

NORAC Induction Motors

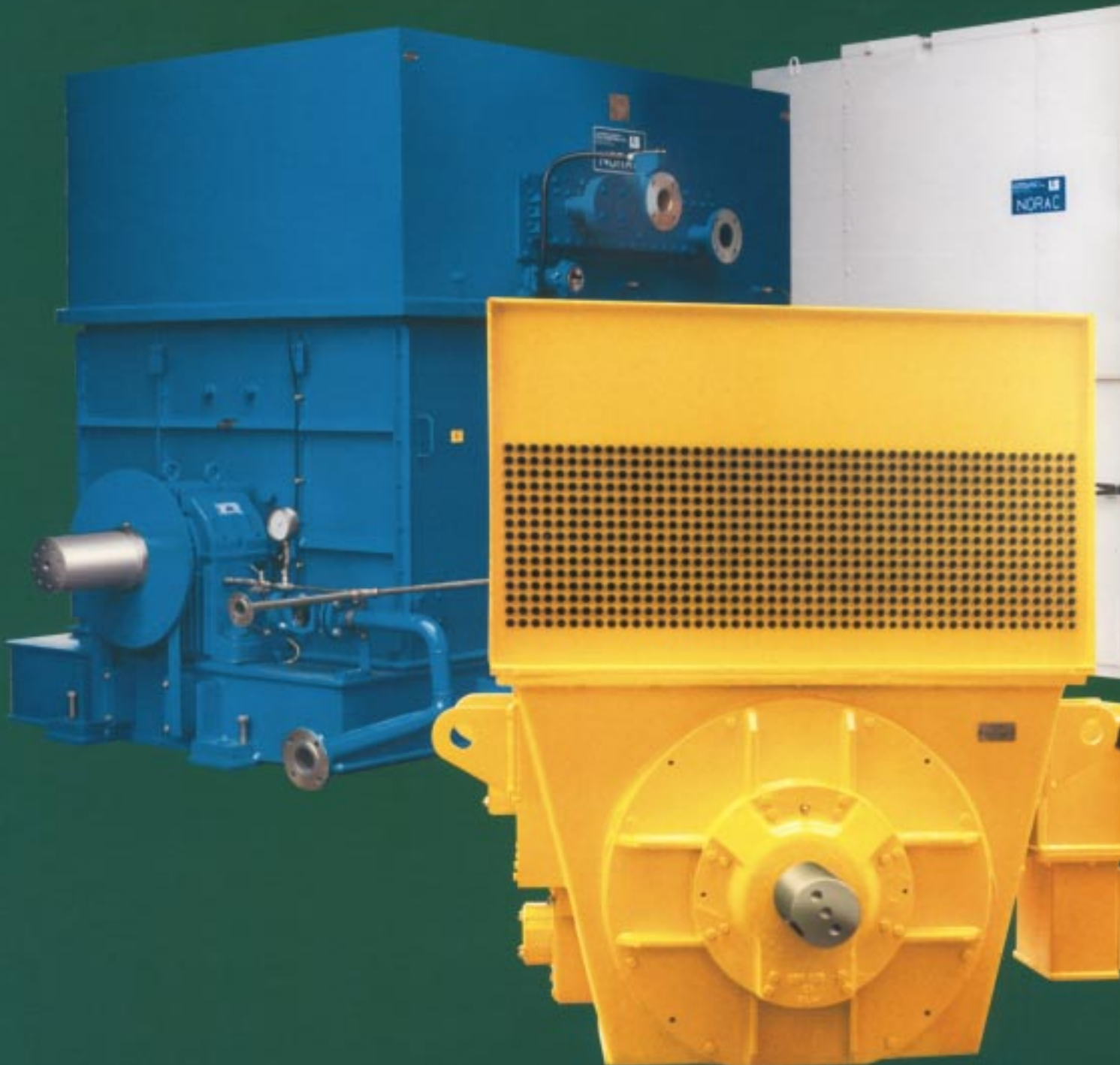


**Laurence, Scott &
Electromotors Ltd**

Rotating Machines
Division

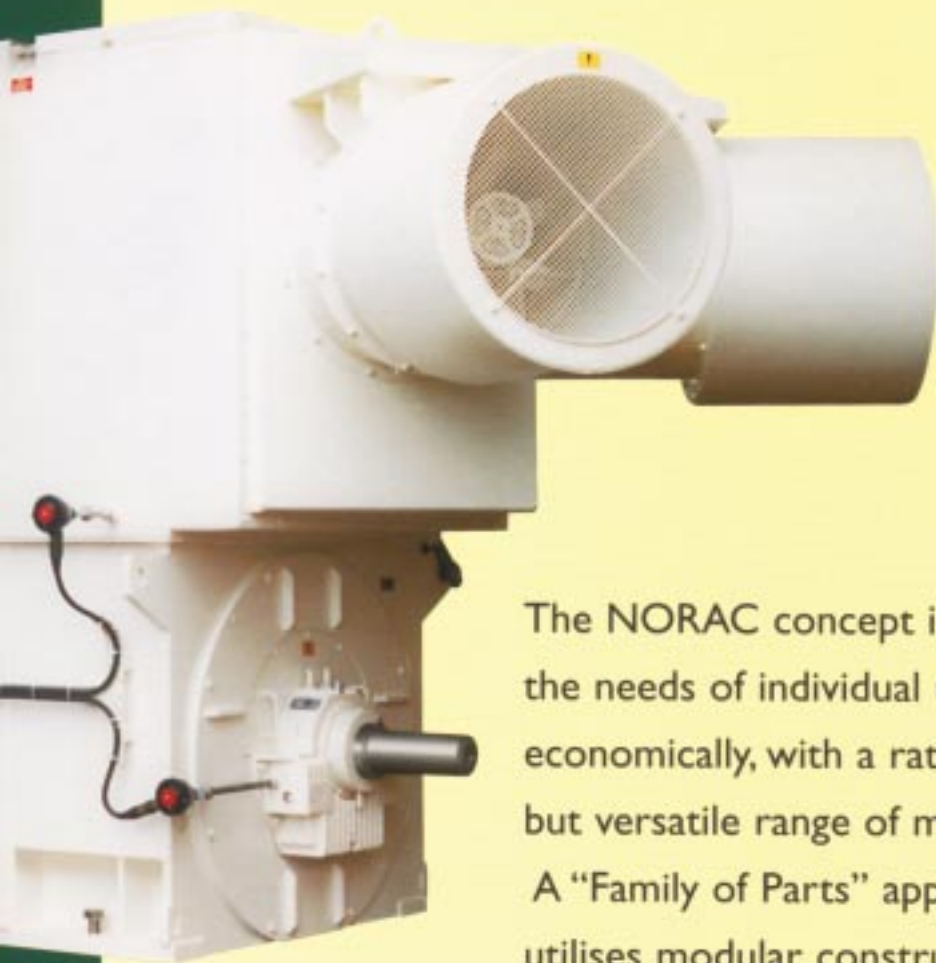
The NORAC Concept

NORAC motors have proven reliability and cost effective operation in a wide variety of industries and environments. These include offshore, petrochemical, water and power generation, pipelines, mining, marine and both desert and arctic conditions.



More than a century of technological leadership in electrical rotating machinery has supported the development of LSE's NORAC range of cage induction motors.

Declaration of Conformity
NORAC cage induction motors, when properly applied, in accordance with the installation and operating instructions, meet the current European directives (Machinery, Low Voltage and EMC) in so far as they are applicable to the motors themselves.



The NORAC concept is to satisfy the needs of individual users economically, with a rationalised but versatile range of machines.

A "Family of Parts" approach utilises modular construction and standardised manufacturing techniques, to produce machines of simple and robust construction with performance to meet the Customers' specific requirement.

Construction

Frame and Enclosure

Machines with centre heights of 355 to 560mm inclusive utilise box frames which may be of cast iron (Grade 220 to BS1452: 1977) or fabricated steel construction. Machines with centre heights of 630mm and above are generally unit construction and have substantial square section fabricated steel baseplates.

The enclosure for unit construction machines consists of a series of steel panels, folded to give a rigid formation. These panels permit easy access to any part of the machine without the necessity for lifting large sections.

