Vapormatic starters
for slip ring motors
M 15 - M 35 - M 70 - M 350
instruction manual

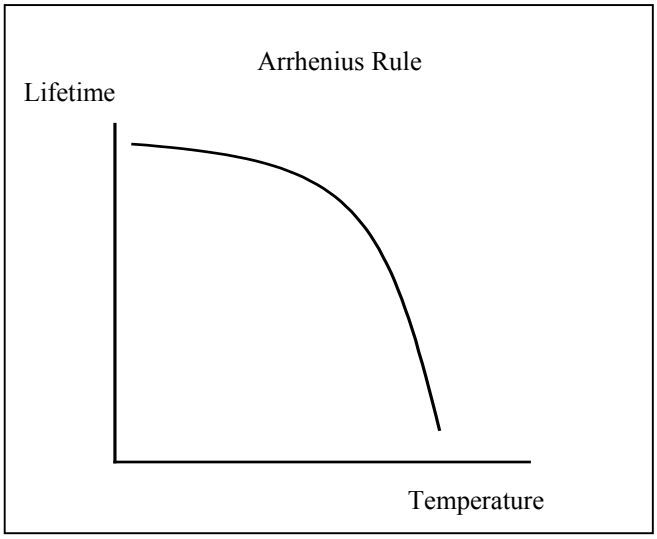
Power Drive Services Ltd.
Unit 1, Victoria St. Ind. Est.
Leigh,
Lancs, WN7 5SE
Tel: 01942 260206
Fax: 01942 260525
Web:- www.inverter.co.uk

Electronic Drive Repairs and Preventative Maintenance

We are able to offer full back up and support for all drive systems, whether new or many years old.
We have workshop facilities to repair and test any electronic drive. We also have engineers based in our northwest repair centre, who are able to visit any site in the UK, to carry our diagnostics, or to carry out preventative maintenance.

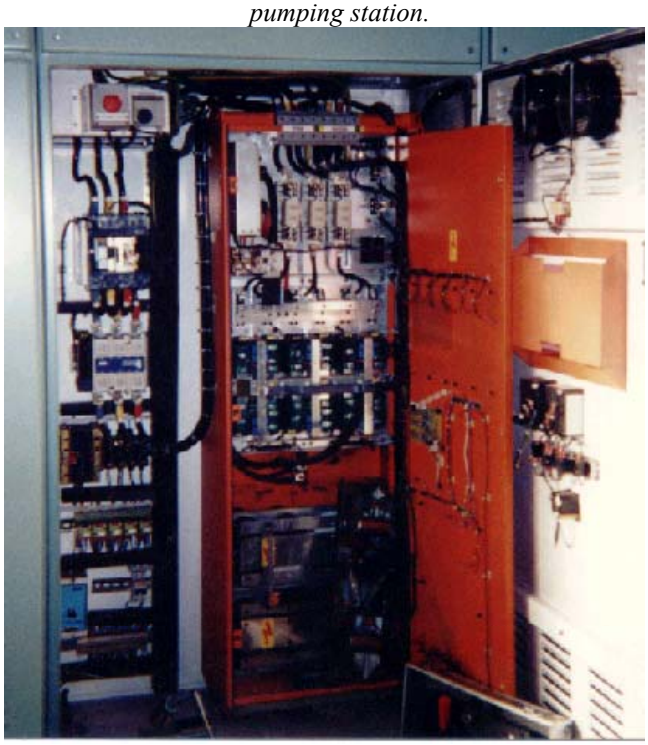
Returning a faulty controllers to manufacturers can be time consuming and therefore costly.
Very often, this is how we can help by offering cost effective repairs with a quicker turn around time.
One source for the repair of any make of drive, and a source of replacements.

As there are very few moving parts in electronic motor controls many people believe it is not necessary or not possible to carry out any preventative maintenance/service. However this is not the case!!
The biggest problems are caused by heat, therefore it is essential to keep cooling fans running in their optimum condition and to keep the airways clear.
Also other components deteriorate with age especially those with a liquid or gel electrolyte which slowly dries out.
From equipment and component manufactures data the typical useful life of some of these components is 5 years. The lifetime is affected by six main factors, the prime factor is heat. These components follow the 'Arrhenius' rule in which the lifetime is reduced by half when the temperature is increased by 10°C. This characteristic dominates the useful lifetime of all electronic motor controls and is a primary factor in deciding a maintenance schedule.



Electronic motor controls do not just suddenly fail, they gradually deteriorate over time therefore it is essential to carry out preventive maintenance in order to avoid a catastrophic failure. The power side of a motor controller rarely fails on its own. Failure of the power side is often due to incorrect firing due to the firing control deteriorating and causing avoidable damage and additional cost, not only financial but also down time. Therefore at the first signs of tripping with no external cause the controller should be serviced with out delay before further damage is caused.

Service being carried out at a regional water company pumping station.



Service and repair at glance:- Electronic drives can be sent into our dedicated workshop. Or engineers are able to visit your sites to carry out service work or to identify an optimum service schedule.

