

Unipak 2
CACA/CACW

High Voltage A C
Induction Motors



Motors for the Long Run!

Unipak2



One of India's most modern motor factories, incorporating extensive CAD facilities with over 50 years' experience in the design and application of induction motors, enables MARATHON Electric to offer the benefits of proven solutions :

- MARATHON Electric has over 2500 MW installed world-wide.
- Upto 4000 KW range capability.
- All speeds available.
- Highest available efficiency - rapid pay-back.
- High Power Factor - Low Power Cost.
- 20 years' expected design life at 1000 starts per year
- Resivac VPI Insulation System for total winding reliability.
- Highest quality - lowest maintenance costs.
- Low Noise Level - Better performance than IS:12065.
- Low vibration level - conforms to IS:12075.
- IP 55 enclosure protection as standard on enclosed machines.
- Factory fixed Air Gap.
- Compliance with National and International Standards.
- Built to type N requirements.
- Upto 11 kV, 50 or 60 Hz. supply.
- Low Starting Current design available.
- Variable speed drive compatibility.
- Horizontal mounting.
- Rolling or Plain Bearings.
- Environmentally friendly motors to meet all drives.
- Type "e" version available on request.
- Slipring version available.

Standards and Specifications

Compliance with the International Standard IEC 34 ensures that motors also meet the requirements of other aligned National Standards including :

IS:325	INDIA
NBN 7 : 1963	BELGIUM
NF C 51-111	FRANCE
VDE 05301/1.66	GERMANY
CEI 2-3, N. 355	ITALY
NEN 3173	NETHERLANDS
NEN 41.69	NORWAY
SEN 2601 01	SWEDEN
SEV 3009	SWITZERLAND
B5 4999 & 5000	UNITED KINGDOM

Compliance with other specifications and standards such as NEMA-MG1 and API 541 can be offered, and further major user specifications can be met on request. Please check with our sales department of the address given on the back of this publication for more detailed information.

Many company and project specifications use IEC 34.1 as a basis or reference and thus compliance may be assured.

Cooling Methods

Air-cooled CACA (TEAAC) IC 0161, Water-cooled CACW (TEWAC) IC OA1W7, Open Ventilated (OVDP) IC 01, and NEMA II enclosures are available as standard options.

Mounting Arrangements

Horizontal Foot Mounting to IM 1001 & Vertical Mounting to IM 3011.

Dimensions

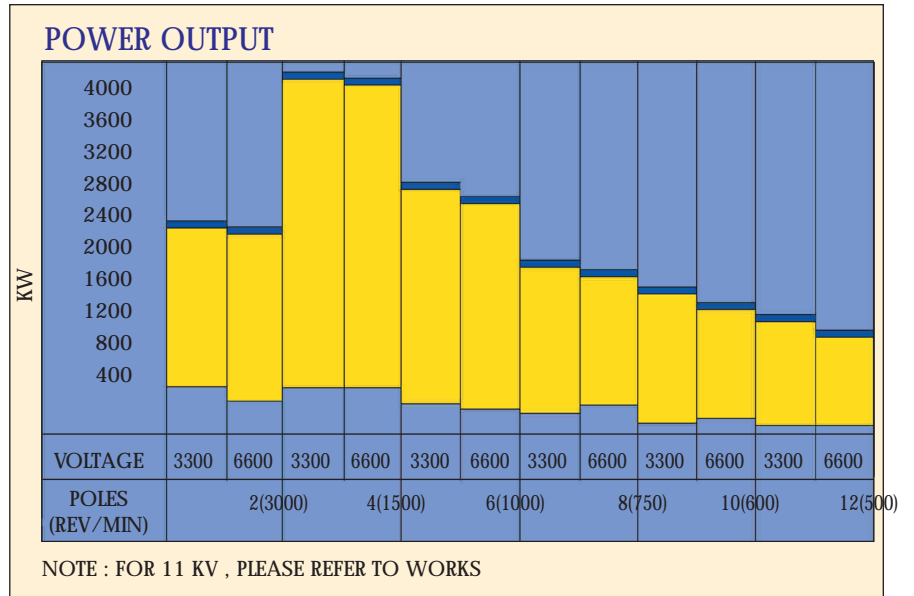
Shaft and fixing dimensions are in accordance with the requirements of IEC 72 and 72A together with BS 4999 part 141 & IS:8223.

