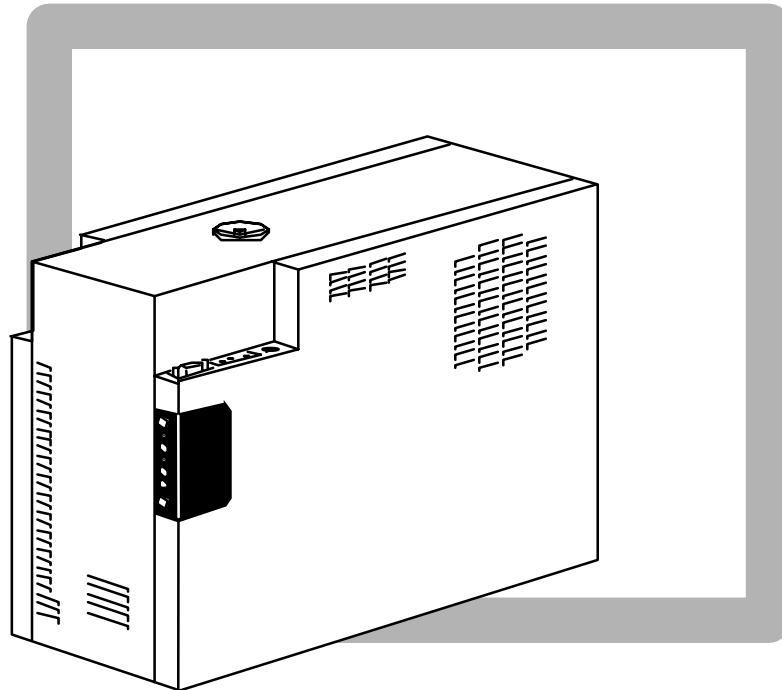




Installation & Operating Manual



MFC AHD - 100

Marine Fuel Cell

Serial Number:.....

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web: www.solarlink.de

Last Updated: 31 January 2005

1. INTRODUCTION

1.1 Safety:

Before starting up your MAX POWER AHD 100, make sure you read the entire operating manual and store the instructions in a safe and easily accessible area. You will then be able to refer to it again later on if there are any questions regarding operation of the **MFC AHD - 100**.



Methanol is poisonous. Do not inhale, swallow or allow it to come into contact with skin. There is a real risk of serious injury due to inhalation, contact with skin or swallowing. In case of accident or nausea, immediately seek medical assistance and present the fuel cartridge label or operating manual (there is a methanol safety data sheet in the appendix at the end of this manual).



Do not use excessive force to open the **MFC AHD-100** or fuel cartridges. Any changes made to the equipment compromise safety and void the operating license and warranty.



Do not operate or store the **MFC AHD-100** or fuel cartridges at a temperature higher than 45° C. Do not expose to heat or direct sunlight.



Keep sources of heat and ignition at a safe distance from the **MFC AHD-100** and its fuel cartridges.



Do not smoke when handling the **MFC AHD-100** or fuel cartridges.



Be sure to keep children away from the **MFC AHD-100** system and its fuel cartridges.



There is a risk of fire if any methanol has spilled (e.g., after an accident or if fuel cartridges have been damaged). Keep ignition sources at a safe distance and thoroughly ventilate the area. Spilled methanol will evaporate without leaving any residue.



Follow all safety instructions and be sure to comply with all warnings printed in bold font to minimize risk of injury to yourself and others.

1.2 Use the Marine Fuel Cell in compliance with regulations:

- The **MFC AHD-100** system is a **charger / automatic battery compensator for 12 V** lead-acid batteries and should only be used for this type of application.
- The **MFC AHD-100** may only be operated using **original Marine Fuel Cell cartridges as supplied by MAX POWER.**
- The **MFC AHD-100** is not designed for use as an emergency power supply (eg. Life emergency equipment).

1.3 Declaration of Conformity:



MAX POWER, 10 Allée F Coli, 06210 Mandelieu, France hereby declares that the product **MFC AHD-100** conforms to the EC Guideline 89/336/EEG as it is relating to electromagnetic compatibility. The following harmonized standards were applied: DIN EN 61000-6-1, DIN EN 61000-6-3.

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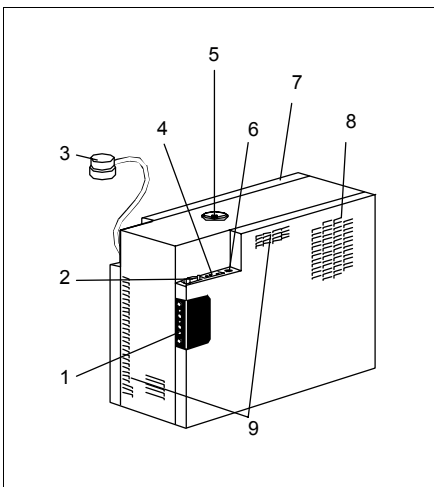
3. CONSTRUCTION

3.1 Package Contents:

The MFC AHD-100 package includes the following items as standard:

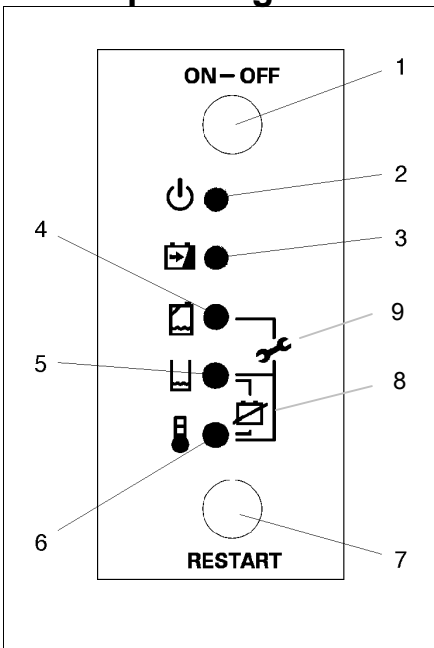
- The MFC ADH-100.
- Mounting plate including two fastening screws.
- Fuel-cartridge holder.
- Exhaust tube.
- 12 Volt connecting cable with screw type connection bar.
- Spare fuse.
- Process medium.
- Manual.