TE CACA machines have coolers with mild steel tubes expanded into substantial tube plates. The completed cooler unit assembly is flood painted prior to dipping in thermosetting varnish to protect against corrosion. Shaft mounted cooling fans are fitted; some machines may require a motorised fan arrangement.

TE CACW machines have water coolers of single tube construction with brass tubes, mild steel or brass tube plates and epoxy coated steel headers. Alternative materials and configurations to customer's specific requirements, or for use with contaminated cooling water supplies are available.

Stator Core Pack

Core pack laminations are manufactured from low-loss electrical sheet steel, insulated on both sides. Notched laminations are built onto a mandrel and substantial longitudinal steel members are then welded between steel endplates giving a robust, dimensionally stable unit.

Stator Windings

Coils are formed to shape from pre-insulated rectangular copper strip and are fitted into open slots in the motor core pack; the end windings are securely blocked and braced.

Resin rich and vacuum pressure impregnated (VPI) insulation systems are employed, both using mica paper in the coil insulation and solventless epoxy resin.

For the resin rich system, slot portions are hot pressed to give a homogenous structure. Consolidation and sealing of the windings is achieved by using a controlled trickle impregnation technique.

The VPI system uses a split resin technique, the wound stator being fully impregnated during the vacuum pressure process.

After impregnation the wound stators are cured in a thermostatically controlled oven.

Rotor

The rotor core is built from laminations of the same type as the stator core. For maximum integrity the laminations are built into a pack which is then shrunk onto the shaft.

Cage type rotors have copper or copper alloy bars brazed to jointless short-circuiting endrings of material appropriate to the electrical and mechanical requirements.

