CDM
High-Frequency Switch-Mode Charger Range

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1 - GENERAL

ENAG has been specialized in the production of power supplies for the marine environment for over 30 years.
ENAG manufactures a complete range of automatic battery chargers.

We can also some regulated and filtered power supplies and converters which permitt to compose especially the global supply of the SMDSM system.

This manual is intended for equipment users and installation and maintenance engineers. The manual must be read thoroughly before any operations are undertaken on the product and all users must be informed.

Choice of Appliance

Battery chargers are designed to provide the battery's charging and floating current and, depending on requirements, the operating current. The ENAG models are filtered and, in the event of battery cut-out or damage, allow **direct current** to be supplied to the load centres.

The choice of appliance will depend on applicable standards, battery type (technology used, number of cells, capacity), amount of current consumed by the load centres and installation and environment constraints.

Appliances running on HF switch mode have the following advantages:

- **Less space required**
- **Low weight**
- **Very low noise level**
- **Direct current for working power supply**
- **Low residual ripple.**

2 - TECHNICAL CHARACTERISTICS

2.1 ELECTRICAL CHARACTERISTICS

2.1.1 Power Supply

- Rated voltage of single-phase network Uln: ± 10%.
- Frequency Fn: ± 5%.
- In-line input current according to model (see plan of connections and settings).

2.1.2 Use

- Regulated output voltage Udn: ± 1% (before fuse or separator).
- Max. ripple factor ≤1% (peak value to mean value).
- Electronic overload protection or limitation of the output current to the rated current level Idn.

2.1.3 Modes of operation

a) FLOATING

Automatic operation in which the charger provides a constant voltage regulated to ± 1% and a current with a maximum limit corresponding to the rated level of the charger.

This floating voltage corresponds to the values indicated by the storage cell manufacturers and is adjustable from 2.17 V to 2.3 V per open or sealed lead cell and from 1.4 V to 1.45 V per nickel-cadmium cell.

b) RAPID CHARGE (optional according to model)

Operation used to make up a temporary battery discharge. This function is designed to restore the battery to its initial capacity more quickly. It is possible to activate the rapid charge by an external contact.

Rapid charge voltage adjustable from 2.25 V to 2.4 V per open or sealed lead cell and from 1.45 V to 1.55 V per nickel-cadmium cell.

2.1.4 Controls, Signalling and Display

The cover comprises the following components as standard:

- one yellow “Mains power on” LED,
- one green “Charge” or “Charger voltage” LED.

Possibility of activating a rapid charge or voltage control according to the battery temperature (see plan of connections and settings).

Possibility of connecting a voltmeter and ammeter to certain chargers (see plan of connections and settings).

2.1.5 Protection

- Network input: Fuse.
- Power output: Fuse(s) sized to the rated output of the charger, electronic protection by limiting the output current.
- Internal protection: Safety circuit provided by overvoltage arrester networks, electronic circuits integrated into the internal converter and temperature circuit.
- Optional protection: contact ENAG for information on relays to monitor insulation, voltage faults and charging faults, voltage/current controller boards, remote controls, etc.

