OPERATION & MAINTENANCE MANUAL

VERSION 1.6

HY1500, HY2500, HY3500, HY4000, HY6000, HY9000

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Safety System and Component Overview

This safety information is provided to operators and maintenance technicians to ensure the safe installation, operation and maintenance of the HYDI system. It is essential that you read and familiarise yourself with this information, which explains safety requirements, precautions, and specific hazards of which you should be aware. This also applies to any personnel, who might be working on the HYDI System only occasionally, such as during installation or maintenance. It is essential that you read and familiarise yourself with this information, which explains safety requirements and precautions and specific hazards of which you should be aware.

The HYDI system is offered in several sizes all with an optional refill tank to extend operational duration:

• HY1500 Vertical & Horizontal • HY2500 Vertical & Horizontal • HY3500 Horizontal Note: These units have a 2.8 litre tank for distilled water. The AR17 Auto Refill tank holds 17 litres	
• HY4000 • HY6000 • HY9000 Note: These units have a 40-litre tank for the distilled water.	

HYDI Unit

The HYDI unit is a sophisticated but simple to use Hydrogen on Demand System. It uses distilled water and low voltage electricity from the electrical system of the vehicle or plant to produce Hydrogen Gas. The HYDI unit does not store Hydrogen and employs a number of safety features to prevent Hydrogen being generated if the engine is not running.

CAUTION

Special guidelines and training is provided to HYDI trained technicians for the calculation and adjustment of gas volumes, H_2O_2 volumes must not be adjusted by non-trained personnel.

General Safety Information

- Study this Operation and Maintenance Manual before operating parent equipment fitted with a HYDI system.
- Allow only authorised personnel to operate, service or repair the HYDI system.
- Allow only properly trained personnel to work on the HYDI system; make sure to clearly specify the person who is responsible for installation, set up, maintenance and repairs.
- Make sure the operator of the parent equipment is aware it is fitted with a HYDI system.
- Wear proper work clothing when operating or working on the parent equipment or HYDI system. Rings, watches, bracelets and loose clothing such as ties, scarves, unbuttoned or unzipped shirts and jackets are dangerous and could cause injury! Wear correct personnel protective equipment, such as safety glasses, safety shoes, work gloves, reflector vests and ear protection where required, or sign posted.
- Prior to working on the HYDI system, ensure the systems us isolated
- Never perform any changes, additions or modifications on the HYDI system, which could influence the safety, without obtaining the permission from the manufacturer. This also applies to the installation and adjustment of safety devices and safety valves as well as to any welding on the Systems enclosure.

NOTE

There are no chemicals or additives used in the HYDI unit, Just High-Quality Distilled Water

Fire prevention

- Always turn off the asset while refilling the HYDI system.
- Never smoke or allow an open flame in close proximity to HYDI system when refilling distilled water
- Check the external electrical system regularly. All defects, such as loose connections, burnt out fuses, burnt or damaged cables must be repaired immediately by authorised, trained and competent personnel.
- Inspect all components, lines, tubes and hoses for damage. Replace or repair any damaged components immediately.
- Be certain that all clamps, guards and heat shields are installed. These components prevent vibration, rubbing, chafing and heat build-up.
- Know the location of the assets fire extinguisher and be familiar with its operation. Make sure you know your local fire regulations and fire reporting procedures.