All rotors are dynamically balanced to ISO1940/1 (BS6861: Part 1: 1987) and tested to fine limits during manufacture. The vibration of every complete motor is checked whilst running unloaded at the rated supply voltage and frequency, to ensure that levels specified in IEC34: Part 14 or BS4999 Part 142: 1987 are not exceeded.

Cooling Fans

Uni-directional or bi-directional fans are fitted to meet the particular noise and efficiency criteria specified.

Bearings

Machines up to 560mm centre height have endshield mounted bearings, either rolling element or sleeve, depending upon load and speed.

Machines of baseplate construction have pedestal mounted bearings, self-contained oil ring, or forced oil circulation type, depending upon size, load and speed. Water-cooled, oil-lubricated bearings are available as appropriate.

Single bearing machines with solid half coupling, forged integrally with the drive shaft are available, a typical application being reciprocating compressor drives.

Cable Terminations

As standard, high tension machines between 4.2kV and 15kV are fitted with moulded type bushings contained in a front withdrawable type terminal box which also provides cable support. Elbow connectors for use with these bushings will normally be supplied by the cabling contractor.

Pressure relieved terminal boxes of the phase insulated, phase separated and phase segregated types are available.

Auxiliary Devices

Temperature monitoring/indication devices, vibration detectors and anti-condensation heaters are fitted to the users requirements, terminated in suitable auxiliary terminal boxes.

NORAC Induction Motors...

...on-going development ensures that our machines will meet end-user requirements well into the next century.

OUTPUT	250kW to 20MW.
VOLTAGE AND FREQUENCY	380 volts to 15kV at 50Hz or 60Hz.
RANGE OF SPEEDS	All poleages are available, either single or multi-speed. Variable speed applications can also be accommodated.
ENCLOSURE AND PROTECTION	All types of enclosure are available e.g. TE CACA IP44 to IPW56 TE CACW IP44 to IPW56 EVDP/Splashproof IP22 to IP24
INSULATION	Class F system incorporating Class H materials provides high interturn voltage withstand and low energy discharge levels.
MOUNTINGS	Horizontal foot (IM1001, IM7011 and IM7211) and vertical flange (IM3011) are standard. Other configurations are available.
AMBIENT TEMPERATURES	Designed for ambient temperatures down to -50°C and up to $+55^{\circ}\text{C}$. Please refer to manufacturer for ambient temperatures outside this range.
QUALITY ASSURANCE	The design and manufacturing processes are administered by the company quality management system which has been assessed and certified to meet the requirements of BS EN ISO9001: 1994 (formerly BS5750: Part 1: 1987).



General Information

Standards

All machines comply with the appropriate parts of IEC34: 1: 1994, IEC72: Part 2: 1991, BS4999: Part 105: 1988, BS5000: Part 99: 1973 in respect of performance and dimensions, therefore meeting the requirements set by the majority of International Standards.

Starting

All machines are designed to withstand the stresses associated with direct-on-line starting. Reduced current direct-on-line starting designs of typically 3 to 3.5 times full load current are available, without detriment to torque. Where other starting methods such as auto-transformer, ac frequency converter or soft start systems are needed, the flexibility of the NORAC design concept allows machines to be offered with performance in line with the appropriate International, European or British Standards.

Testing

LSE's direct loading test bed facilities enable machines rated up to approximately 8MW on 50Hz supplies or approximately 4MW on 60Hz supplies, to be fully and directly tested under rated load and voltage conditions.

The test bed facilities include an 8MW water dynamometer, loading generators, motorette test rigs, 60Hz supply generators and variable frequency arrangements. Controlled environments are available for ageing and humidity tests.

The 10MVA mains supply to the test area is of sufficient capacity to permit direct-on-line switching of most machines in the range.

Machines above these limits can be tested at reduced power in accordance with procedures generally accepted within the industry, or specifically agreed with the end user.

Hazardous Area Applications

Purged and Pressurised EExp	Zones 1 and 2 EN50016
Increased Safety EExe	Zone 2 EN50019
Non Sparking ExN	Zone 2 BS5000: Part 16: 1985

The NORAC range is well established in all the foregoing alternatives.

For safe operation of high voltage motors (3kV and above) in potentially explosive atmospheres users are referred to the requirements of DEr Notices 3/89, 11/89, 14/89, 21/89 & 17/90, HSE document 498/12 and PTB notice dated 20th August 1990.

The responsibility of ensuring the safety of any installation lies with the user.

Other types of rotating machines manufactured by Laurence, Scott & Electromotors are:

Series 'C' and Series 'R'
MV Cage Induction Motors
100kW to 1000kW, 2 pole - 8 pole
380 volts to 6.6kV at 50Hz or 60Hz

Series 'E'
Flameproof Motors - EExd(e)
75kW to 2500kW, 2 pole - 8 pole
380 volts to 11kV at 50Hz or 60Hz

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