3.2 Overview:



- 1 Operating panel
- 2 Terminals for optional remote control
- 3 Fuel-cartridge supply tube with cartridge connector
- 4 Device terminals batteries
- 5 Exhaust opening / fill opening for process medium
- 6 6.3 A fuse, (semi-fast)
- 7 Cooling-air exhaust (rear)
- 8 Cooling-air intake (front)
- 9 Ventilation openings

3.3 Operating Panel:



- 1 "ON-OFF" button
- 2 Green "ON" LED
- 3 Green or Blue LED "Battery charging in progress"
- 4 Orange LED "Cartridge empty"
- 5 Red LED "Process-medium shortage"
- 6 Red LED "Temperature too high or too low"
- 7 "RESTART" button
- 8 When LED 5 and 6 are both lit:
"Connected battery voltage too high or too low"
- 9 When LED 4, 5 and 6 are all on at the same time:
"MFC defective - contact Max Power"

3.4 Technical Specifications:

	Performance data:				
Power rating:	50 W				
Voltage:	10.5 ... 13.8 V				
	Fuel consumption (methanol):				
In charging mode:	+/- 1,2 litre per kWh				
In freeze protection mode:	0 °C	50 ml/Jour			
	-10 °C	60 ml/Jour			
	-20 °C	70 ml/Jour			
	Features:				
Power output connection:	12 V output including sensor to automatically charge a 12 V lead-acid battery				
Control interface:	Sub-D plug to connect an external operating panel (available as optional component)				
Electrical protection:	Electronic shutdown on overload 250V, 6.3 A fuse, M (medium-lag) for short-circuit protection				
	General specifications:				
Noise emission:	about 47 dB (A) at a distance of 1 m during fuel cell operation				
Maximum dimensions:	380 mm x 260 mm x 155 mm (l x h x w)				
Weight:	about 8 kg				
	Ambient conditions:				
Operating temperature:	-20 °C ... +40 °C				
Storage temperature:	+1 °C ... +45 °C				
Humidity of air:	20% ... 90%				
	Maximum permanent inclination angles:				
Maximum Angle Longitude:	30°, 0°, 30°				
Maximum Angle Lateral:	40°, 0°, 40°				
	Safety-tested plastic canisters:				
	Volume :	Weight:	Capacity*:	Part Number :	Reference:
	5,0 litres	4,2 kg	3,8 kWh	150 905 006	MFC M5

*Average at nominal charge

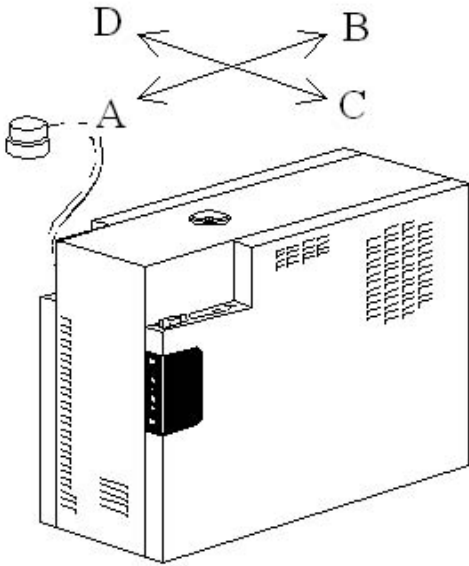
4. INSTALLATION

The device generates a significant amount of heat, which must be exhausted to the outside. Please take this into consideration when planning the installation location.

- Make sure the MFC AHD-100 and the methanol cartridges are securely tied or bolted down to avoid accidents. Make sure that the unit is installed in a stable and horizontal position in central area to avoid shocks to the system.
- The MFC AHD-100 shall not be installed in hazardous locations (explosion risk).
- Children must not be permitted to have access the MFC 100 AHD or the fuel cartridges. Protect the MFC 100 AHD from exposure to temperatures exceeding 45 °C and from direct sunlight.
- The MFC AHD-100 is not waterproof. Do not install where water can enter the equipment.
- On the yacht, due to heeling during navigation, it is recommended you install the MFC AHD-100 in line with the yacht, close to the centre of gravity (see maximum angles the unit can sustain).

4.1 Installation Location:

- **Ensure that temperatures will not exceed +40° C.**
- Choose an area that is well ventilated with circulating air from the bottom of the boat with an air vent above it (the bottom of the boat usually has colder air circulation).
- Avoid installing unit in too closed spaces where hot air can accumulate. It is recommended to maintain a clearance of about 20 cm between the wall and cooling-air exhaust (7). Do not obstruct the cool air intake (8).
- Cooling and exhaust air ducts and their fittings are available as an option (see Chapter 4.5). This enables the heated MFC AHD-100 exhaust air to be properly evacuated and enables the device also to be operated in a very confined space.
- Make sure you have sufficient access to be able to remove the unit if needed and that the system can be easily stopped if necessary.
- The control panel, the electrical connections, the fill opening for the process medium and the fuel cartridge should be easy accessible.
- Install the MFC AHD-100 and the fuel cartridge at the same level. Ensure that the fuel cartridge installation location is within reach of the cartridge supply tube and that no kinks occur in the tube.



⚠ On yachts, install the MFC 100 AHD parallel to the length of the yacht (A, B) as close to the centre of gravity as possible.

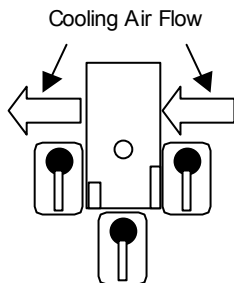
The unit should only be installed on a flat, horizontal surface.

In direction AB:
a permanent inclination of over **30°** might cause the system to fail.

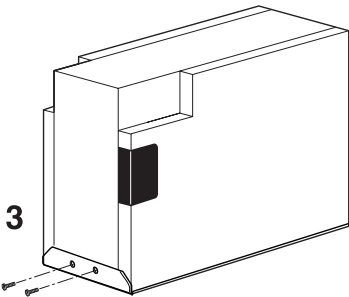
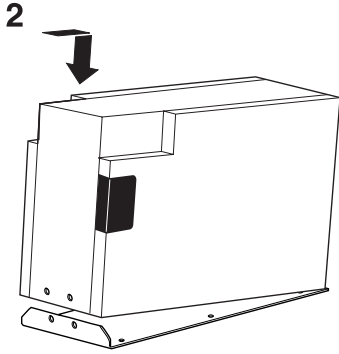
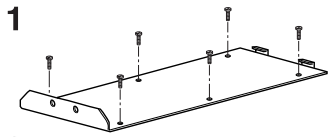
In direction CD:
a permanent inclination of over **40°** might cause the system to fail.