Frame Sizes

Shaft centre heights from 400 to 710 mm are covered.

Speeds

All fixed speed requirements can be



met, together with machines for variable speed drive systems. Proven designs exist for most driven equipment needs (e.g. compressors, pumps, fans, crushers and mills).

Electrical Supply

All National and International supply voltages and frequencies are catered for by the Unipak range.

Insulation

Unipack Class F Resivac Vacuum and Pressure Impregnation Insulation systems comply with IEC 85. After impregnation the stator windings are subjected to the voltage tests specified in IEC 34.1. All machines are subject to loss tangent tests.

Degree of Protection by Enclosure

IP 55 as standard for totally enclosed water or air cooled machines. Protection and enclosure types are as recommended by IEC 34-5 & IS:4691.

Cooling Method

Methods of cooling are as recommended by IEC 34-6 (complete system) & IS:6362.

Ventilation

The designs employ radial ducted

ventilation using shaft mounted steel fans to circulate the internal cooling air. CACA (TEAAC) motors are fitted as standard with high efficiency, uni-directional low noise level, shaft mounted steel fans.

Noise Level

Particular attention has been given to all sources of noise generation and Unipak standard designs meet the most stringent modern requirements, (i.e. typically 85 dB (A) at 1 metre).

Vibration

Unipak motors comply with the requirements of API 541, and IS:12075. Rotors are dynamically balanced prior to assembly in two planes. Vibration is then checked on test before and after overspeed tests to prove stability.

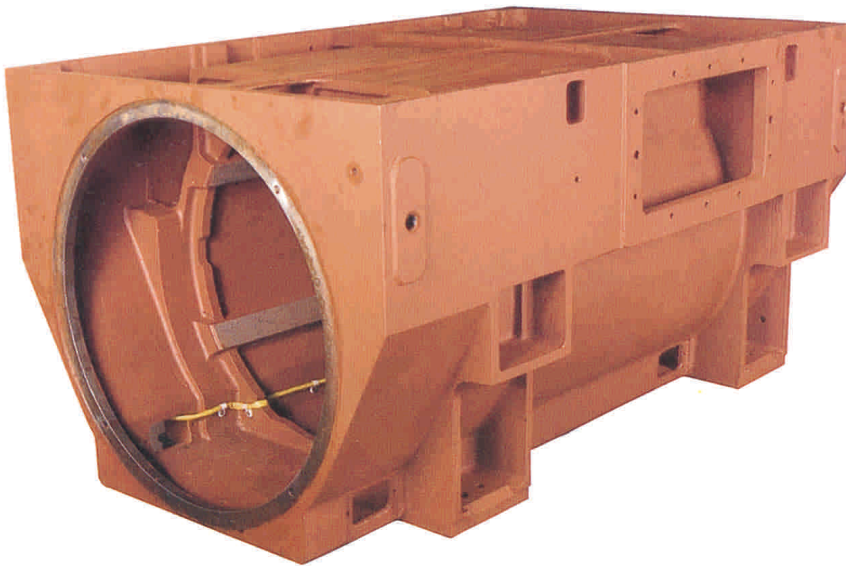
Efficiency

Typically, full load efficiencies greater than 96% are achieved as standard ensuring low operating costs.

Starting Current

Standard designs are within BS 4999 Part 112 design D limits. Lower starting current designs can be tailored to suit specific supply system limitations where required.

Construction



Rotor Cage Windings

Rotor bars are designed and manufactured to maintain a tight fit throughout the slot length and depth, and are connected to the end-rings by means of a specially developed one-shot brazing process ensuring total reliability throughout the life of the motor. Cage designs are optimised to ensure a minimum starting capability of 1000 starts per year over a 20-year period.