2.1.6 Interference Suppression

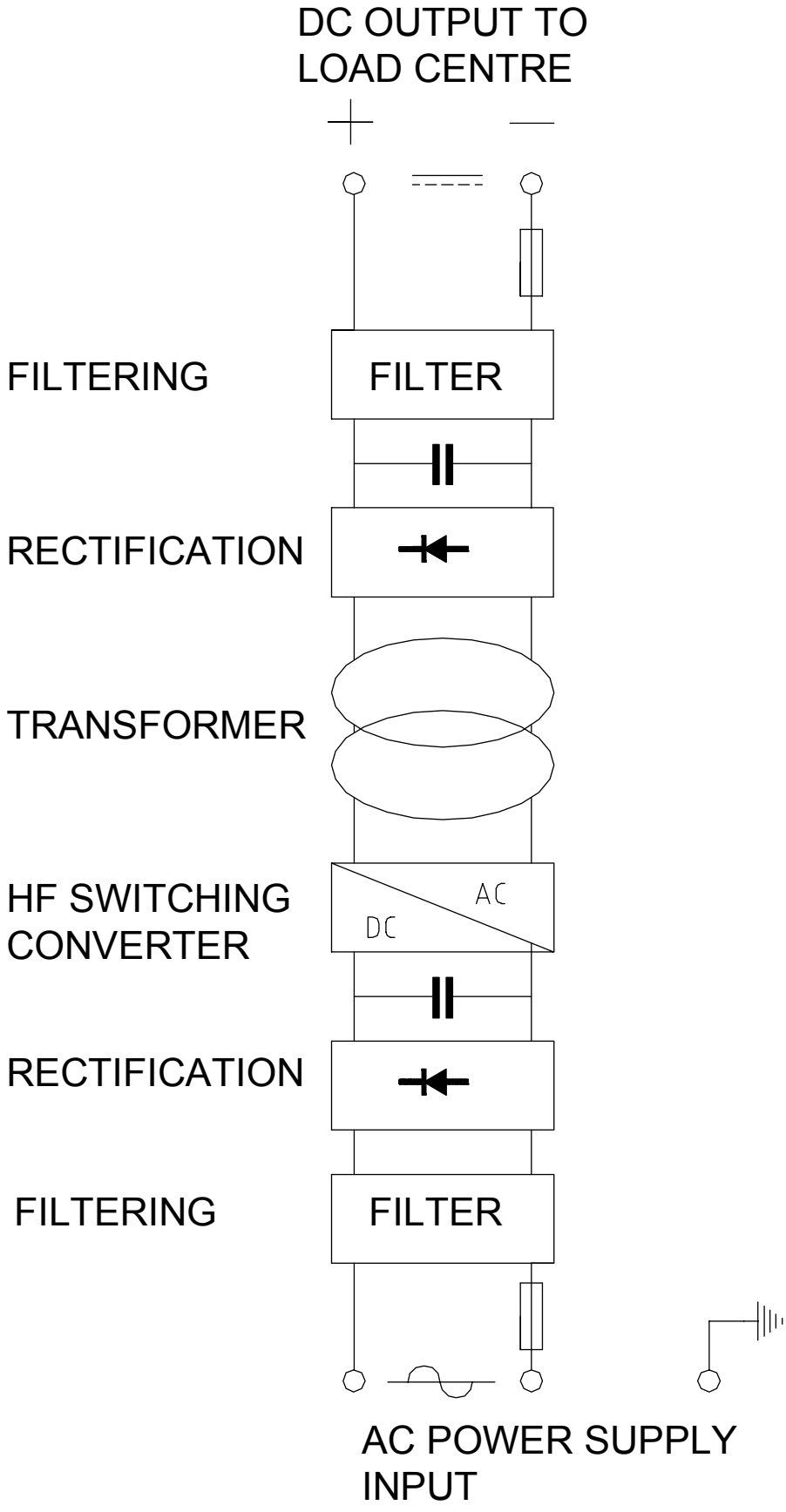
- Conformity with NF EN 50081-2 (EN 55022A) Emission (conduction and radiation)
  NF EN 50082-2 Immunity
- Special charger design to attenuate radio disturbance by conduction or radiation.
- Metal casing with grounding points providing effective shielding of the assembly against disturbance by radiation.
- Very low susceptibility at ambient disturbance level.
- Attenuating filters for conducted electromagnetic disturbance in common mode and differential mode.

2.2 MECHANICAL CHARACTERISTICS

- Presentation: wall-mounted unit.
- IP 20 protection as standard.
- Standard paint: salt spray-resistant polyester coating in matt black and blue (RAL 5012).
- Dimensions: see space requirement and mounting plan.

3 - DESCRIPTION - OPERATION

3.1 BLOCK DIAGRAM



3.2 DESCRIPTION OF OPERATION

- EMC filter in common mode and differential mode on the power supply network.
- Rectification of the ac voltage by a diode bridge.
- Filtering of the dc voltage obtained by an electrolytic capacitor.
- Switching of the dc voltage at high frequency (20 to 100 kHz), by a converter.
- Transformation of the ac voltage by an HF transformer which also provides galvanic isolation.
- Rectification and filtering by an LC structure.
- EMC filtering.

3.3 ENVIRONMENT AND OPERATING CONDITIONS

- Permanent operation in accordance with the provisions laid down in section 18-01 of Bureau Véritas (Models in a steel case).
- Ambient temperature: 0 - 45°C.
- Storage temperature: -20°C +70°C
- Average relative humidity of 70% (95% without condensation).

4 - INSTALLATION - CONNECTION - SETTINGS TROUBLESHOOTING

4.1 INSTALLATION

As the appliance is cooled by natural convection, a minimum allowance must be left for installation. Around the periphery of the case (cover and four sides), there must be a ventilation space of at least 100 mm from each point of the case (except for the mounting part).

Mounting centre distance and space requirement: see enclosed drawing.

The situation of the charger must be adapted to its protection rating.

4.2 CONNECTION

- See enclosed drawing.
- A shielded cable connection attenuates electromagnetic disturbance and reduces the susceptibility of the appliance. This type of cable is recommended in all installations.
- The external ground terminal or lug of the appliance must be connected by a short, wide strap to the installation ground.
- The ground strap of the shielded cables must be linked to the appliance ground inside the case.
- The safety wire must be connected to the safety terminal (see plan of connections and settings).
- Separate the supply, load and control cables.
- To set the output voltage Udn, use the potentiometer indicated on the plan of settings.