System Maintenance Safety

- Never attempt maintenance or repairs to the HYDI system if not trained and authorised to do so.
- Use only replacement parts corresponding to the technical requirements specified by manufacturer. This is assured by using only original HYDI replacement parts.
- Before any maintenance work make sure a “Do not operate” tag is attached to the starter switch, or the parent machine is isolated as per regional industry standards.
- Don’t use any harsh cleaners and use only lint free cloths on HYDI components.
- Use only non-flammable cleaning fluids to clean the HYDI system.
- If you use a high-pressure cleaner with steam or hot water to clean the parent equipment machine, observe following recommendations:
    - The distance between the nozzle and the surface of the HYDI unit must be no lower than 30 inches.
    - The water temperature should not exceed 60°C (140°F).
    - Limit the water pressure to 8000 psi.
    - If you employ cleaning fluid, only use neutral cleaning agents such as customary car shampoos diluted to 2 or 3 percent maximum.
    - Observe all product safety guidelines when handling chemical substances.
- When working overhead or at height, use appropriate and safe ladders, scaffolding or other working platforms designated for that purpose.
- Never step on parts or components on the machine when maintaining or repairing items overhead.
- When working high above ground, make sure you are fitted with ropes and appropriate safety devices, which will prevent a possible fall.
- Always keep handles, steps, railings, platforms and ladders free of dirt, snow and ice!
- Always disconnect the battery cable before working on the electrical system or before any arc welding on the equipment or with in the local vicinity of the HYDI system. Always disconnect the negative (-) cable first and reconnect it last.
- Hoses and lines must be replaced if any of the following points are found during an inspection:
    - Damage on the external layer into the inner layer (such as chaffing, cut and rips);
    - Brittleness of the outer layer (crack formation of the hose material);
    - Changes in shape, which differ from the natural shape of the hose or line, when under pressure or when not under pressure, or in bends or curves, such as separation of layers, blister or bubble formation.
    - Leaks.
    - Non observance of installation requirements.
    - Damage or deformation of hose fittings, which might reduce the strength of the fitting or the connection between hose and fitting.
    - Any movement of hose away from the fitting.
    - Corrosion on fittings, which might reduce the function or the strength of the fitting.
    - Storage or service life has been exceeded.
    - When replacing hoses or lines, it is recommended to always use original replacement parts.

Safety Signs and Labels

There are several safety decals and information labels fitted to the HYDI system. Their locations and description are reviewed in this section. Please take time to familiarise yourself with these labels.

Never smoke or allow an open flame in close proximity to HYDI system when refilling distilled water	 *Figure 1: Warning label No Ignition source present while filling*
Distilled water must be used to ensure no damage to PEM cell occurs	 *Figure 2: Warning label Ensure only filled with distilled water ONLY*
Identifying the hydrogen (H2O2) ensures the line is not incorrectly fitted to another component during maintenance activities	 *Figure 3: Hydrogen Line notification label*

HYDI Product Overview

Safety Critical Event Protection

- System deploys mission critical safety algorithms
- Roll over protection
- Internal gas leak protection
- Over temperature switching (Off)
- Water level monitoring and switching (Off)
- Water flow monitoring and switching (Off)
- Operational warning lights (Refill) (Fault) (Gas) (Power)
- Live data monitored recorded and transmitted, e.g. Performance, faults, warnings etc
- Power supply fuse protected

Features

- State of the Art electronics, featuring high performance internal microcomputer and digital sensors for accurate fast decision-making algorithms
- Fully configurable to characterise any engine installation.
- Expandability to suit any hydrogen demanding environment.
- Auto Refill, maintains appropriate water levels automatically when external water supply connected -(Optional)
- Heating (below zero temperatures), heat monitoring and control via heat blanket. (Optional)
- Remote access – (Optional)
- Data log (Optional)
- Direct ECU interfacing to obtain correct engine demand requirements and emission feedback parameters - Optional

Communications

- Industry standard Modbus protocol for monitoring, utilising wireless technologies, including (but not limited to) RS485, Bluetooth, 4G, and Wi Fi.
- Wireless expandability utilising Zigbee nodal mesh network when fitted.

Electrical

- 12 & 24 volt
- Reverse polarity protected
- Powering from 12-volt system draws approximately 17 amps average, up to 30 amps maximum.
- Powering from 24-volt system draws approximately 25 amps average, up to 50 amps maximum.
- Internal fuse protected
- Power supply short protected

NOTE

The HYDI product only draws 200 micro-amps when not in use

Installation

HYDI unit and Auto Refill mounting location identifactation

A suitable mounting location needs to be identified with concideration give to the below items

- HYDI unit should be in a location that does not impair the viewing area of the equipment operator
- HYDI unit should not be installed in a location where the technicians or operators may unintentionally use as a step
- Consideration needs to be given to distance the HYDI unit is installed from the engine, ideally the unit should not exceed 5 meters from the engine intake system
- Consideration should be given to access from maintenance and filling of distilled water
- HYDI units should not be mounted in the engine bay, mounting externally improves the unit's efficiency as excessive ambient temperatures can affect the systems efficiency. Additionally, the sustained increased ambient temperature will reduce the service life of components within the HYDI unit

NOTE

Once fitment is complete and ready for commissioning, if you're able to power the unit up, and it run without the engine operating, it has been wired incorrectly. Do not continue and investigate the issue.

