

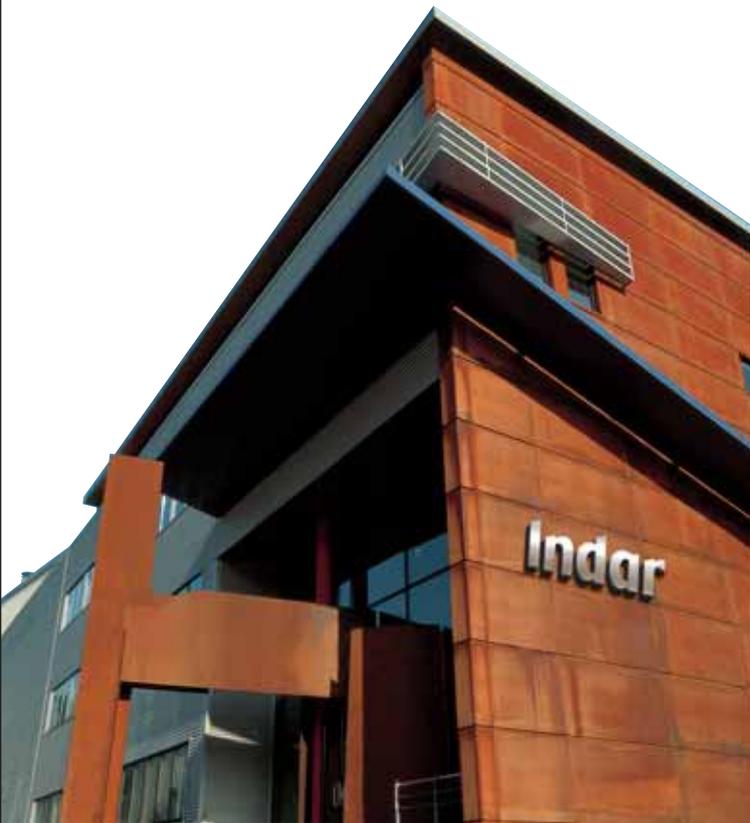
SERIES
→ MTK



ASYNCHRONOUS
M O T O R S



Indar



W H O W E A R E

Indar Electric's trajectory is endorsed by the construction of thousands of motors for the different industrial sectors.

The C.I.M. (Cogeneration, Industry & Marine) Business Unit, with highly qualified personnel, designs and manufactures our machines using the most advanced technological means, guaranteeing maximum flexibility and services, in close cooperation with our clients.

The special dedication to the industrial sector and this combination of quality, technological capacity and dedication to the client allows Indar Electric to be in the vanguard in the manufacture of electrical engines.

Indar Electric is present in several continents through delegations and after-sales assistance workshops, integral service for their motors: technical assistance, maintenance, repairs and supplies.

The industry moves in an extremely competitive environment, always linked to the quality of its products, which obliges us to manufacture a high quality product at economic prices, that is robust, reliable and needs little maintenance.

— Indar Electric, an Ingeteam company, has worked for over sixty years in the design, manufacture and supply of electrical rotating machines.



CONSULTANCY

— SUPPLY

MAINTENANCE

TECHNICAL ASSISTANCE

MTK SERIES ASYNCHRONOUS MOTORS

The new MTK series of asynchronous motors integrates the asynchronous motors with different forms of cooling that Indar Electric have been making in recent years. This series is characterized by its high performance and reliability for all kinds of applications where electrical drive is needed.

The motors comply with international regulations for design and manufacture of rotating electrical machines (IEC, CEI, NEMA...)