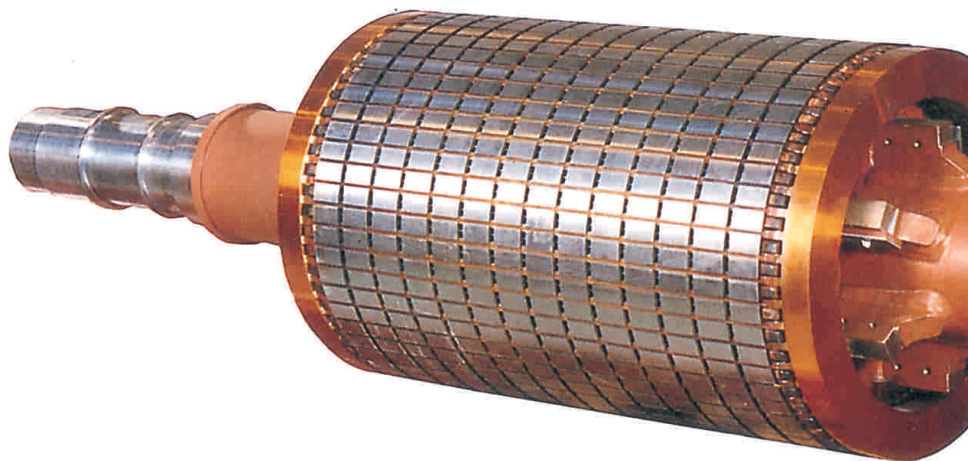
Frames

Unipak Motor frames are of box configuration, manufactured from cast iron or Fabricated Steel, thus ensuring an extremely robust and rigid support structure. The top of the frame has a rectangular opening to allow fitment of the air/air or air/water heat exchanger, or alternative ventilation arrangements.

Stator and Rotor Cores

Stator core packs are built on expanding mandrels using packets of insulated, low-loss laminated electrical steel, interspersed with I-beam spacer sections which form radial cooling ducts. Cores are hydraulically compressed between substantial steel end-plates and the entire assembly is secured by sequentially welding longitudinal steel core-bars to the back of the laminations and the end-plates to maintain the pressure. The core bars extend beyond the end plates to form rigid anchorages for bracing of the end windings.

Rotor cores are built against a compression plate utilising packets of insulated laminations in a similar manner to the stator cores. These are then shrunk onto the shaft assembly and retained by circumferential keys.



Stator Coils

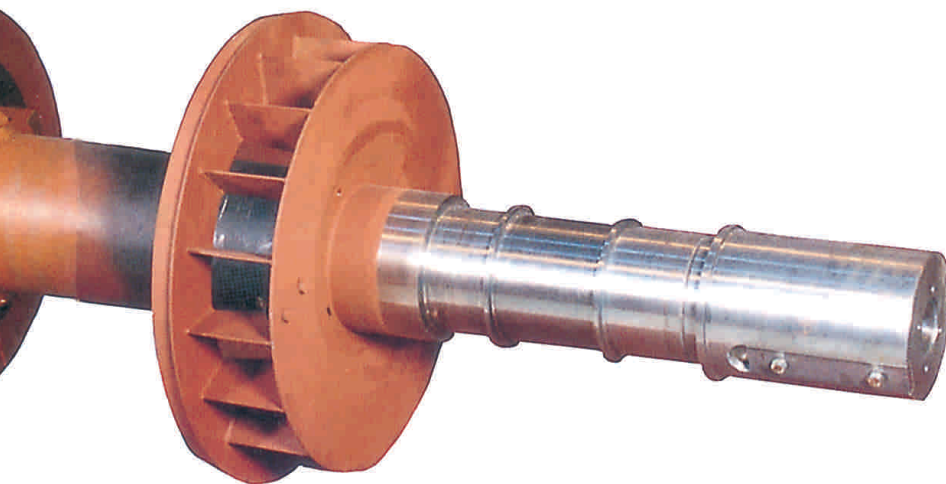
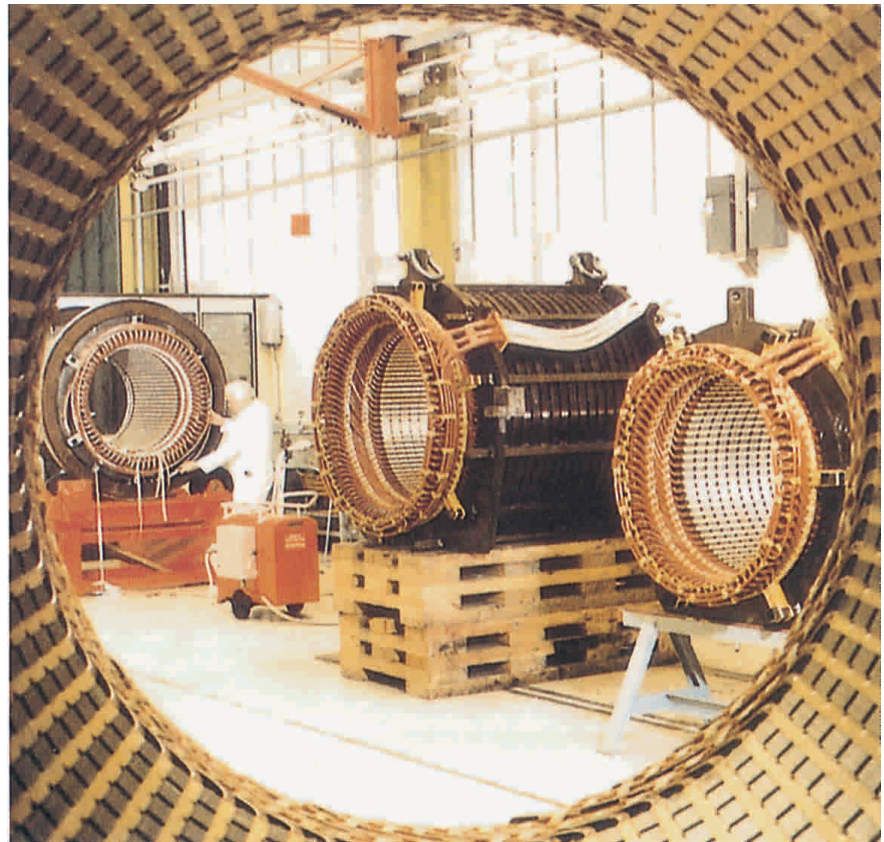
All Unipak stator Coils are manufactured from annealed copper strip, insulated with mica-paper tape. Loops are formed with the appropriate number of turns, and the coil is then pulled into the required shape in a forming machine. Layers of mica tape insulation are then added, followed by the application of corona shield or semi-conducting tape as appropriate to the supply voltage.