WORKSHOP REPAIRS:
*Fast Turnaround Times
*6 Months Warranty
*Free Estimates
*Extensive Testing (Simulation of application)
*Repair to Component Level Including Surface Mount
*Courier Next Day Delivery

FIELD SERVICE:
*Breakdown Service:
*Same day response if required
*Planned Maintenance
*Installation and commissioning

Contact:-

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Contents

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Pages

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M 15 - M 35 - M 70 - M 350

1. OVERVIEW

1.1 Presentation

The RLV starters are used for slip ring motors of low to medium power ratings.
Associated with an Electronic Protection Module (DRS 1), specially designed for motor optimal starts, the RLV starters offer 1, 2 or 3 stage starting depending on the model.
At the end of start, the resistance is shorted out by a contactor.

The RLV starter is composed of:
- one electrolytic resistance unit,
- one shorting contactor (end of start),
- one or several insertion contactors (depending on the model, 2- or 3- stage),
- one control block (DRS 1, time-delay, signaling),
- one antifreeze device (immersion heater above M 350, optional extra).

1.2 Models and characteristics

1.2.1 Main characteristics

Table 1

Model	Power	Range ① of the shorting ② contactor	Max. rotor voltage	Starting type	Capacity (litre)	Weight without electrolyte (kg)	Weight with electrolyte (kg)	Dimensions chapter 6
M 15/1	Up to 30 kW	110 A to 175 A	750 V	1-stage	15	25	40	Fig. 1
M 35/1	Up to 30 kW	110 A to 380 A	750 V	1-stage	35	38	73	Fig. 2
M 35/2	From 30 to 60 kW	110 A to 380 A	750 V	1-stage	35	38	73	Fig. 2
M 35/3	From 60 to 90 kW	110 A to 380 A	750 V	1- or 2-stage	35	38	73	Fig. 2
M 35/4	From 90 to 120 kW	110 A to 380 A	750 V	1- or 2-stage	35	38	73	Fig. 2
M 70/4	From 90 to 120 kW	140 A to 700 A	750 V	1- or 2-stage	70	115	185	Fig. 3
M 70/6	From 120 to 200 kW	140 A to 700 A	750 V	1- or 2-stage	70	115	185	Fig. 3
M 350/2A	From 200 to 300 kW	280 A to 1 300 A	1 500 V③	2- stage	350	170	520	Fig. 4
M 350/2B	From 300 to 440 kW	280 A to 1 300 A	1 500 V③	2- stage	350	170	520	Fig. 4
M 350/3	From 440 to 750 kW	280 A to 1 300 A	1 500 V③	3- stage	350	170	520	Fig. 4

① Depends on the rotor current which is indicated on the starter rating plate, available on all models.
② Contactor operating category: AC2 according to IEC Publication 947-4.
③ The DRS 1 is limited to 750 V. For higher voltage, use a conventional equipment (time-delay device).

1.2.2 Other characteristics

1.2.2.1 Current definition

The current flowing through the main circuits is an alternative current with a frequency which is variable according to the slip. Its frequency is obligatory below 50/60 Hz.

1.2.2.2 Rated impulse voltage

The rated impulse voltage for the main circuits is 8 kV.

1.2.2.3 Rated power of the auxiliary circuits

The power consumption by the auxiliary circuits is as below:

- 1-stage starter models M 15, M35 and M 70: hold power 100 VA; pull-in power 1 200 VA.
- 2-stage starter models M 35 and M 70: hold power 150 VA; pull-in power 1 200 VA.
- M 350 all models: hold power 200 VA; pull-in power 1 200 VA.

1.2.2.4 Protection of personnel

The metal sheath IP 53 connected to the earth protects personnel against any contact. There is a barrier which protects the operators during possible adjustment procedures when live.

1.2.2.5 Neutral requirement

Neutral requirement is not applicable. The user may choose the neutral requirement for the auxiliary circuits.

1.3 Operating principle

This is based on the difference in resistivity between a liquid electrolyte and its vapour contained in an electrode chamber.

The passage of the initial rotor current causes immediate partial vaporization of the electrolyte and instantaneously adjusts resistance and starting torque to optimum values.

During the run-up to speed, the thermal interchanges which occur progressively decrease the resistance.

The short-circuiting is carried out over a low residual resistance (that of the liquid) using a shorting contactor controlled by the DRS 1.

The starting torque is determined according to the requirements of the driven machine or the current limitation.

With this type of starter, starting is performed without surge and peak of current.

1.4 Safety provisions

1.4.1 Safety standards

The unit is constructed according to the safety standards.
It meets the following standards:

- EN 60439-1 - October 1994: Low voltage switchgear and controlgear assemblies, part 1.
- EN 60204-1 - February 1993: Electrical equipment of industrial machines, part 1.

1.4.2 Following instructions supplied with the accompanying documents

The unit is constructed to operate under safety conditions if the instructions supplied with the accompanying documents are followed. Any usage, except those described, is prohibited as it may be dangerous and reduce the safety of the operator.

The unit is adjusted in our works and changing the adjustments is prohibited.

List of the accompanying documents:

- the present instruction manual,
- the wiring diagram(s),
- the instruction manual of the DRS 1 if required,
- the rating plate(s).