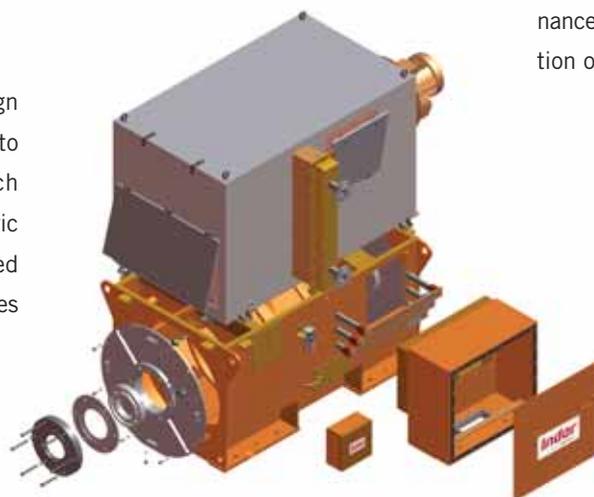


Modular construction of the motor

Modularization of the MTK series allows the motors to be fabricated in a shorter period of time and to reduce design and manufacture costs.

The greater flexibility of design in the motors allows adaptation to the specific requirements of each application and allows Indar Electric to offer both a totally standardized product range and unique machines designed for a given application.

The incorporation in the motors of commercial element as well as easy accessibility to these, facilitates maintenance and assures correct operation of the machine.



The main structural components are analyzed by means of Finite Element Modeling (FEM)

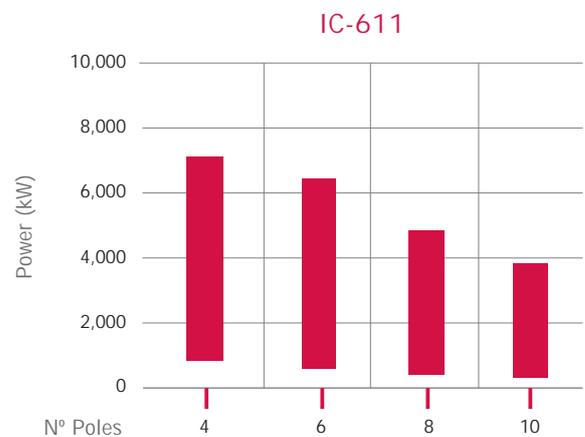
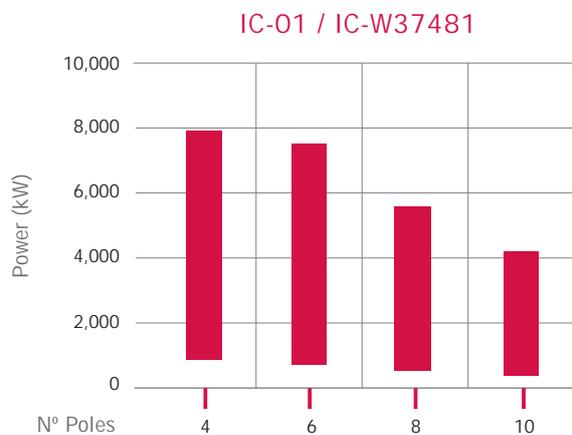
CONSTRUCTION DESIGN OF THE MOTORS

The standard INDAR MTK series of asynchronous motors is the consequence of accumulated experience in the manufacture of asynchronous motors during much time. This new standard series integrates the principal constructive and performance requirements for satis-

fying the drive needs of many fixed and variable speed applications.

Below the basic characteristics of the new MTK series are detailed:

Power (kW)	400 ÷ 8.000
Nº Poles	4 ÷ 10
Voltage (V)	690 ÷ 15,000
Insulation class	H
Heating class	F
Temperature (°C)	40
Standards	CEI, NEMA, VDE, ANSI...
Other standards	Bureau Veritas, Lloyd's Register, Det Norske Veritas,...



DESIGNED FOR EACH APPLICATION

Thanks to the modularity of these motors, the new MTK series is a perfect solution for applications as diverse as:

- Main electrical propulsion and transverse propulsion motors, pump drives, deck machinery, etc.
- Combined cycle plants: circulation pumps and condensation pumps.
- Compressors.
- Fan drives: wind tunnels, thermal generating stations, smoke extraction...
- Drive for mills in the paper, coal, rubber industries...
- Metallurgical industry: boxes, winders, unwinders, cutters,...