- For installations where the ambient temperature is less than 3°C, the MFC AHD-100 must at all times have sufficient fuel (methanol) available and be connected to a 12V battery, in order for the freeze protection to operate (see chapter 5.5).
- If unable to regularly connect filled cartridges, the MFC AHD-100 should be stored at a temperature higher than 3°C.
- When in operation the MFC AHD-100 consumes about the same amount of air oxygen as a human (about 60 l/h or 86 g/h O₂) when it operates. It also emits small amounts of humid air and carbon dioxide via the exhaust opening. The amount is similar to what humans exhale (about 40 l/h or 80 g/h CO₂) Use the exhaust tube to channel the exhaust air from the installation room to outside.

4.2 Fixing the MFC system and the fuel-cartridge holder:



- The fuel cartridge must not be installed where it will be exposed to the heat of the exhaust air or where it will block the cooling air intake.
- The fuel cartridge can be installed in positions as indicated on diagram.
- The above also applies for the stocking of spare cartridges.



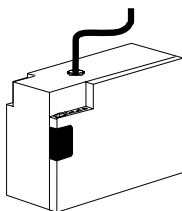
- The **MFC AHD-100** must only be installed/fixe in the vertical (upright) and horizontal (level) position.
- Once decided on the installation position as previously described, screw or bolt the mounting plate securely in place to ensure that the plate will remain in place even when subjected to heavy shocks.
- Slide the MFC AHD-100 against the catch on the mounting plate. Then fasten the MFC AHD-100 to the mounting plate using the screws supplied in the package.
- Proceed to fasten the cartridge support in the same way making sure that you do not obstruct the air vents.

4.3 Installing the Exhaust Tube:

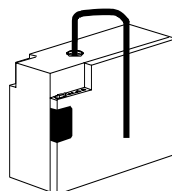


The supplied fuel cartridge supply tube and the exhaust tube must not be damaged and not be replaced by any other types of tube.

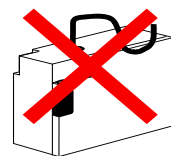
- An exhaust tube must be installed to ensure that the MFC AHD-100 operates properly.
- Use only the exhaust tube as originally supplied.
- The humid exhaust-air temperature may from time to time exceed 60°C during operation.
- Keep in mind that the exhaust air contains small quantities of water vapour, which condense in the tube, therefore the exhaust tube should always lead out of the installation space.
- Ensure that the end of the tube cannot become closed or plugged and make sure that the tube cannot kink or create a siphon.



Maximum 1 meter upwards.



Maximum 1,5 meters downwards



Avoid creating a siphon.

Installation examples of exhaust tube:

Downwards: towards the washbasin, shower, grey tank or bilge.

Guide the tube, to the required length without creating a siphon (maximum 1.5 meters*), to an area where water can be evacuated, (for example into a recipient). Make sure that tube end is above water level in order for air to escape without forcing.

Upwards: towards the bridge, cockpit etc with protection,

Guide the tube, without siphon, (maximum 1.2 meter) to evacuate air and water to the outside or recuperate as mentioned above. Make sure that nothing can enter or block the tube (sand, dust or water from outside).

***It is possible to lengthen the original tube**, if following points are respected:

- Never exceed the above-mentioned maximum lengths.
- Always ensure a constant downward slope, without siphons, to facilitate the natural flow.
- To lengthen system use a tube with an inside diameter of minimum 12mm, of good enough quality not to kink or deform, without out exceeding a total length of 4 meters. When connecting tubes together it is recommended you install the smaller diameter tube into the larger. Make sure the tubes are watertight.
- If total length is more than 4 meters, increase the diameter of the lengthening tube.



For sailing yachts, when calculating the downward slope of the exhaust tube, keep in mind the heeling angle when under sail, so a siphon cannot be created.



When in temperatures below 0° make sure you do not have ice forming in the tube.

4.4 Electrical Installation:



Only a qualified electrician is authorized to carry out electrical work. All conductors used should be isolated with an insulation level corresponding to the system voltage. No bare wires or exposed contacts are permitted and must be isolated in order to avoid any risk of short circuits.

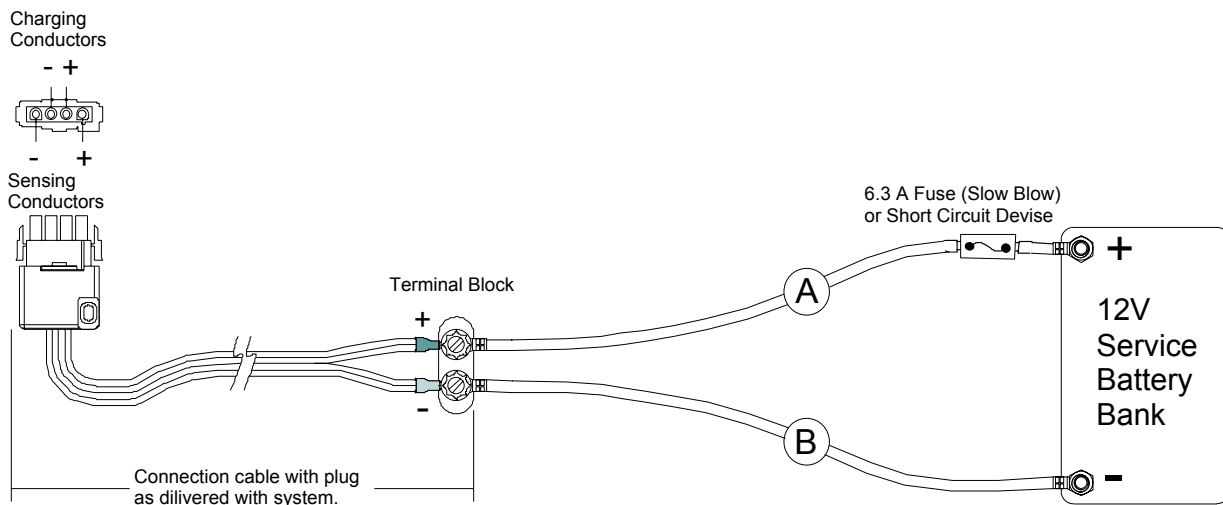
- Use the original connection cable and plug as delivered with unit (approx. 1 meter).
- Lengthen the **originally supplied connection cable**, respecting the cable sections and the polarity, through the markings (+) red for positive and (-) black for negative.