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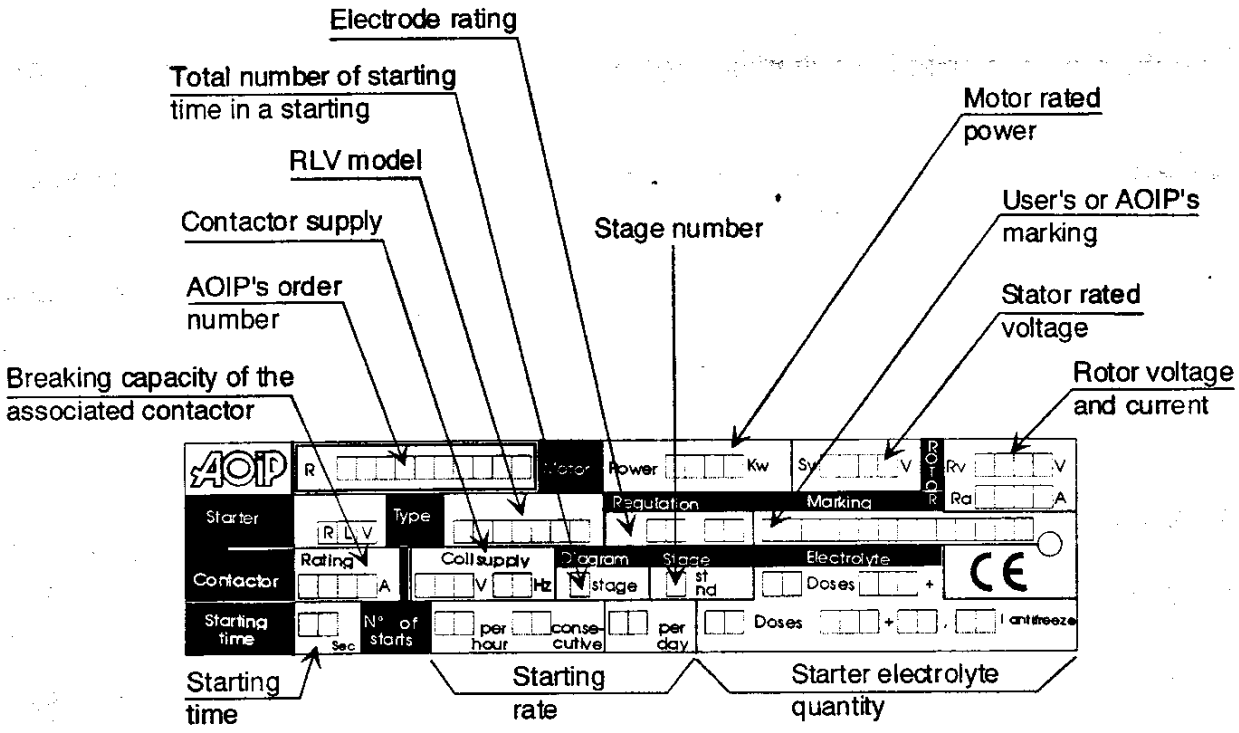
1.4.3 Presentation of the rating plates

Over each RLV is a rating plate per cycle (stage). The plate(s) are located close to the corresponding filler holes.

1.4.4 Description of the rating plate



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2. GETTING STARTED

2.1 Preliminaries

Check as follows that:

- The details on the equipment rating plate suits that of the motor to which it is associated.
- The control voltage meets the operating voltage of the contactor coils (see rating plate).

2.2 Installation

Installation and connection should be carried out **with power down and should be done by qualified personnel well acquainted with the electrical safety rules.**

2.2.1 Installation conditions

The RLV starter must be installed on a solid horizontal surface able to hold the unit (see table 1). Leave at least 600 mm around the starter and 1 000 mm above it in order to provide correct cooling and access to maintenance and repair operations.

2.2.2 Environmental conditions

Unless otherwise specified, the unit is designed for working in a room temperature of 40°C maximum and is protected to IP 53. Make sure that these conditions are followed.

2.2.3 Electrical environment

The material is specially designed to operate in an electrical environment CAT III, pollution 3.

2.2.4 Dimensions and mountings

See table 1 and chapter 6.

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2.3 Connection

- Remove the cover(s) from the starter and read the connection diagram.
- Perform control connections using the attached diagrams.
- Connect the starter to the rotor.
  When the shorting contactor is supplied separately, first connect the rotor to the shorting contactor then to the tank(s) containing the electrolytic resistances.
- If several tanks have to be connected: make a parallel connection between the various elements (if the starter is composed of several elements) by using the gland plates (to be drilled on site) between the tanks. Follow the markings of the terminals.
- Performance of the protection sheath depends on the adaptation of the packing boxes and their adaptation to the cables.
  The user will have to drill and adapt the gland plate to its own usage by following all the safety rules.
- The unit should be earthed using the terminal provided for this purpose which is marked with the earth symbol. For the cable size, refer to table 2 below issued from the IEC Publication 60439-1.

Table 2

Size of the phase conductors S mm^2	Min. size of the corresponding protection conductor Sp mm^2
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S \leq 400$	S/2
$400 < S \leq 800$	200
$S > 800$	S/4

2.4 Control connection

- Connect the control circuit according to the diagram supplied with the unit.
  Check that the control voltage applied conforms with the rating plate.