Tension reel motor in lamination plant

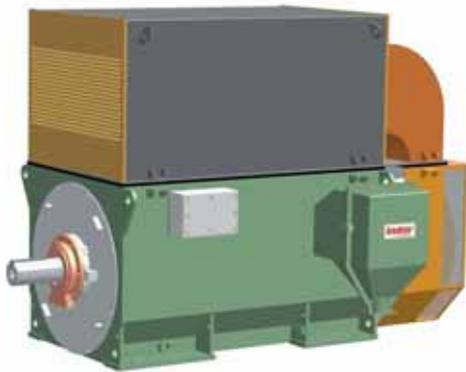


Fan drive motor in thermal plant

Circulation pump drive motors in combined cycle plants

R + D + i AT YOUR SERVICE

The R+D+i support unit has advanced technical means for the design and development of machines that along with the know-how acquired throughout years of experience, allows us to develop machines of maximum performance to satisfy the needs of our clients.

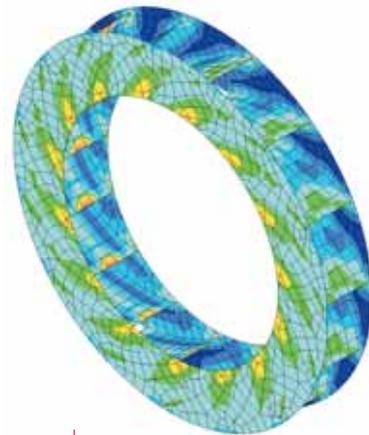


Electrical and mechanical optimization studies have been carried out using different finite element simulation programs:

- Electrical optimization: based in reducing to the maximum electrical losses, reducing starting current, obtaining maximum and high starting torque and an optimum electrical circuit design achieving low levels of noise.



- Mechanical optimization: based on optimization of the cooling circuit, modularization and low vibrations, (absorbing/damping of vibrations).



— Finite element study of the different components that form part of the motor

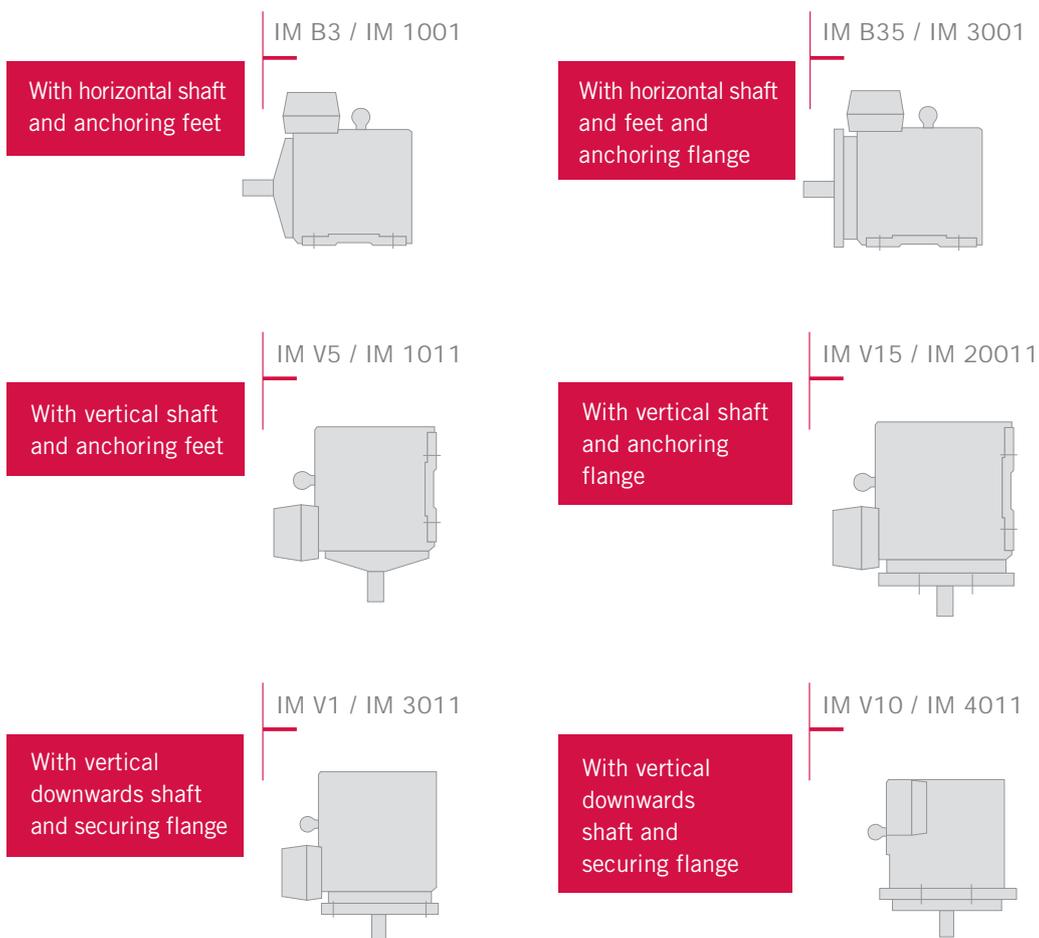
Each machine is especially analyzed with the client (appearance, supply, number of startings, overloads, etc), providing a motor in accord with the needs of each project.