It is very important to respect the cable sections as advised below in order for the system to function correctly.

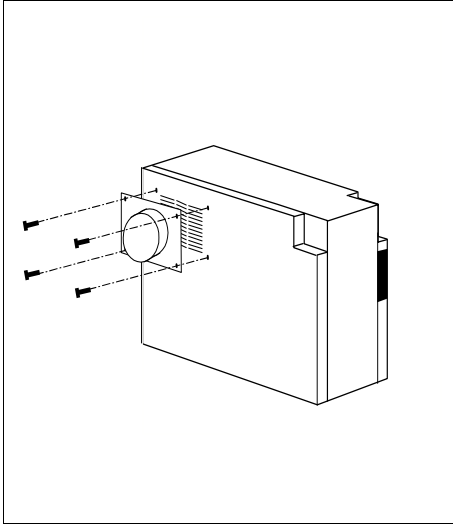
Total Length (A + B)	Diameter in mm ²	AWG Size
Up to 2 meters	2,5 mm ²	14
Up to 4 meters	4 mm ²	12
Up to 8 meters	6 mm ²	10
Up to 14 meters	10 mm ²	8
Up to 20 meters	16 mm ²	6

- The connection to the original connection cable can be done using a connection box with screw type terminals, isolated terminals, terminal blocks ect. Wires can also be soldered and isolated by heat shrink tubing.



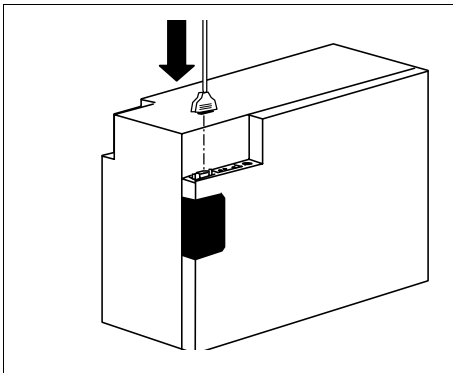
4.5 Cooling Air Supply:

- Flexible ducts and its adapters (diameter 100mm) are available as an option, in order to supply/evacuate the cooling or hot exhaust air. This allows the control of the airflow of the MFC AHD-100, which allows the unit to be installed in close or small spaces.



- Screw the adapter bracket for the cooling-air duct to the unit using the predrilled holes and push duct in place and guide to cool air inlet.
- To ensure maximum efficiency of the MFC it is preferred if these cooling and exhaust air ducts are installed.
- Use adequate air inlet and outlet adaptors. Make sure that there are no kinks in the duct and that no moisture or debris can accumulate. If necessary, use a screen or grill to protect the opening of the air outlet.

4.6 Remote installed control panel (optional):



- The remote installed control panel allow the MFC AHD-100 to be controlled and monitored from a remote location.
- To connect, remove the protection cover of the plug (2), insert the male plug of the control panel cable and screw down.

5. USE & OPERATION

5.1 Connecting the Fuel Cartridge:

Use only original MFC cartridges to avoid compromising safety.



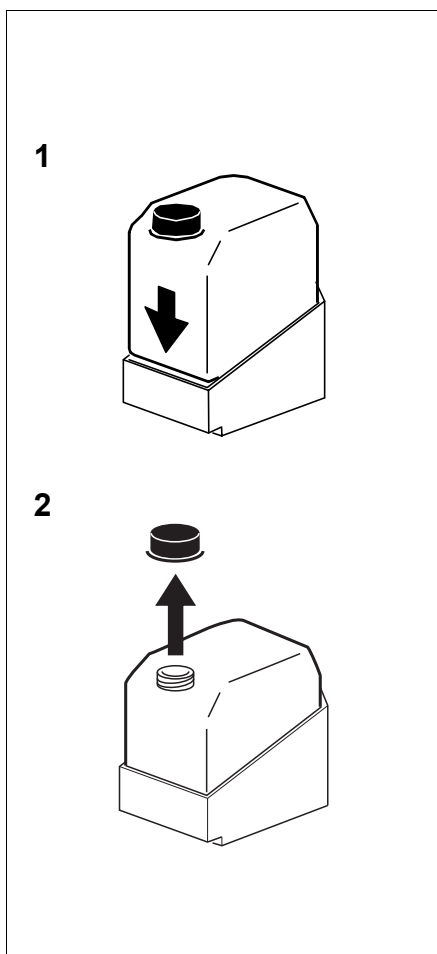
For safety and quality reasons, it is important to use only fuel and fuel cell cartridges as supplied by MAX POWER.



Do not smoke while replacing fuel cartridges!



The fuel cartridge must not be positioned in front of the MFC AHD-100 cooling-air inlet or in front of the exhaust air outlet, since the device generates heat.



- It is possible to change the cartridges while the system is in operation.
- Unscrew the fuel connector cap from the empty cartridge.
- Replace the empty cartridge with full cartridge, without opening cap.
- Connect only fuel cartridges that are inserted and securely fastened in the fuel cartridge holder.
- Remove cap and tightly screw down fuel connector cap.
- Replace cap on empty cartridge.
- Press the "RESTART" button.
- Do not discard the depleted fuel cartridges with household waste. Use reserved recycle points or return to Max Power or a MFC distributor.

5.2 Switching the Device ON, Ready to Operate (Standby):

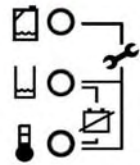


Do not use the MFC in temperatures above +40°C or below -20°C.