- Thermostat
  The adjustment is performed in our works.
  It is composed of a NC contact which controls the circuit and is rated at 400 V/16 A.
  1. Engines equipped with DRS 1: the thermostat is connected in our works on the DRS 1.
  2. Engines without DRS 1: The thermostat or the associated relay (see diagram) must be connected by the user according to the diagram supplied with the unit (generally in the contactor hold circuit on the stator panel).

- DRS 1 (if present)
  The DRS 1 must be connected according to the attached instruction manual.

- Power: see paragraph 1.2.2.3.

2.5 Preparing the electrolyte

Important: These products should be handled with care (see below).
There is a risk such as effects linked to irritation due to the chemical composition.

- **Precautions**

  Handling and storage:
  Use a well-ventilated room, away from reactive substances, such as acid, zinc, quick-lime, aluminum.

  Protections:
  - Protect against inhalation (use a mask for protection from dust).
  - Hands should be protected using gloves made of Neoprene or rubber.
  - Eyes should be protected by wearing tight, dust protecting spectacles.
  - Skin should be protected by wearing adequate clothes.

  The user must follow the legislative, regulation and administrative texts related to safety and protection concerning the human health and environment.

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- **Preparing the electrolyte**

The electrolytic solution components are inside the starter packaging, or, if required, apart in a separate package.

These components are:
- The electrolyte which is vacuum-sealed in plastic sachets (electrolytic type: S2, CS, BS, etc.)
- The oil which is supplied in bottles. To avoid evaporation, the electrolyte is covered with an oil film.
- The antifreeze (if supplied) is also supplied in bottles. It should be added after dissolving of the electrolyte.
  Refer to the rating plate of the unit or to table 3 for determining the type and quantity of electrolyte to be used as well as antifreeze.

Preparation:
Warning: Models M 35, M 70 and M 350 may have an internal barrier which divides the tank into a small and a large compartment. The various doses constituting the electrolytic solution in each compartment are detailed on the respective rating plates.

Perform the filling operation by following the instructions and adding the doses prescribed on the rating plate or in table 3.

1. Preparing the solution
   For all the models, dissolve the electrolyte sachets in 2 litres of drinking water per sachet in a PVC container (use water between 20°C and 40°C to make it easier to dissolve).

2. Filling up the tank
   For models M 15 and M 350, remove the level screw.
   For all models, pour the solution in the tank through the filler hole(s) by using a funnel.
   Add antifreeze (if supplied).
   Add oil.
   Top up with drinking water always through the filler hole(s) and follow the quantity indicated in the table 3:
   - For models M 15 and M 350 up to level screw hole.
   - For model M 35 up to max. level of the dipstick.
   - For model M 70, fill up until the liquid is present at the base of the filler pipe.

3. Closing the filling up aperture
   Replace the level screw on models M 15 and M 350.
   For all models, replace the filler hole cap(s).

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Table 3

Models	Electrolyte dose	Oil volume	Solution volume ①	Antifreeze volume
M 15	3 sachets	0.5 litre	15 litres	Refer to rating plates of each tank
M 35 without barrier	7 sachets	1 litre	35 litres	
M 35 large compartment	5 sachets	0.75 litre	25 litres	
M 35 small compartment	2 sachets	0.25 litre	10 litres	
M 70 without barrier	14 sachets	1.5 litres	70 litres	
M 70 large compartment	9 sachets	1 litre	45 litres	
M 70 small compartment	5 sachets	0.5 litres	25 litres	
M 350 large compartment	See rating plate	3 litres	247 litres	There is no antifreeze ②
M 350 small compartment	See rating plate	1.25 litres	103 litres	

Notes:
① ***The volume in the tank is composed of: the solution volume prepared in the container, the oil volume and the antifreeze volume (except for model M 350) as well as the volume of the additional water.***
② ***Antifrost protection above model M 350 is by immersion heater.***

2.6 Operation

There is no adjustment to be performed as the starter has been configured and adjusted according to the ordering information.

Before switching on:
- Check connections and be sure that all the screws of the electrical connections are well tightened.
- Replace the various protective covers.

Initiate starting:
1- Closing the stator contactor powers the starter control circuit.
2- The main resistance block of the starter is inserted in the motor rotor circuit and the motor starts to accelerate.
3- For a 2- (or 3-) stage starter, insert one (or 2) additional resistances when the time specified on the starter has elapsed. The motor accelerates each time a new resistance is inserted.
4- When the starting time is complete, the shorting contactor shorts out the rotor circuit.
5- The motor reaches its rated speed.

Never exceed the operating rates indicated on the rating plate.

3. MAINTENANCE AND INSPECTION

For all the operations described below, the starter should be switched off.

1. Check the level of the electrolyte

To provide correct operation of the unit, the level of the electrolyte should be checked every 6 months and toped up if required as indicated paragraph 2.5, number 2.

2. Inspection

Every two years, check as follows:

- State of the electrodes.
- State of the contacts on the contactors (lift the contactor cover).
- Tightness of all connections.