Correct selection of new materials together with the robust design allows us to have motors that meet the expectations of the market, whose easy maintenance makes them especially appealing.

— Analysis of the distribution of magnetic induction carried out using finite element

CONSTRUCTIVE FORMS

INDAR modular motors are manufactured with the following constructive forms:



All of the machines can be supplied with a 2nd. shaft end similar to the main one or with access for positioning a speed meter.

D E G R E E S O F P R O T E C T I O N

INDAR motors are manufactured with different degrees of protection, which are:

- IP-23 and IP-W24: open motors.
- From IP44 to IP-56: enclosed motors.

Following international recommendations the degree of protection is represented by the initials IP followed by two numbers and it indicates to us the degree of sealing of the motor with respect to physical accessibility or to external element such as solids or liquids.



IP

— Nomenclature of protection class

— It indicates the degree of protection against accidental contact with the active parts and the penetration of solid bodies

2. Motors protected against objects greater than 12 mm

4. Motors protected against objects greater than 1 mm

5. Motors protected against penetration of dust

IC-01 Cooling

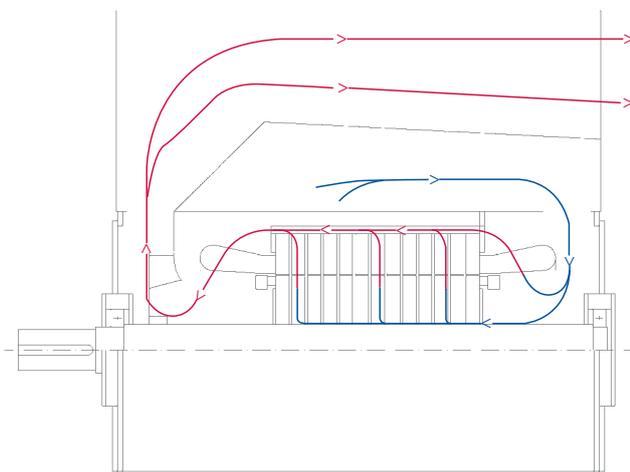
— Degree of protection referring to the motor sealing with respect to the penetration of liquids

3. Motor protected against drops less than 60 ° (rain)

4. Motor protected against splashing from any direction

5. Motor protected against water sprays

6. Motor protected against buffeting by sea



COOLING INDEX

Depending on the environmental conditions of the installation a type of cooling will be selected in accordance with it:

IC-01 Cooling

If the motor is located in a room whose environmental conditions are clean, the type of cooling can be IC 01, where the air is taken from outside the motor and is made circulate through its interior by means of a fan placed on the shaft.