- As soon as the 12 V (minimum 10.5 V) battery is connected, the MFC will be on standby.
- If the device was previously switched off by pushing the "ON-OFF" button, it may be restarted by pressing the button again.
- The green "on" LED directly below the "ON-OFF" button will light.
- In standby mode, the voltage of the connected battery is continually monitored. If the voltage falls below 12.6 V, for more than ten seconds, the MFC AHD-100 automatically switches to charge mode.

5.3 Charge Process:



- The green "On" and the green/blue "Charge" LED's both light up.
- Please note that during the first few minutes of the "Charging" mode, no current is fed to the battery.
- Furthermore, the charge process is briefly interrupted every thirty minutes.
- The charging process has been completed and the device automatically switches to standby mode when the connected meets the following conditions:
 - Battery voltage is higher than 13.8 V and/ or the charging current is less than 1 A.
 - When the battery has been charged for six hours and the voltage is higher than 12.6 V.

5.4 Shutdown:

- Press the "ON-OFF" button until the green "on" LED goes out.
- The MFC has a minimum run cycle of 30 minutes after being started-up. If the "ON-OFF" button is pressed during this time, the device automatically shuts down at the end of this 30 minutes cycle.
- With the system shutdown, the voltage level are no longer monitored or controlled.
- Note that the system cannot restart if the voltage is less than 10.5 V



5.5 Freeze Protection:

- The freeze protection is turned on automatically when the ambient temperature falls below 3 °C.



Or:



- Freeze protection is also turned on when the device is switched off.
- A sufficiently filled fuel cell cartridge and an adequately charged battery shall therefore always be connected when storing the device at temperatures below 3° C.
- Automatic freeze protection regularly turns on the device for about thirty minutes. This warms up the MFC AHD-100 and protects the internal components from damage due to freezing.
- The device subsequently shuts down and does not restart until the system temperature has dropped again.
- The system will be unable to restart if the voltage is less than 10.5 V.

5.6 Long Term Shutdown:

- Press the "ON-OFF" button, if the MFC 100-AHD is still switched on (also see chapter 5.4: Shutdown).
- The "On" LED goes out.
- Unplug the connection cable plug, unscrew the fuel connector cap from the fuel cartridge and screw the original cap onto the cartridge.
- Store the MFC AHD-100 in a cool location at temperatures above 0°C.



Protect the connection cable plug from moisture (risk of short-circuit!).
Do not smoke when working with the MFC AHD-100 or fuel cartridges.

- Protect the fuel connector cap from contamination with a plastic bag.
- For transport and shipping the MFC should always be kept in an **upright position**, packed in its original packaging.
- The system can only be put back in service at temperatures above 0°C.
- Please note that output of unit might reduce, if unit has been stored without protection against freezing at temperatures below 0°C.

6. MAINTENANCE / SERVICE

- The MFC AHD-100 does not need any maintenance under normal operating conditions.



The MFC does not contain any parts that can be repaired or maintained by the owner.



Any opening of the MFC or of the fuel cartridges in trying to solve a problem will lead to a cancellation of the warranty terms.

6.1 Cleaning:



Before starting to clean unit, switch off the MFC AHD-100 and remove the connection cable plug.



The unit is not waterproof. Ensure that no moisture is able to enter the plug or the unit.

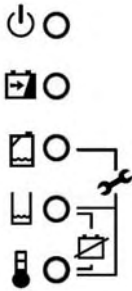
- Use only mild cleaning solutions and a damp, soft cloth to clean the unit.

7. TROUBLE SHOOTING

Depending on the previous operating state, the green ON-LED  may also be lit.

Description:

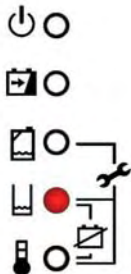
No response when the system is turned on:
No indicator LED's are lit:



Possible cause / solution:

- The battery is not correctly connected or not connected at all:
 - Check contacts, polarity and wiring.
- Connected battery is discharged below 10.5V:
 - To verify measure voltage of battery bank.
 - Connect an adequately charged battery to start the MFC.
- Short-circuit protection has tripped:
 - Turn off the system. Find and remove the cause of the short-circuit or overload; e.g., check the connections for correct polarity and replace the fuse if necessary (see Chapter 7.1).
- If the problem persists:
 - Contact Max Power's After Sales Service.

Red "Process medium shortage" LED is lit:



- If used in normal conditions, the unit will generate sufficient process medium from the methanol to operate correctly. If temperature remains high for an extended period of time and/or humidity is low, or if cooling-air openings are blocked, a process-medium shortage can occur:
 - Top up the process medium (see Chapter 7.2).
 - If this is a reoccurring problem, improve the ventilation of fresh air in the area where the unit is installed.

Yellow "Fuel cartridge empty" LED is lit:



- Fuel cartridge is depleted or improperly connected:
 - Change the fuel cartridge and press the RESTART button.
- The fuel cartridge is full, but the unit has not been operated for an extended period of time:
 - Repeatedly turn 'On' the MFC AHD-100.
- If the problem persists:
 - Contact Max Power's After Sales Service.

Description:

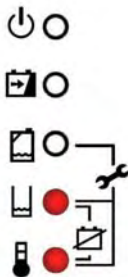
Possible cause / solution:

Red "Temperature" LED is lit:



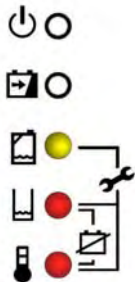
- The ambient temperature is too high or too low:
 - As soon as the ambient temperature has returned to the permissible range (0 °C to 40° C) and unit's temperature has adjusted accordingly, the device can be restarted, or will restart automatically if it was previously in standby mode.

Both red LED's are on at the same time:



- The voltage at the connected battery is outside the permissible range (10.5 V to 16 V):
 - Connect a battery that meets specifications.
 - After the voltage returns to the 12.6 V to 16 V range, the MFC AHD-100 will restart.

The yellow LED and the two red LED's are all on at the same time:



- The MFC AHD-100 is defective. The problem cannot be corrected automatically:
 - Contact Max Power's After Sales Service Department.
 - Please have the serial number of your unit and the operating manual ready.

7.1 Replacing the Fuse (See chapter 3.2, n°6):



Before replacing the fuse: Turn off the MFC AHD-100. Remove the connecting plug.