4.3 TROUBLESHOOTING

4.3.1 Rules of Safety

Maintenance and repairs must be carried out by the manufacturer or a competent engineer recommended by ENAG.

Personnel authorized to carry out such operations must have received appropriate technical training and have the necessary experience to:

- perform tasks inside the case;
- be aware of the dangers to which they are exposed when performing a task and the measures to be taken to minimize the danger to themselves and to others.

Operators and users are not authorized to open the case.

4.3.2 Troubleshooting Guide

- The “Mains power on” LED remains out.

➲ **Check** the presence of line voltage Uln across the input terminals.

➲ **Check** the condition of the input fuses applying the necessary safety precautions.

- The “Mains power on” LED is lit, the “Charge” or “Charger voltage” LED is out.

➲ **Check** the charger output voltage.
If necessary, adjust the charger output voltage setting (potentiometer, see plan of connections and settings) to reach the floating voltage recommended by the battery manufacturer. This setting is not possible unless the output current is lower than the rated charging level.

➲ **Check** the condition of the output fuses and the continuity of the battery cables.
➲ Eliminate the battery, connect a resistive load across the charger terminals and check the output voltage and current.

- The “Charge” or “Charger voltage” LED is still out after these checks.

➲ Contact the ENAG Technical Department who will indicate any further tests to be carried out according to the measuring and testing means available to the operator.

☞ If the problem persists, contact the ENAG factory or the nearest stockist.

The charger must be dismounted and sent to the factory where the internal electronic circuits are checked on an appropriate test bench.

5 - MAINTENANCE

- Switch off the charger (power input and load centre output).
- If the appliances are situated in a dusty atmosphere, clean them periodically with a vacuum cleaner as a build-up of dust prevents heat dissipation.
- An annual check on the main nuts and screws may prove necessary in highly disturbed environments (strong vibrations, wide temperature variations, etc.).
- The electrolytic capacitors must be replaced on average every ten years.
- A full technical inspection by a qualified inspector is recommended every five years. Depending on the type of appliance, this general check-up may be carried out by returning the appliance to the factory.

6 - GUIDELINES ON EQUIPMENT INSTALLATION

By virtue of European directive 89/336/EC, the equipment must conform to electromagnetic compatibility criteria ⇨ Date of application: January 1st, 1996.

The two main demands in terms of electromagnetic compatibility are:

- **Emission**: Protection of the environment against disturbance by conduction and radiation.
- **Immunity**: Absence of susceptibility in a disturbing atmosphere.

6.1 INSTALLATION

General Rules

The equipment must be installed according to the recommendations of the user manual. The main rules are as follows:

- Use shielded cables with a correct section in order to power the appliance and the load centres within acceptable tolerance limits.
  (Definition criteria: nature and length of the cables, ambient temperature, voltage drop, type of tracking, etc.).
- Make sure the equipment is correctly ventilated for good heat dissipation (installation space, ambient temperature, etc.).
- Choose the location in accordance with the protection rating of the appliance.

6.2 EMC-RELATED INSTALLATION GUIDELINES

Cables:

- Use shielded cable for all connections (*). The shielding must be grounded on the transmitter side and the receiver side.
- Keep the cables and shielding connections as short as possible.
- Feed the cables as close as possible to the ground ("loose" cables or loops are to be avoided - fasten the cables down to the ground).
- Separate the supply and load cables.
- Separate the power and control cables (minimum 200 mm).
- The cables should only supply power to the appliance. A branch connection or bridge to supply another appliance are to be prohibited.

(*) This is a recommendation but is not compulsory. The installation electrician will consider the EMC environment and decide whether or not to use shielded cable.

6.3 METAL CASING

- The cases or cabinets for the appliances or containing the equipment must be metallic or have a conductive coating.
- The ground bolt or lug of the casing should be connected to the main ground by the shortest strap possible. The bolt connected to the main ground must have a good electrical contact (scratch off the paint and weld the bolt).
- The ground being the reference point of the potential, the various current-bearing parts of the equipment environment must be made equipotential by linking them together (where possible, metal shielding and troughs are grounded with the shortest straps).

6.4 ADDITIONAL ATTENUATOR SYSTEMS

- The coils of contactors, relays, solenoid valves and electromagnets must be equipped with overvoltage arresters (RC circuits, varistor or diode on direct current, RC circuits or varistor on alternating current).

- Additional filters may be mounted according to applicable standards. Disturbance attenuation enables the specified levels to be attained. The filters must be mounted as near as possible to the appliance.

  Remember that filters increase the leakage current.

  As a general rule, we recommend consulting the manufacturer before installing a filter, particularly on the load and control cable side.