IC-81W Cooling

When the environmental conditions do not allow open motors to be used, totally enclosed motors, cooled through air - water exchangers (IC-W81), or air - air exchanger (IC-611), can be used.

— **Air-water:** with a fan placed in the shaft of the motor the interior air is made to circulate through the heat exchanger thus cooling the motor.

In the standard execution it is a simple pipe although, subject to client requirements, it can be double pipe.

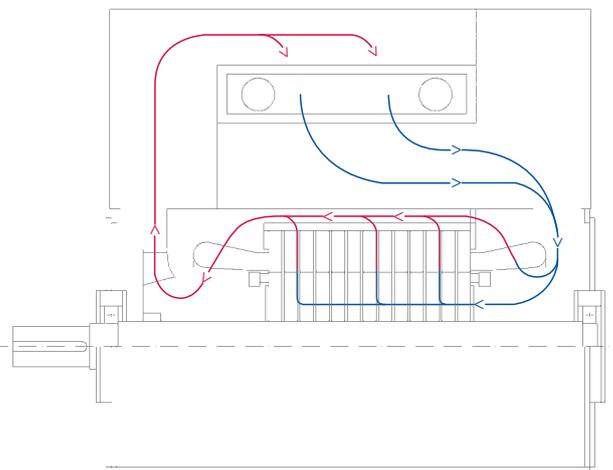
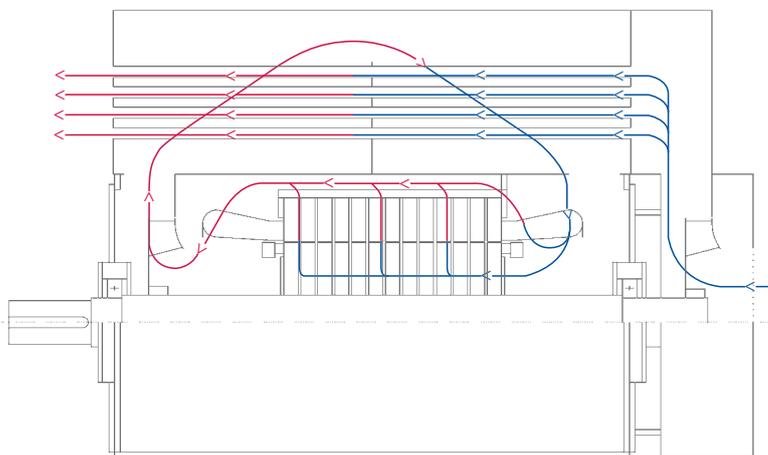
Depending on the quality of the water the pipe material changes, Cu being the material for fresh water without additives, whereas for salt water CuNi is used. In the case that the water contains additives or corrosive element the most appropriate material will be used.

— **Air-air:** in addition to the interior fan there is another fan on the outside secured to the shaft which takes the air from the outside and forces it to circulate through the cooling pipes.

When the motors are supplied by frequency converters, and they have to work in a variable speed range, it often happens that the fan that is attached to the shaft it is not capable of providing sufficient flow of air for the optimum cooling of the motors. In this event in these motors the shaft fan is eliminated, and an electro-fan is added to them.

IC-611 Cooling

IC-81W Cooling



THE STATOR

The sheet steel used for the manufacture of the stator and rotor assemblies is low loss insulated non-orientated grain sheet steel.

Stator

Once the sheet steel has been cut, it is pressed and longitudinally welded, leaving radial ventilation channels to achieve a uniform temperature and efficient cooling. All of this assembly forms a rigid metallic structure.



Medium voltage stator assembly ready to be introduced in the VPI tank



losses and noise. Next they are impregnated using the VPI system.