3. Emptying the electrolyte from the tank

In cases where the electrolyte is not reused, it is necessary to neutralize it, either in the tank or by sending it to a specialist.

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4. TROUBLESHOOTING

1. If the motor stops during the starting phase (thermostat opening), check:
   - that the room temperature is not too high.
   - that the starting rate authorized is not exceeded (also refer to the DRS 1 instruction manual if required). Allow the starter to cool.
   - that the power is present in the command circuit.
   - the triggering sequence and state of the contactors on the insertion stage and shorting contactor stage.

2. If the motor does not start, check:
   - the connection order of stator phases.
   - that the rotor is not locked (also refer to the DRS 1 instruction manual if required).
   - the state of the contactors on the insertion stage and shorting contactor stage.
   - the amount of sodium in the electrolyte solution (chemical constitution of the solution).

3. If the motor does not reach its rated speed, check:
   - the load driven by the motor (transmission, engine, etc.).
   - the triggering sequence and state of the contactors on the insertion stage and shorting contactor stage.
   - that the power is present in the control circuit.

4. If the starter solution boils:
   - check the state and connection of the thermostat.
   - carry out tests in 1. above.

If these troubles do not disappear, contact AOIP INSTRUMENTATION or your local approved agency.

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5. WARRANTY

The unit is fully warranted for one year in respect of defects which under proper use may appear in any parts and which are due to faulty manufacturing materials or workmanship, provided that no unauthorized modifications have been made on the unit.

If the unit is not operating correctly, it must be returned to the address below or to your local approved agency by using the original packaging and explaining if possible the reasons for returning it.

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6. DIMENSIONS AND MOUNTINGS

6.1 Model M 15

Dimensions in mm.

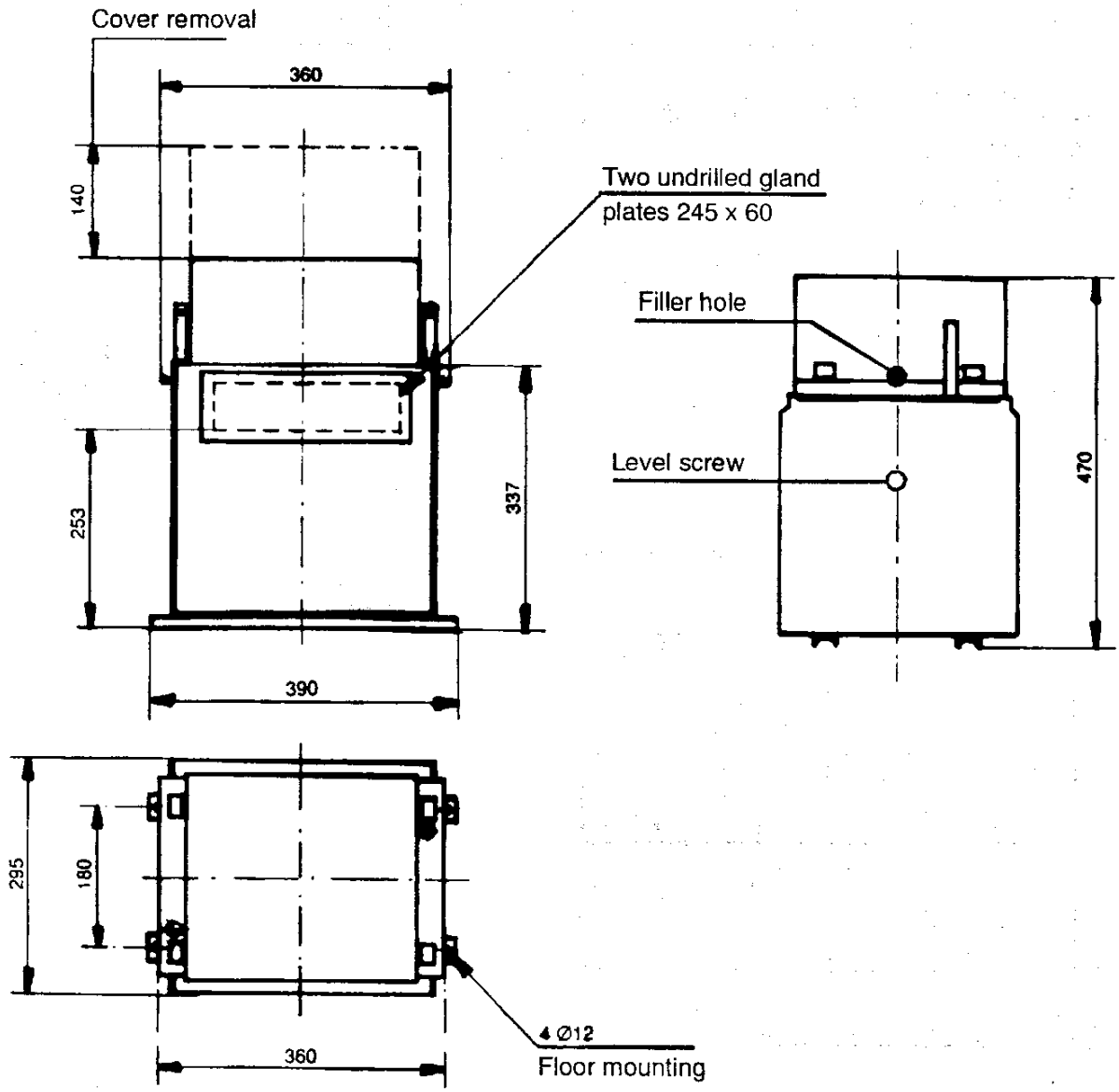

Figure 1

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6.2 Model M 35

Dimensions in mm.