Mounting of HYDI unit

The HYDI unit will require a sturdy mounting location, a mounting bracket may be required to ensure an effective installation in achieved.

Figure 4: HY2500 vertical mount with custom bracket

Figure 5: HY2500 horizontal with auto refill and custom bracket

Gas Line installation

Consideration should be given to the hose route to ensure the integrity of the line is not compromised, the use of rubber coated P Clamps are advised and the installation of fire-retardant sleeving.

Figure 6: example of gas line installation

Engine Air Intake HYDI port

The inlet port for the gas mix into the intake ideally should be located as close as reasonably practical to the intake hose on pre turbocharger. The port can be installed as per fig. 7 or a threaded weldment.

NOTE

If the port is installed incorrectly, it may create a point of entry for foreign debris to enter the intake system post filter.

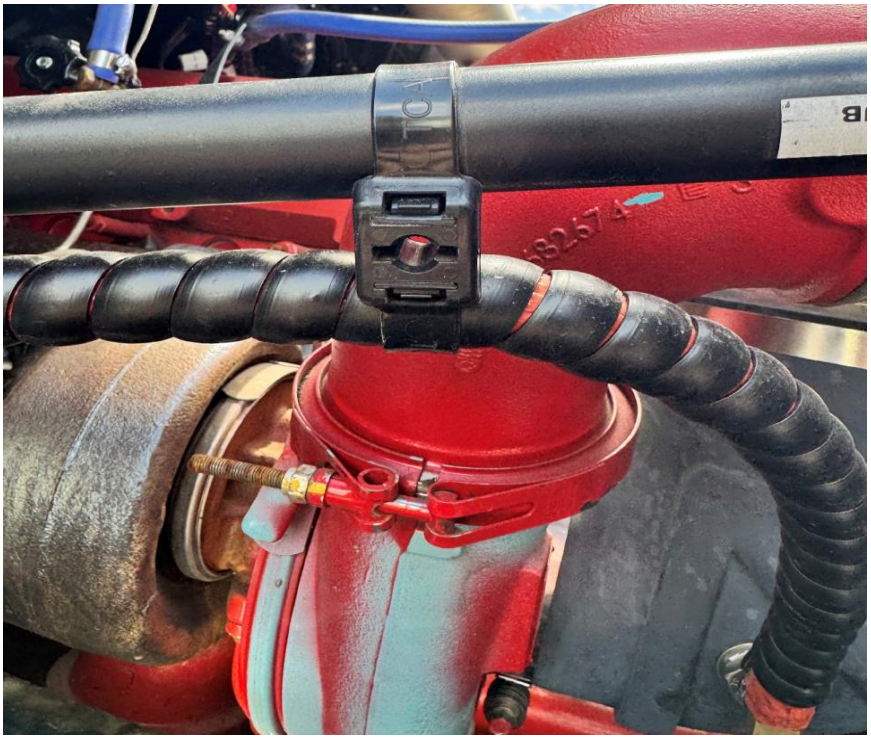