Between the windings heads fiberglass separators, wrapped with a porous material, are placed, so that when the unit is impregnated the winding heads remain rigidly secured.

After the VPI process it is cured in a furnace obtaining a mechanically and electrically rigid assembly, capable of supporting starting and operation of the motors without suffering damage. Next, and to finish the process, the stator assembly is inserted into the casing.

Windings

All of the system of isolation is class H, the unit having a high resistance against moisture, aggressive gases and steam, excellent mechanical stability and long life.

To fabricate the windings, copper sheet, insulated with fiberglass and mica, is used. Once the windings have been formed they are given a layer of insulation, depending on the voltage, and are placed in the open slots of the steel sections, being secured using magnetic cleats that reduce



VPI Installations and drying ovens

THE ROTOR

During the manufacturing process tests are carried out following that set out in the Indar Electric procedures. Among the tests that are carried out the following can be mentioned: hot points test for the magnetic assemblies, measurement of insulation between turns, tangent.delta, dielectric strength, surge test...

Rotor

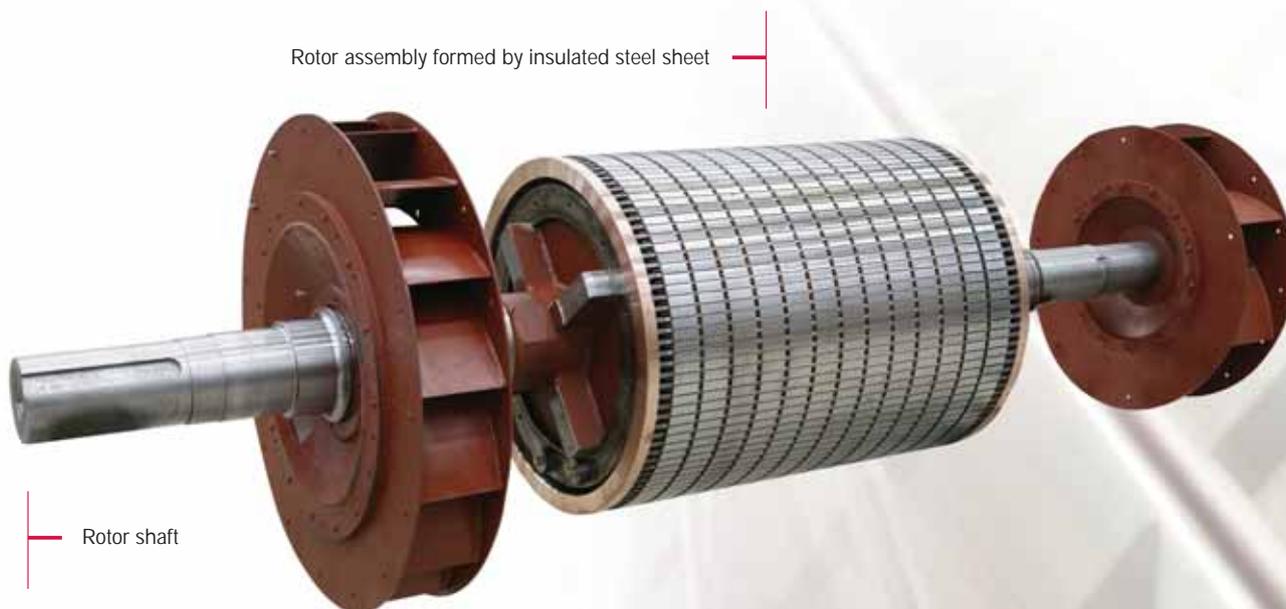
The shaft material is selected bearing in mind the application, forces and torques transmitted.

In the rest of the motors the ribs, on which the rotor assembly rests, are welded onto the shaft.

The process of welding the ribs onto the shaft, as well as their stabilization, is carried out following strict procedures and controls.



One of the keys for long life motor life consists in that when the motor is operating its vibrations be minimum. This is achieved by manufacturing a robust rotor, and with fine balance.