Fuses may only be replaced by specified types that have the indicated nominal current ratings. Under no circumstances may they be temporarily repaired or bypassed.



The cause of fault must be located and repaired or removed before changing the fuse.

- Replace the fuse: 20 x 5 mm, 250V 6.3A, M (medium slow-blow)
- Plug in the connection cable plug, reconnecting MFC to 12V system.
- The green "On" LED on the display will light up. If the voltage at the connected battery is less than 12,6 V, the MFC automatically turns on.

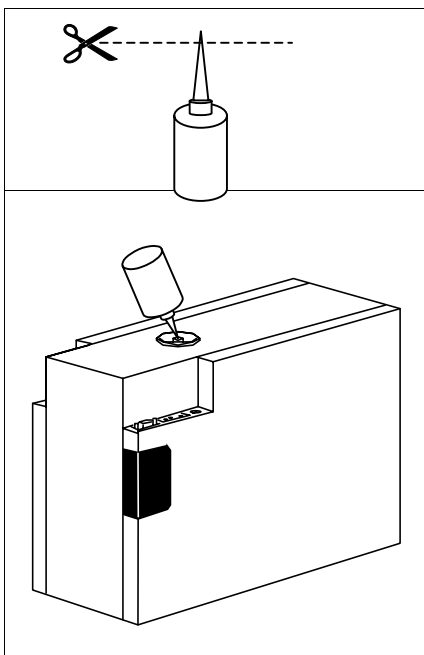
7.2 Process Medium:



Before topping up the process medium: Turn off the MFC AHD-100. Remove the connecting plug.

Use only the original Max Power refill kit to top up the process medium.

- The process medium is required for cooling as well as for the fuel cell process.
- Ensure that no contaminants enter the refill opening.



- Cut the tip of the bottle using scissors.
- **The refill kit is only suitable for one-time use.**
- Remove the exhaust tube.
- Squeeze the entire contents of the bottle into the centre of the exhaust connector opening at the top of the unit.
- Use a rag to wipe up any process medium that overflows.
- Reconnect the exhaust tube and press the "RESTART" button.
- Make sure you always have a process medium refill kit from Max Power on board.

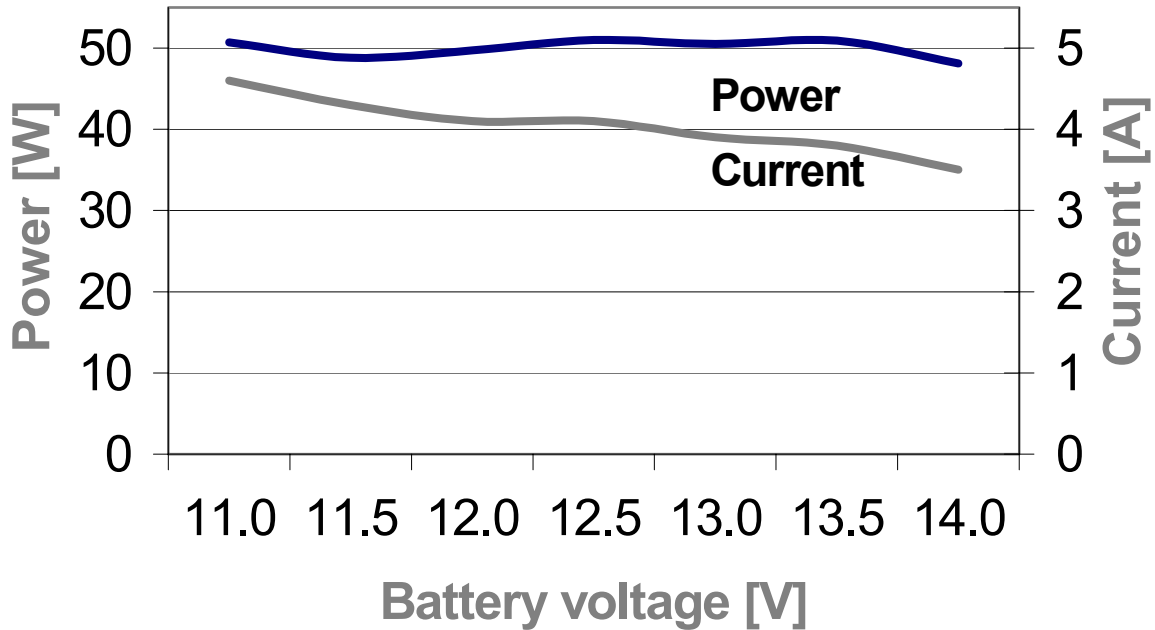
8. ACCESSORIES



Use only original accessories and fuel cell cartridges!
Use of unapproved components compromises safety and voids the warranty.

8.1 Output Characteristics:

V-I characteristic graph as per CE test 09/2003.



9. Methanol Safety Data Sheet



When working with methanol fuel cartridges, be sure to comply with the following safety data sheet.

In case of accident or nausea, immediately seek medical assistance and present this safety data sheet.

1 Identification of the Substances / preparation and the company

1.1 Identification of the substance or preparation:

Synonyms : Methyl alcohol, methyl hydrate, wood spirit, methyl hydroxide

Product use : Solvent, fuel, feedstock

CAS no. : 000067-56-1

EC index no. : 603-001-00-X

EINECS no. : 200-659-6

RTECS no. : PC1400000

NFPA code : 1-3-0

Molecular weight : 32.04

Formula : CH₃OH

1.2 Company/undertaking identification:

MAX POWER

10 Allée Francois Coli

Parc D'Activite De La Siagne

06210 MANDELIEU

FRANCE

Tel.: +33 (0)4 92 19 60 60

Fax.: +33 (0)4 92 19 60 61

1.3 Telephone number for emergency:

(+32) 14-58 45 45

Information centre of dangerous goods (B.I.G.)