Figure 7: Example of intake tube gas inlet installation

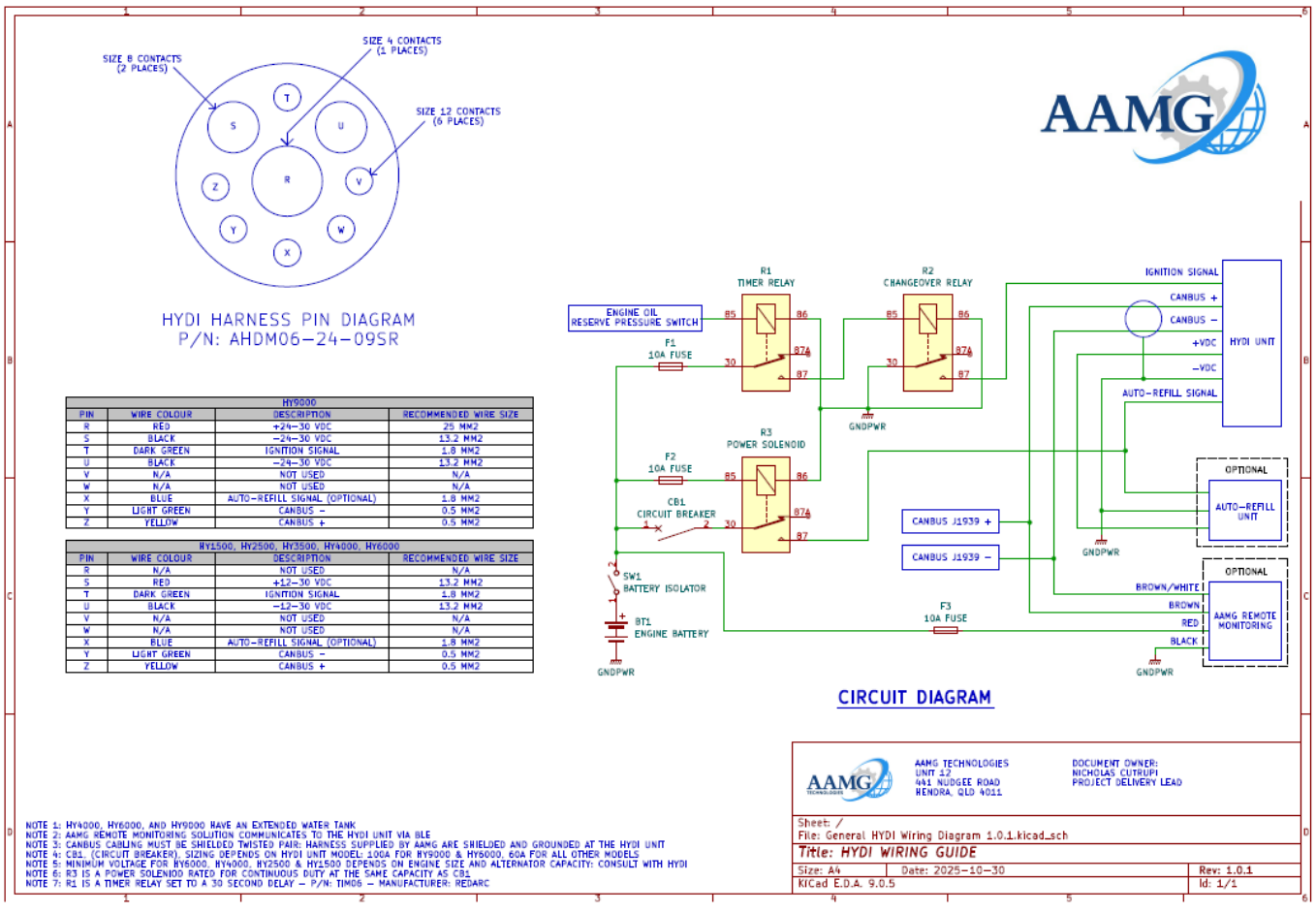

Figure 8: Electrical Installation wiring diagram

Operation of the HYDI Unit

General operation

1. Ensure HYDI isolator switch is in the “on” position - the yellow lever is in the retracted-up position.	
2. Ensure equipment is running	
3. Observe LEDs on the unit: Green power light should be on	
4. Orange light after a shortly delay after engine startup will illuminate and indicate gas generation	
Note: If Red indicator light Illuminates, it will flash a fault code. *Refer to the fault code table in appendix*	

Note: Blue light illuminated indicates when unit requires refilling. *Blue light will indicate approximately 3 hours run time remaining before unit will shutdown* *Blue refill LED will illuminate at 30% and unit will shut down at 15% capacity, this protection is in place to avoid damage to the HYDI units internals.*	