B E A R I N G S

The drive side and the opposite covers have been designed to incorporate the bearings in accordance with the machine fabrication type as well as its number of poles.

Antifriction bearings

The standard configuration is with a fixed bearing in the DE and loose one in the NDE. When the motors will be supplied by a frequency converter the NDE bearing is usually insulated and a discharge brush is placed in the DE to avoid current being passed. Bearing life is calculated for it to always be greater than 50,000 hours.

Lubrication is carried out using grease and it has grease cups to facilitate re-greasing.



— Mounting of insulated bearing to avoid passing current through them

Sleeve bearings

These are used when the motors must operate in extreme conditions such as external stresses or high speeds. Flanged sections are placed in the covers and the lubrication by oil can be natural, using a self-lubrication ring, or forced.



— Sleeve bearing prepared for forced lubrication

When forced lubrication is needed lubrication sets can be included in the scope of supply.

They are usually divided type, in order to facilitate maintenance.

Bearing life is calculated in order that in order that it be greater than 100,000 operating hrs.

CONNECTION BOXES



In addition to these auxiliary elements our design is formulated in order to be able to install other auxiliary elements so that the requirements of our clients are satisfied. These elements can be:

- 4-20 mA converters for temperature sensors
- automatic valves
- local thermostats
- vibration meters
- differential protection and measurement transformers
- air filters
- flow meters
- vibration detector.

Auxiliary element

The motors have the following auxiliary element as standard:

- heating resistance
- 2 x 3 PT 100 in windings
- 1 PT 100 in each bearing.

When the machine is of the IC-81W cooling type, the air-water exchanger is a simple tube with copper pipes and chambers, and steel flanges coated with epoxy for use with additive-free water. It also has a water leak detector.



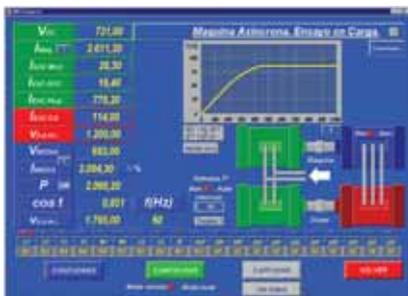
Heating resistance



Oil level in bearing and Pt 100 indicator

T E S T S

Each motor is tested in our Tests Laboratory in accordance with the CEI-60034 standard. If required they can be tested in accordance with other standards such as NEMA, IEEE, or classifying bodies such as LR, BV, GLR...for marine applications.



Motor MTK 560 (IP56),
diesel electric marine propulsion

Standard tests

- Measurement of windings resistance in ohms.
- Measurement of insulation resistance.
- Vacuum test.
- Overvoltage test.
- Vibrations test.
- Checking of rotation direction and phase.
- High voltage test.
- Checking of auxiliary element.

"Type test" tests

- Separation of losses.
- Heating test.
- Readings at different load conditions.
- Locked rotor at reduced voltage test (determination of torque and level of starting current).
- Overspeed test.
- Determination of performance.
- Measurement of noise level.

A complete tests protocol is prepared and sent along with the machine. Subject to agreement, special tests can be carried out, with or without the presence of the client.

START-UP AND SPARE PARTS

A highly qualified team is available to give assistance to INDAR motors clients, once the motors have been delivered.

Total knowledge of the product by the SERVICE department allows us to offer our clients a complete service not only of our machines but also of other manufacturers, offering the following services:



- **Mounting**
and start-up.

- **Repair**
of motors and generators.

- **Diagnosis**
of the state of windings / insulation.

- **Investigation**
of breakdowns.

- **Maintenance**
courses.

- **Preventive and predictive**
maintenance contracts.

All of this is possible since our technical personnel are in the same facilities in which our machines are designed and manufactured, and where our engineers are located.

Likewise Indar Electric guarantees that spares for our motors be available during a minimum period of 10 years.



Indar

Una Marca ***Ingeteam***