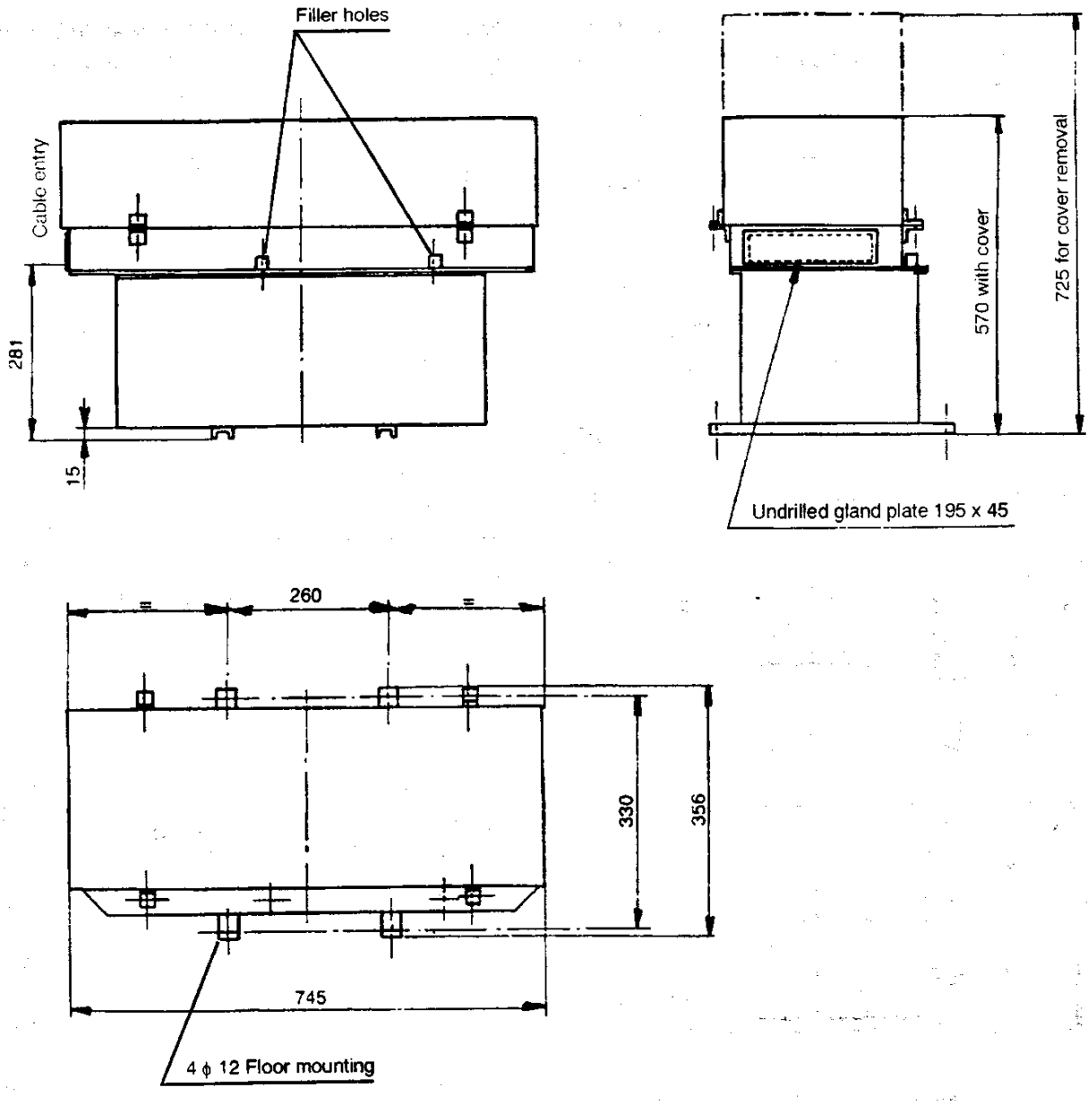

Figure 2

6.3 Model M 70

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Dimensions in mm.

