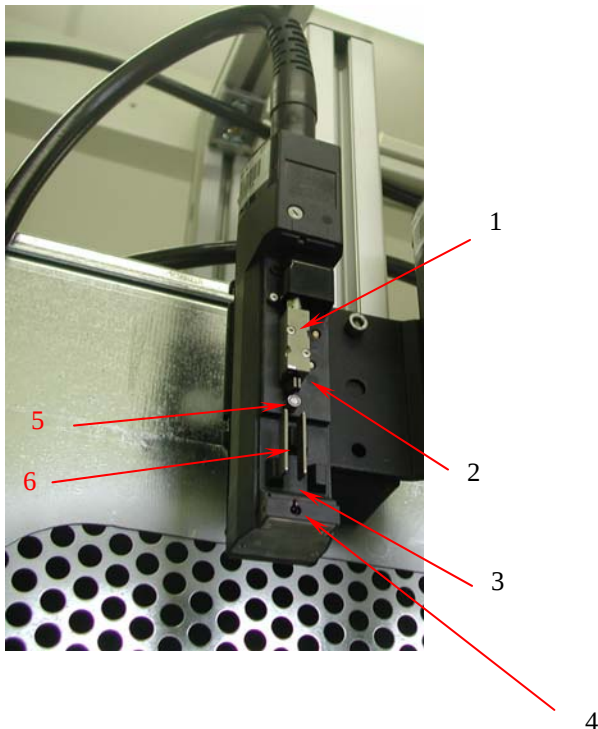
Drops not used for printing go into the gutter and are recycled.

Drops used for printing are charged electrically at the charge electrode (5). They are deviated from their original trajectory by the electrical field generated by the two deflection plates (6) and fly out of the head and onto the product to form the desired symbol.

The symbol is formed drop by drop, raster by raster.

The height of the symbol is determined by how many drops are deflected, and the amount they are deflected (proportional to the charge on them).

The width of the symbol is determined by how fast the object moves relative to the print head.



General information



Resonator block

The modulation assembly is a low-volume cavity in which pressurized ink is conditioned (regular jet flow, no air bubbles, modulation) before passing through the ejection nozzle to form a controlled jet.

Piezo-electric resonator

The piezo-electric resonator comprises a quartz crystal glued to a metal bar. When an alternating electrical signal is applied to the resonator, it vibrates in phase with the signal. This vibration is transferred to the ink and causes the jet to create drops in harmony with this vibration. Modulation affects the quality and location of the break-off point as well as the size and shape of the drops.

Recovery gutter

The gutter is permanently connected to a circuit under negative pressure, using suction to recover non-deviated drops which are then recycled.

The gutter position can be adjusted so that the jet shoots in the center of the gutter.

Charge electrode

The charge electrode and ink drop together act like a capacitor: when an electrical voltage is applied to the charge electrode, an equal but opposite voltage is set up on the drop located at the break-off point.



■ Algorithms

An algorithm is a series of rules used to calculate the correct charge value for each drop used to form a symbol.

The algorithm is chosen depending on the desired result (printing height, resolution, quality), the possible distance between the head and the object, and the printing speed imposed by the production line (the speed at which the object moves relative to the head).

Using algorithm on 9020 and 9030 printers

An algo is defined by several parameters:

- Number
- Head type
- Head/object distance
- Number of printed drops
- Position of the first printed drop/gutter
- Resolution
- Total number of drops used in the raster

This information is in the designation of the algo.

Example : 004G10_07_01_28_18

004 = Font number 4

G = Head type G

10 = Head/object distance 10mm

07 = Number of printed drops

01 = Position of the first printed drop/gutter or number of lines * height for multiline (ex : 2*7)

28 = Resolution 2,8 pts /mm

18 = Total number of drops used in the raster

IMPORTANT : In message editing, when the algo 000 is used, the printer chooses the best algo.

General information



Calculation of the maximum speed of an algo:

Maxi speed = $1 / (F_{\text{piezo}} * \text{nb of drop in the raster} * \text{resolution})$

- $f_{\text{piezo}} = 16\mu\text{s}$ for a G head and $12\mu\text{s}$ for a M head)
- resolution nb of drops / mm

Example: Algo 004G10_07_01_28_18

$$1 / (0,000016 * 18 * 2,8) = 1240 \text{ mm/s}$$

Using restriction:

The algo. 4x7 can be used only on a mono-jet printer.