Technische Schoolstraat 43A, B-2440 Geel, Belgium

2 Composition / information on ingredients

Hazardous ingredients	CAS no.	Conc in %	Hazard class.	Risks (R-phrases)
METHANOL	000067-56-1	99.85	F;T	11-23/24/25-39/23/24/25

3 Hazards identification

- Toxic by inhalation, in contact with skin and if swallowed
- Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
- Highly flammable
- May build up electrostatic charges: risk of ignition
- Gas/vapour flammable with air within explosion limits

4 First Aid measures

4.1 Eye contact:

- Rinse immediately with plenty of water for a minimum of 15 minutes, ensuring all surfaces and crevices are flushed by lifting lower and upper lids
- Consult a doctor/medical service

4.2 Skin contact:

- Remove clothing before washing
- Wash immediately with lots of water/soap for 15 minutes
- Consult a doctor/medical service if irritation occurs

4.3 After inhalation:

- Remove the victim into fresh air
- Restore or assist breathing if necessary
- Consult a doctor/medical service

4.4 After ingestion:

- Swallowing methanol is life threatening
- Onset of symptoms may be delayed for 18 to 24 hours after ingestion
- If conscious and medical aid is not immediately available, do not induce vomiting
- Transport to medical attention

5 Fire-fighting measures**5.1 Suitable extinguishing media:**

- Small fires: Powder, carbon dioxide, halon, water spray, Standard foam
- Large fires: Water spray, AFFF(R)(Aqueous Film Forming Foam (alcohol resistant)) type with either a 3% or 6% foam proportioning system

5.2 Unsuitable extinguishing media:

- N.D.

5.3 Hazardous Decomposition Products:

- Toxic gases and vapours; carbon monoxide, carbon dioxide and formaldehyde

5.4 Instructions:

- Methanol burns with a clean clear flame, which is almost invisible in daylight
- Keep upwind, mark the danger area
- Concentrations of greater than 25% methanol in water can be ignited
- Cool tanks/drums with water spray and remove them into safety
- Take account of toxic firefighting water
- Use firefighting water with moderation, contain it if possible

5.5 Special protective equipment for firefighters:

- Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective clothing
- Protective fire fighting structural clothing is not effective protection from methanol. Do not walk through spilled product as it may be on fire and not visible

Accidental release measures**5.6 Personal protection:**

see 6.6

5.7 Environmental precautions:

- Prevent soil and water pollution
- Substance must not be discharged into the sewer
- Plug the leak, cut off the supply
- Dam up the liquid spill
- Try to reduce evaporation
- Recover methanol or dilute with water to reduce fire hazard

5.8 Clean-up:

- Eliminate all ignition sources
- Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard
- Maximize methanol recovery for recycling or reuse
- Collect liquid with explosion proof pumps
- For small spills: take up into non-combustible sorbent

6 Handling and storage

6.1 Handling:

- Reduce/avoid exposure and/or contact
- Keep container tightly closed
- No smoking or open flame
- Use spark-/explosionproof appliances and lighting system
- Take precautions against electrostatic charges
- Handle uncleaned empty containers as full ones

6.2 Storage:

- Keep away from heat and ignition sources, oxidizers, acids, bases
- Store in a dry and well-ventilated area
- Store in totally enclosed equipment
- Tanks must be grounded and vented and should have vapour emission controls
- Provide for a tub to collect spills

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6.3 Materials for packaging:

- Anhydrous methanol is non-corrosive to most metals at ambient temperatures except lead and magnesium
- Coatings of copper (or copper alloys), zinc (including galvanized steel) or aluminium are unsuitable for storage as they are attacked slowly
- Mild steel is the recommended construction material for tanks

Exposure controls/Personal protection

6.4 Recommended engineering controls:

- In confined areas, local and general ventilation should be provided to maintain airborne concentrations below permissible exposure limits
- Ventilation systems must be designed according to approved engineering standards

Sampling methods:

NIOSH 2000

6.5 Exposure limits:

TLV-TWA :		mg/m3	200	ppm
TLV-STEL :		mg/m3	250	ppm
TLV-Ceiling :		mg/m3		ppm
OES-LTEL :	(266)	mg/m3	(200)	ppm
OES-STEL :	(333)	mg/m3	(250)	ppm
MAK :	270	mg/m3	200	ppm
TRK :		mg/m3		ppm
MAC-TGG 8 h :	260	mg/m3		
MAC-TGG 15 min. :		mg/m3		
MAC-Ceiling :		mg/m3		
VME-8 h :	260	mg/m3	200	ppm
VLE-15 min. :	1300	mg/m3	1000	ppm
GWBB-8 h :	266	mg/m3	200	ppm
GWK-15 min. :	333	mg/m3	250	ppm
Momentary value :		mg/m3		ppm
EC :	260	mg/m3	200	ppm
EC-STEL :		mg/m3		ppm
Odour threshold :			2000	ppm
(irritation at 1000 ppm, poor olfactory warning properties)				

Sampling methods:

NIOSH 2000 / OSHA 91

6.6 Personal protection:

eye protection:

- Face shield and chemical splash goggles

hand protection:

- Gloves

skin protection:

- Protective clothing

materials for protective clothing:

- Butyl rubber
- Nitrile rubber

respiratory protection:

- Air respirator when airborne concentrations exceed exposure limits

7 Physical and chemical properties

7.1	Appearance (at 20°C) :	Clear liquid
7.2	Odour :	Slight alcohol odour
7.3	Colour :	Colourless
7.4	pH value :	N.D.
7.5	Boiling point/boiling range :	64.5 °C
7.6	Melting point/melting range :	-97.8 °C
7.7	Flashpoint :	11 °C (TCC)
7.8	Auto-ignition point :	385 °C
7.9	Explosion limits :	6/36 vol%
7.10	Vapour pressure (at 20°C) :	1278 hPa
7.11	Relative density (at 20°C) :	0.792
7.12	Water solubility :	Completely
7.13	Soluble in :	Ethanol, ether, acetone, chloroform
7.14	Relative vapour density :	1.1
7.15	Saturation concentration :	166 g/m ³
7.16	Viscosity :	0.0006 Pa.s

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8 Stability and reactivity

8.1 Stability:

- Stable under normal conditions

8.2 Reactivity/Hazardous decomposition products:

- Reaction with oxidizers, strong acids, strong bases
- May be corrosive to lead and aluminium
- Hazardous decomposition products: formaldehyde, carbon dioxide and carbon monoxide

9 Toxicological information

9.1 Acute toxicity:

LD50 oral rat :	5628	mg/kg
LD50 dermal rat :	N.D.	mg/kg
LD50 dermal rabbit :	15800	mg/kg
LC50 inhalation rat :	85	mg/l/4 h