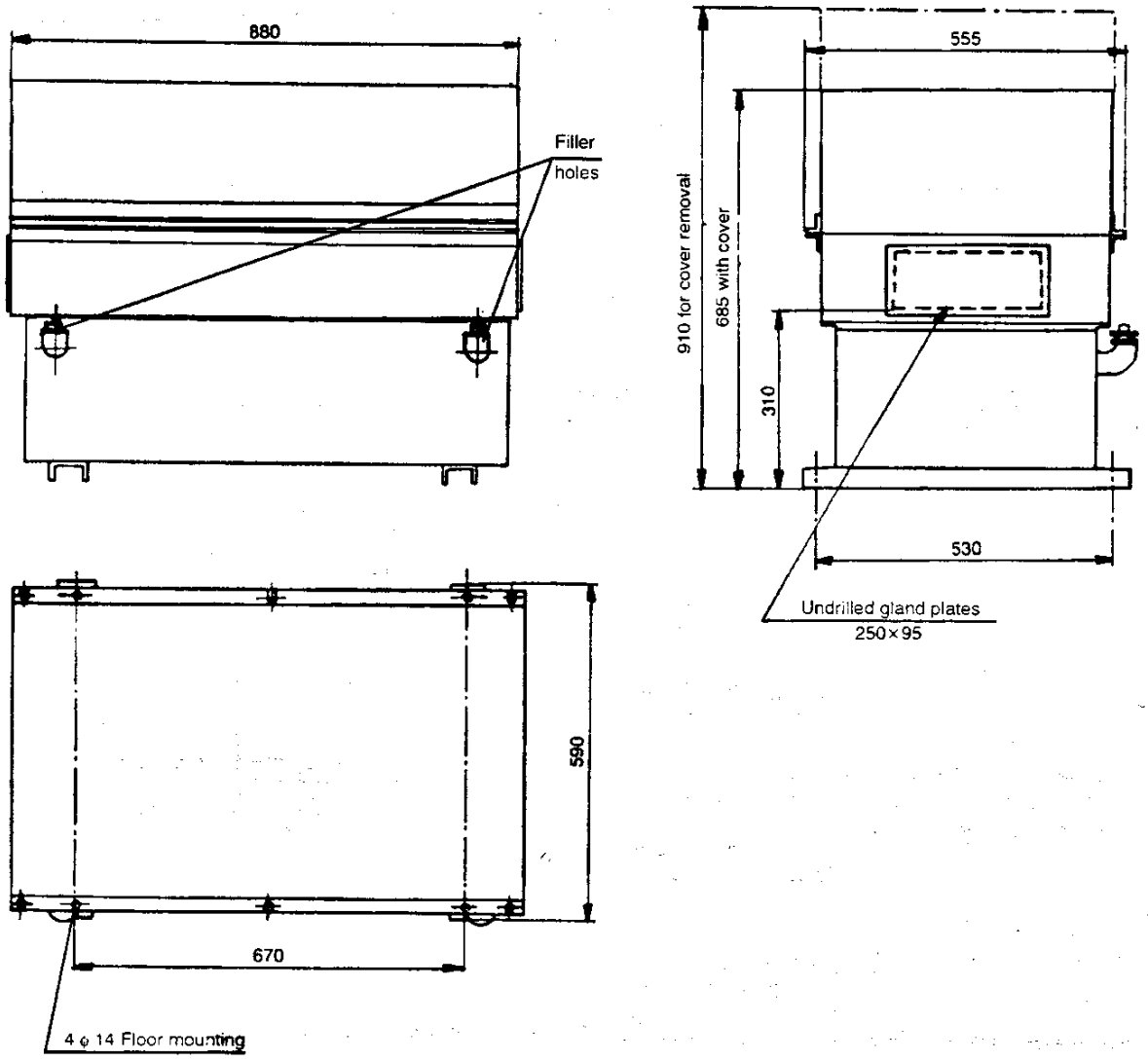

Figure 3

6.4 Model M 350

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Dimensions in mm.