General information



Algorithm table

(speed calculations +0, -5mm)

HEAD G				
Number	Name	Resolution	Speed max mm/mn	Head/objet distance
001	001G10_05_01_28_05	2,8 pts/mm	4460	10mm
002	002G10_07_01_28_07	2,8 pts/mm	3185	10mm
003	003G10_16_01_28_17	2,8 pts/mm	1310	10mm
004	004G10_07_01_28_18	2,8 pts/mm	1240	10mm
005	005G10_16_01_28_40	2,8 pts/mm	0555	10mm
011	011G10_11_01_28_12	2,8 pts/mm	1860	10mm
012	012G10_24_01_28_60	2,8 pts/mm	0370	10mm
013	013G30_07_01_28_23	2,8 pts/mm	0970	30mm
014	014G30_16_01_28_57	2,8 pts/mm	0390	30mm
019	019G10_09_01_28_22	2,8 pts/mm	1010	10mm
020	020G10_11_01_28_26	2,8 pts/mm	0855	10mm
030	030G10_3x5_1_28_16	2,8 pts/mm	1395	10mm
031	031G10_07_01_28_06	2,8 pts/mm	3720	10mm
032	032G10_05_01_28_04	2,8 pts/mm	5580	10mm
040	040G10_3x7_1_28_22	2,8 pts/mm	1010	10mm
041	041G10_4x5_1_28_24	2,8 pts/mm	0930	10mm
043	043G10_24_01_28_28	2,8 pts/mm	0795	10mm
047	047G10_2X7_1_28_15	2,8 pts/mm	1485	10mm
048	048G10_2x5_1_28_11	2,8 pts/mm	2025	10mm
050	050G10_4x7_1_28_37	2,8 pts/mm	0600	10mm
999	999G_SP_EAN	2,8 pts/mm	0240	10mm



General information



HEAD M				
Number	Name	Resolution	Speed max mm/mn	Head/objet distance
006	006M08_05_01_45_06	4,5 pts/mm	3085	08 mm
007	007M08_07_01_45_08	4,5 pts/mm	2310	08 mm
008	008M08_07_01_45_26	4,5 pts/mm	0710	08 mm
009	009M08_16_01_45_53	4,5 pts/mm	0345	08 mm
010	010M08_16_01_45_19	4,5 pts/mm	0970	08 mm
015	015M08_11_01_45_16	4,5 pts/mm	1155	08 mm
016	016M08_24_01_45_78	4,5 pts/mm	0235	08 mm
017	017M20_07_01_45_32	4,5 pts/mm	0575	20mm
018	018M20_11_01_45_48	4,5 pts/mm	0385	20mm
022	022M08_11_01_45_38	4,5 pts/mm	0485	08 mm
033	033M08_07_01_45_07	4,5 pts/mm	2645	08 mm
035	035M08_3x5_1_45_20	4,5 pts/mm	0925	08 mm
036	036M08_3x7_1_45_26	4,5 pts/mm	0710	08 mm
037	037M08_4x5_1_45_26	4,5 pts/mm	0710	08 mm
038	038M08_24_01_45_31	4,5 pts/mm	0595	08 mm
042	042M08_05_01_45_05	4,5 pts/mm	3700	08 mm
044	044M08_07_01_28_08	2,8 pts/mm	3720	08 mm
045	045M08_05_01_28_05	2,8 pts/mm	5950	08 mm
049	049M08_2x5_1_28_13	2,8 pts/mm	2285	08 mm
996	996M_SP_EAN_24	4,5 pts/mm	0235	08 mm

Algos CURVPRINT

The algos 100 to 199 are reserved for Curvprint function.

CURVPRINT.speeds table

	HEAD G	HEAD M
2x8 points	0,620 m/s	0,363 m/s
1x8 points	1,48 m/s	0,949 m/s
16 points	0,465 m/s	0,195 m/s



■ Printing, pressure, speed

Printing with an ink jet requires:

- ink with a controlled quality
- a jet, which implies speed, i.e. ink under pressure

Controlling the quality of ink

Ink quality covers both the electrical and physical characteristics of the ink.