Refilling the HYDI unit

1. Shutdown and isolate equipment
2. Wear appropriate PPE (gloves & safety glasses)
3. Using 3 points of contact if required, access the HYDI unit on the equipment
4. Remove cap on fill point of HYDI unit
5. Using appropriate size container, refill HYDI unit with Distilled water only (David Gray's Distilled Water recommended) – Any other type of water will contaminate the PEM and cause early failure
6. Replace cap firmly on fill point
7. Remove power isolation (Return the power isolator switch back to the on position)

Maintenance of the HYDI unit

- The HYDI Unit is a sealed unit and does have a 12 monthly service requirement for internal parts (These services should be performed by HYDI trained and competent personnel, if this is required to be completed by non-service agent technicians, please contact HYDI to get the appropriate training required to perform)
- During equipment preventive maintenance, visual checks of HYDI unit, cabling and hoses for damage and leaks is required
- In the event of the red fault code indicator light illuminating Refer fault code chart in the appendix, if unable to rectify fault contact your regional HYDI representative for further assistance

Removal of the HYDI unit

When removing the component from service:

- Make sure the component is isolated from all power, pressure, or fluid sources.
- Wear appropriate PPE and follow all site safety procedures.
- Use proper lifting equipment — do not drag, drop, or shock-load the component.
- Do not cut or damage any wires or electrical harnesses — this will void the warranty.
- Do not cut or damage any hoses — this will void the warranty
- Follow any OEM instructions or diagrams during removal to avoid internal damage

Storage & Transport of the HYDI unit

It is critical to store and transport the HYDI units correctly, to ensure longevity to the unit, and minimal damage.

- Store upright — never lay the component on its side or upside down.
- Fill the component completely with distilled water before storage.
- Ensure the water tank cap is fitted tightly and sealed to avoid evaporation, contamination, or internal corrosion.
- Store in a dry, weather-protected location, away from direct sunlight, dust, or chemicals.
- Keep the component off the ground using pallets or supports to avoid water damage or contamination.
- Transport in a suitable box with support to stop movement or vibration

Appendix A

Fault Code Chart

Red Fault light Flash count	Diagnosis Meaning	Possible cause of fault	Action to rectify
1	Invalid License	Unit Software License Invalid	Contact HYDI representative to received new license
2	Safety Module: Unit over heated and cooling down	Operating temperature of the unit has exceeded a redefined safety threshold of 60c	Allow unit to cool down and fault will be cleared automatically
3	Hydrogen Module Error	1. System Setting desired exceeds capacity of the unit 2. Power module ID 1 failure 3. No power module ID 1 present	1. Check system setting 2.check communication dip switches on power module
4	Water over temp and cooling down	1. Water temperature has exceeded threshold setting 2. external source generating heat radiation toward HYDI unit	1. Allow unit to cool down 2.Inspect for and remove potential introduced external heat source 3. Adjust threshold setting
5	Water Empty	System is reporting internal tank has insufficient water to produce hydrogen	Fill tank
6	Water pump faulty	Water pump not operating, failed or not detected	1. disable pump tach detection if not required 2. Replace water pump
7	Water flow restricted	1. Water flow blockage and/or water pump issue 2. Controller not detecting water flow tachometer 3. Current system threshold id set to high	1. Check for water blockage 2. Use the GUI to check for water flow tach value vs. system setting
8	ECU not found	When license has been set to lock the HYDI unit against the onboard ECU and the controller can not communicate with it.	If no ECU requirement is required or locking vehicles ECU to the unit is not necessary, reissue of lines required with out the option check.
NON fault code fault	Diagnosis Meaning	Possible cause of fault	Action to rectify
	Display light non operational	Check power supply	1. Power has been switched off 2. Check will multimeter
		Earthing wire not active	1. Check to ensure earth wire has correct contact free from insulation 2. ensure earth wire is connected to the negative terminal
		Check LED lights for connection	1. Check terminal connectors are correctly fitted and firm 2. Use multimeter to check if current id getting to lights.