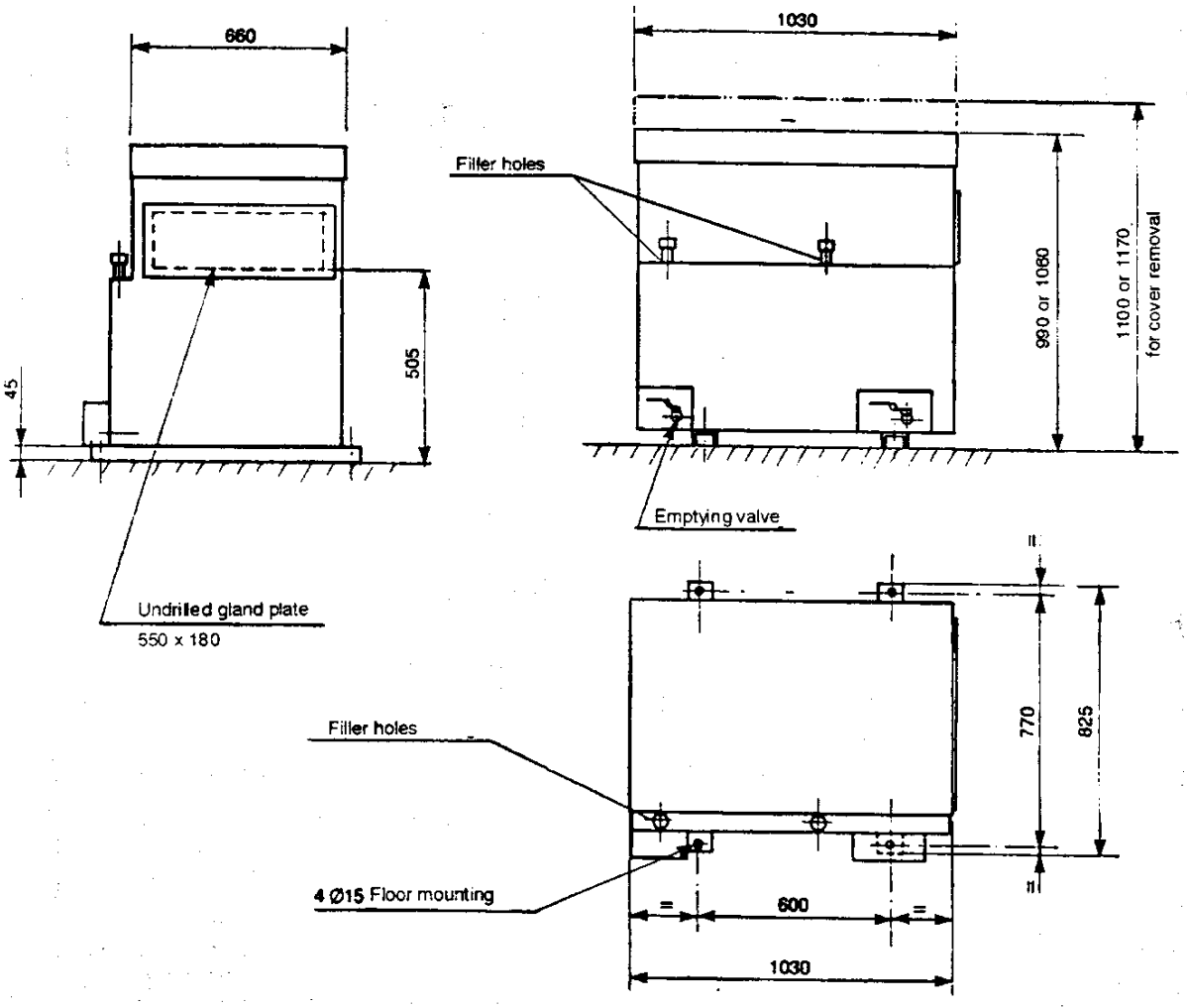

Figure 4

AOIP
INSTRUMENTATION

CE

Déclaration d'incorporation et de conformité

Declaration of incorporation and conformity

Nom du fabricant :
Manufacturer's name : AOIP

Adresse du fabricant :
Manufacturer's address : Z.I. de Saint-Guénault - Rue Maryse Bastié
BP 182 - 91006 EVRY CEDEX - FRANCE

Déclare que le produit
Declares, that the product

Désignation :
Designation : Démarreurs rotoriques RLV
RLV Vapormatic starters

Référence :
Model number : M 15 - M 35 - M 70 - M 350

Date : 04.07.97

- a été conçu pour une utilisation dans un ensemble soumis à l'application de la directive 89/392/CEE sous réserve que son incorporation soit effectuée en respectant les consignes spécifiées dans la notice de montage et d'utilisation et les documents annexes.

- a été fabriqué conformément aux spécifications techniques du produit et sous tous ses aspects, est conforme aux normes et réglementations en vigueur s'y rapportant et en particulier à la :

Sécurité
EN 60439-1 (10/1994)
EN 60204-1 (02/1993)

Le produit nommé ci-dessus est conforme aux prescriptions de la directive européenne basse tension 73/23/CEE amendée par 93/68/CEE.

- *has been designed to be used in a device complying with the requirements of the directive 89/392/EEC on condition its assembling is performed according to the recommendations given in the instruction manual and the accompanying documents.*

- *has been manufactured according to the technical specifications of the product and conforms in all respects to the relevant standards and regulations in force and especially to :*

Safety
EN 60439-1 (10/1994)
EN 60204-1 (02/1993)

The product herewith complies with the requirements of the low voltage directive 73/23/EEC amended by 93/68/EEC.

R. SOUCEK
Directeur Assurance Qualité
Quality Assurance Manager

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AOIP INSTRUMENTATION étudie, fabrique et commercialise depuis 100 ans des instruments de précision et des systèmes d'automatisme et s'est ainsi forgée une réputation de qualité et de fiabilité concrétisée par un agrément ISO 9002.

Grâce à son fort potentiel en recherche et développement, AOIP est un spécialiste européen dans différents domaines :

- Mesure de grandeurs électriques.
- Calibration et mesure de températures et autres grandeurs physiques.
- Acquisition, affichage et traitement de mesures.
- Pilotage des moteurs asynchrones.
- Test de lignes et terminaux de télécommunication.

AOIP est présente dans plus de 30 pays sur les 5 continents et développe activement sa politique de partenariat international.

AOIP INSTRUMENTATION has been developing, manufacturing and selling precision instruments and automation systems for 100 years, gaining an enviable reputation for quality and reliability (ISO 9002 certified).

Advanced electronic skills have brought AOIP to forefront of European industry in:

- *Electrical quantities measurement.*
- *Calibration and measurement of temperatures and other physical quantities.*
- *Data acquisition, display and processing.*
- *Asynchronous motor drive.*
- *Telecommunication wires test.*

AOIP is present in over 30 countries on 5 continents and is actively developing a policy of transnational partnerships.

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