These characteristics vary depending on two main parameters:

- temperature
- evaporation rate

Quality must be optimum at the precise point where the ink is used, i.e. in the print head. This is where the last two ink quality checks are made: monitoring the jet ejection speed (checking the physical characteristics of the ink) and the charge on the drops (checking the electrical characteristics of the ink).

Markem-Imaje uses two different principles:

- quality at constant viscosity (S4 and S8)
- quality at constant concentration (S7, 9020, 9030)

Ink under pressure

Examples:

- In the Markem-Imaje 9020/9030 or the S8 Contrast, the accumulator is a pressurized reservoir of ink.
- In the S8 Master or Classic, pressure is generated on demand by the pump.

Pressure is what enables ink to be ejected through the nozzle.

Movement always takes place from a high-pressure zone towards a lower pressure zone.

The higher the pressure, the faster the jet.

General information



■ Atmospheric pressure, absolute pressure, relative pressure



Atmospheric pressure

Atmospheric pressure is around 1013 mbar at sea level.

This pressure, given by weather services, corresponds to the "weight" of the atmosphere on a unit surface area. The value depends primarily on altitude.

Absolute pressure

An absolute pressure of 0 bar would be obtained in a perfect vacuum.

Relative pressure

Relative pressure is the difference between atmospheric pressure and the pressure measured in a closed vessel. This value may be positive or negative.

Examples of relative pressure:

- the pressure to which car tires are inflated



- pressurization in an aircraft cabin

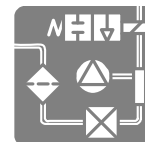


- pressure around a deep sea diver



- vacuum pressure inside a cathode ray tube

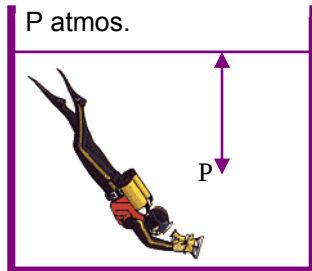
- positive or negative pressure inside an ink circuit in a Markem-Imaje printer.



General information



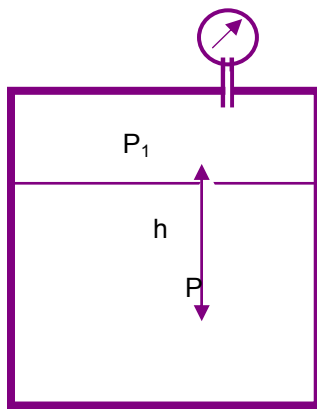
Pressure in a liquid



Open vessel

$$P = \rho gh$$

where P = pressure at a point in the liquid,
 ρ = density of the liquid,
 g = normal acceleration due to gravity,
 h = height between the surface of the liquid and the point considered.



Closed vessel

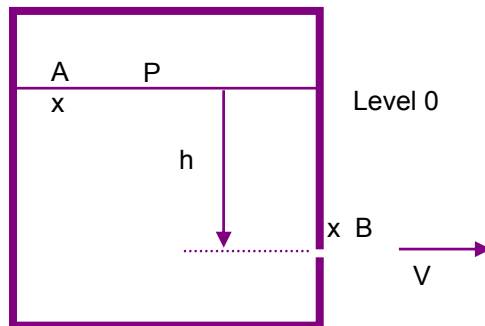
$$P = P_1 + \rho gh$$

where P_1 = pressure relative to the top of the liquid surface
 P = pressure at a point in the liquid,
 ρ = density of the liquid,
 g = normal acceleration due to gravity,
 h = height between the surface of the liquid and the point considered.



Relationship between ejection speed and pressure

The vessel is pierced with a small hole below the level of the liquid (h is negative)
Consider point A to be at the surface of the liquid (level 0), and point B to be at the hole.



The liquid escapes through the hole at speed V .
The potential energy at the points by the hole is converted to kinetic energy at point B.

Physical law:

$$P + \rho V^2/2 + \rho gh = \text{Const}$$

This is true at any point in a liquid.