The odour threshold of methanol is several times higher than the TLV-TWA

9.2 Chronic toxicity:

EC carc. cat.:	not listed
EC muta. cat.:	not listed
EC repr. cat.:	not listed
Carcinogenicity (TLV):	not listed
IARC classification:	not listed

9.3 Routes of exposure: swallowed, inhalation, eyes and skin**9.4 Acute effects/symptoms:**

- Swallowing even small amounts of methanol may cause blindness or death Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity
- Inhalation of high concentrations: irritation of the mucous membranes, headache, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and death
- High vapour concentration or contact with liquid: irritation of the eyes, tearing and burning
- May be absorbed through the skin in toxic or lethal amounts

9.5 Chronic effects:

- Repeated exposure by inhalation or absorption: systemic poisoning, brain disorders, impaired vision and blindness
- Inhalation may worsen conditions such as emphysema or bronchitis
- Repeated skin contact may cause dermal irritation, dryness and cracking

Reproductive effects:

- Reported to cause birth defects in rats exposed to 20000 ppm

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10 Ecological information**10.1 Ecotoxicity:**

- LC50 (96 h) : 10800 mg/l (SALMO GAIRDNERI/ONCORHYNCHUS MYKISS)
- EC50 (48 h) : 24500 mg/l (DAPHNIA MAGNA)
- EC50 (72 h) : 8000 mg/l (ALGAE)

Methanol can be harmful for as well salt water organisms as freshwater organisms

10.2 Mobility:

- Volatile organic compounds (VOC): 100%
- Soluble in water

For other physicochemical properties see section 9

10.3 Persistence and degradability:

- biodegradation

BOD5 :	0.6 - 1.1	g O2/g substance
COD :	1.42	g O2/g substance
- water : Readily biodegradable in water(test: 99% OECD 301D. BOD 80% ThOD)
- soil : N.D.
- Methanol will be broken down to carbon dioxide and water

10.4 Bioaccumulative potential:

- log Pow : -0.82/-0.66
- BCF : < 10 (LEUCISCUS IDUS)
- Slightly bioaccumulative

10.5 Other adverse effects:

- WGK : 1 (Classification in compliance with Verwaltungsvorschriftwassergefährdender Stoffe (VwVwS) of 17 May 1999)
- Effect on the ozone layer : Not dangerous for the ozone layer(Council Regulation (EC) No.3093/94, O.J. L333 of 22/12/94)
- Greenhouse effect : No data available
- Effect on waste water purification : Sludge digestion is inhibited at800 mg/l/Nitrification of activated sludges inhibited at 160 mg/l; 50%

11 Waste disposal considerations**11.1 Provisions relating to waste:**

- Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 07 01 04 (other organic solvents, washing liquids and mother liquors)
- Waste material code (Flanders): 001; 015; 034
- Waste code (Germany): 55315
- Hazardous waste (91/689/EEC)

11.2 Disposal methods:

- Incineration is the recommended disposal method
- Biological treatment may be used on dilute aqueous waste methanol
- Methanol wastes are not suitable for underground injection
- Waste materials must be disposed of in accordance with your municipal, state, provincial and federal regulations

11.3 Packaging:

- Waste material code packaging (91/689/EEC, Council Decision 2001/118/EC,O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

Transport information

336
1230

11.4 Classification of the substance in compliance with UN Recommendations

UN-number :	1230
CLASS :	3
SUB RISKS :	6.1
PACKING :	II
PROPER SHIPPING NAME :	UN 1230, Methanol

ADR (transport by road)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

RID (transport by rail)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

ADNR (transport by inland waterways)

CLASS :	3
PACKING :	II
DANGER LABEL TANKS :	3+6.1
DANGER LABEL PACKAGES :	3+6.1

IMDG (maritime transport)

CLASS :	3
SUB RISKS :	6.1
PACKING :	II
MFAG :	19
EMS :	-
MARINE POLLUTANT :	-

ICAO (air transport)

CLASS :	3
SUB RISKS :	6.1
PACKING :	II
PACKING INSTRUCTIONS PASSENGER AIRCRAFT :	
PACKING INSTRUCTIONS CARGO AIRCRAFT :	

11.10 Special precautions in connection with transport

none

11.11 Limited quantities (LQ)

When substances and their packaging meet the conditions established by ADR/RID/ADNR in chapter 3.4, only the following prescriptions shall be complied with:

each package shall display a diamond-shaped figure with the following inscription:

- 'UN 1230'

or, in the case of different goods with different identification numbers within a single package:

- the letters 'LQ'

12 Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens



Highly flammable



Toxic

R11 :	Highly flammable
R23/24/25 :	Toxic by inhalation, in contact with skin and if swallowed
R39/23/24/25:	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed
S(01/02) :	(Keep locked up and out of reach of children)
S07 :	Keep container tightly closed
S16 :	Keep away from sources of ignition - No smoking
S36/37 :	Wear suitable protective clothing and gloves
S45 :	In case of accident or if you feel unwell, seek medical advice (show the label where possible)

13 Other Information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. = NOT APPLICABLE

N.D. = NOT DETERMINED

* = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R11 : Highly flammable
R23/24/25 : Toxic by inhalation, in contact with skin and if swallowed
R39/23/24/25 : Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed

Exposure limits:

TLV : Threshold Limit Value - ACGIH US 2000
OES : Occupational Exposure Standards - United Kingdom 2001
MEL : Maximum Exposure Limits - United Kingdom 2001
MAK : Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK : Technische Richtkonzentrationen - Germany 2001
MAC : Maximale aanvaarde concentratie - the Netherlands 2002
VME : Valeurs limites de Moyenne d'Exposition - France 1999
VLE : Valeurs limites d'Exposition à court terme - France 1999
GWBB : Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK : Grenswaarde kortstondige blootstelling - Belgium 1998
EC : Indicative occupational exposure limit values - directive 2000/39/EC

NOTE TO PHYSICIAN

Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to CNS, eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication.

Blurred vision, decreased acuity and photophobia are common complaints.

Treatment with ipecac or lavage is indicated in any patient presenting the symptoms within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.