General information



Calculating the ejection speed

$$P_A + \rho V_A^2/2 + \rho gh_A = P_B + \rho V_B^2/2 + \rho gh_B$$

P_A = Atmospheric pressure

$V_A = 0$ (no movement at point A)

$h_A = 0$ (origin for levels)

P_B = Atmospheric pressure

The equation becomes: $\rho V_B^2/2 + \rho gh_B = 0$ (with h_B negative)

or: $V_B = \sqrt{2gh_B}$

NOTES: *The ejection speed of the liquid is independent of its density.*

The ejection speed of the liquid is independent of the hole's diameter.

Bernoulli's theorem



Daniel Bernoulli (1700-1782), one of the founders of hydrodynamics, devised the above theorem concerning the conservation of energy in a fluid on a stream line, which relates the ejection speed of a liquid to the pressure.

General information



■ Fundamental units



Mass

1 kilogram (kg) = 2.2046 pound (lb)

1 lb = 0.4536 kg

Length

1 meter (m) = 3.281 feet (ft)

1 inch = 25.4 mm

1 yard = 0.9144 m

Volume

1 liter (l) = 0.2642 US gallons

1 US gallon = 3.785 l

1 cubic meter (m³) = 35.315 cubic feet

1 cubic inch = 16.387 cubic centimeters

Mass, weight and force

1 kilogram force (kg f) = 9.81 Newton (N)

in practice 1 kg f = 10 N

1 Newton (N) = 0.2248 pound force (lb f)

Pressure

Pressure = Force / Surface area

The international system (SI) defines pressure in Newton per square meter.

The SI unit of pressure is the Pascal (Pa).

1 Pa = 1 N/m²

A Pascal is a very small pressure unit. In practice, the metric system uses a multiple: the bar.

1 bar = 1 decanewton per square centimeter

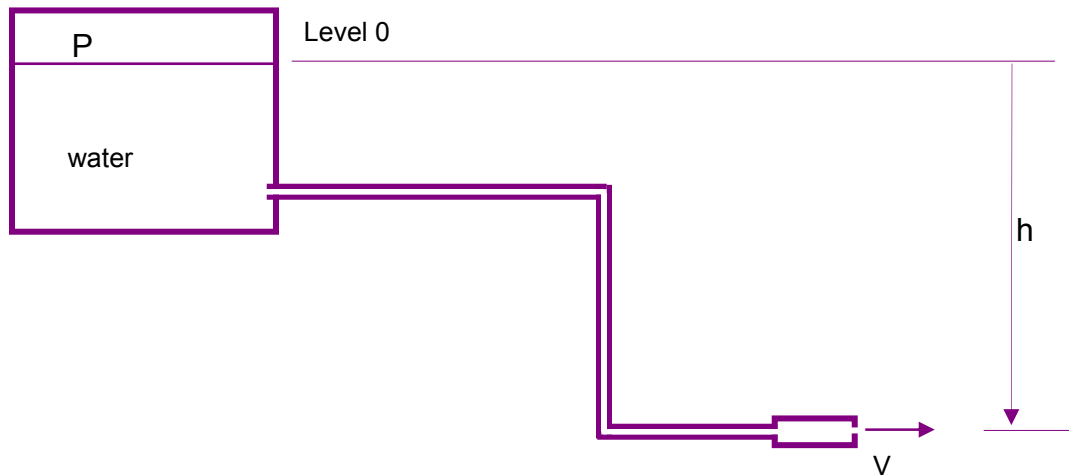
The Imperial system uses "psi" (pound force per square inch).

1 bar = 14.5 psi





■ Exercise:



Neglect the effects of the fluid's viscosity.



Calculate the ejection speed of the jet at the hole for the following values:

A)

$P = 2.0 \text{ bar}$

$h = 0 \text{ m}$

B)

$P = 2.0 \text{ bar}$

$h = -2 \text{ m}$

C)

$P = 2.0 \text{ bar}$

$h = +2 \text{ m}$

General information



Notes:

General information



Notes:



A  Company

Head Office
9, rue Gaspard Monge
BP 110
26501 Bourg-lès-Valence
Cedex
France

Tel : (33) 4 75 75 55 00
Fax : (33) 4 75 82 98 10
<http://www.imaje.com>



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