The coils are inserted into their slots in the stator core pack and fixed firmly in position with slot wedges. Endwindings are securely braced, thus ensuring the prevention of movement during starting and service.

High voltage tests are carried out both before and after connection, and again after impregnation in order to check insulation integrity. On completion of the winding process, resistances and impedances are checked for balance and design conformity.

End Winding Bracing

The end winding bracing system is designed to match the rotor capability



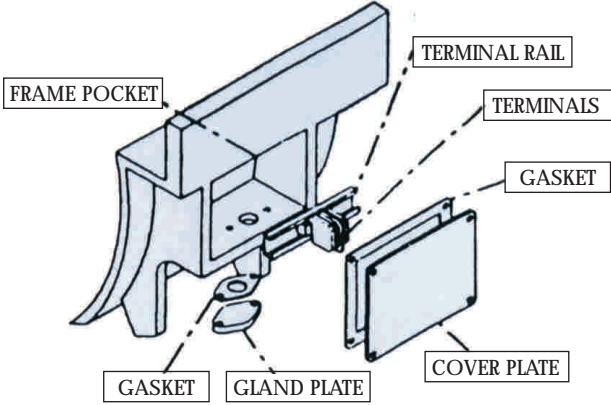
of a minimum 1000 starts per year for 20 years and to withstand the stresses involved in 180 degrees out-of-phase re-switching.

Winding Impregnation

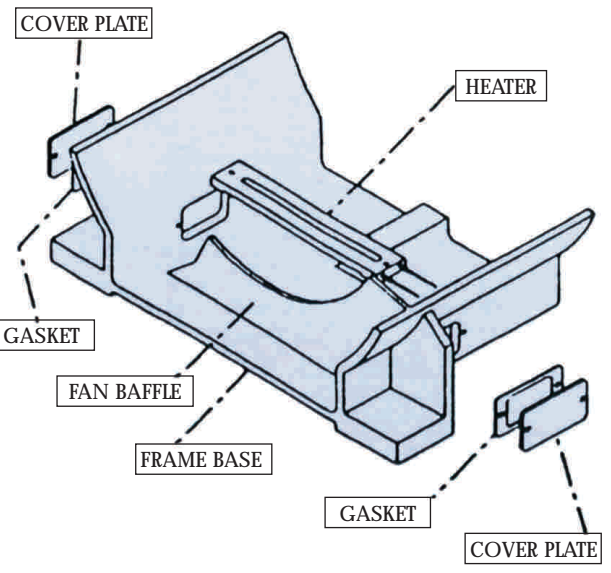
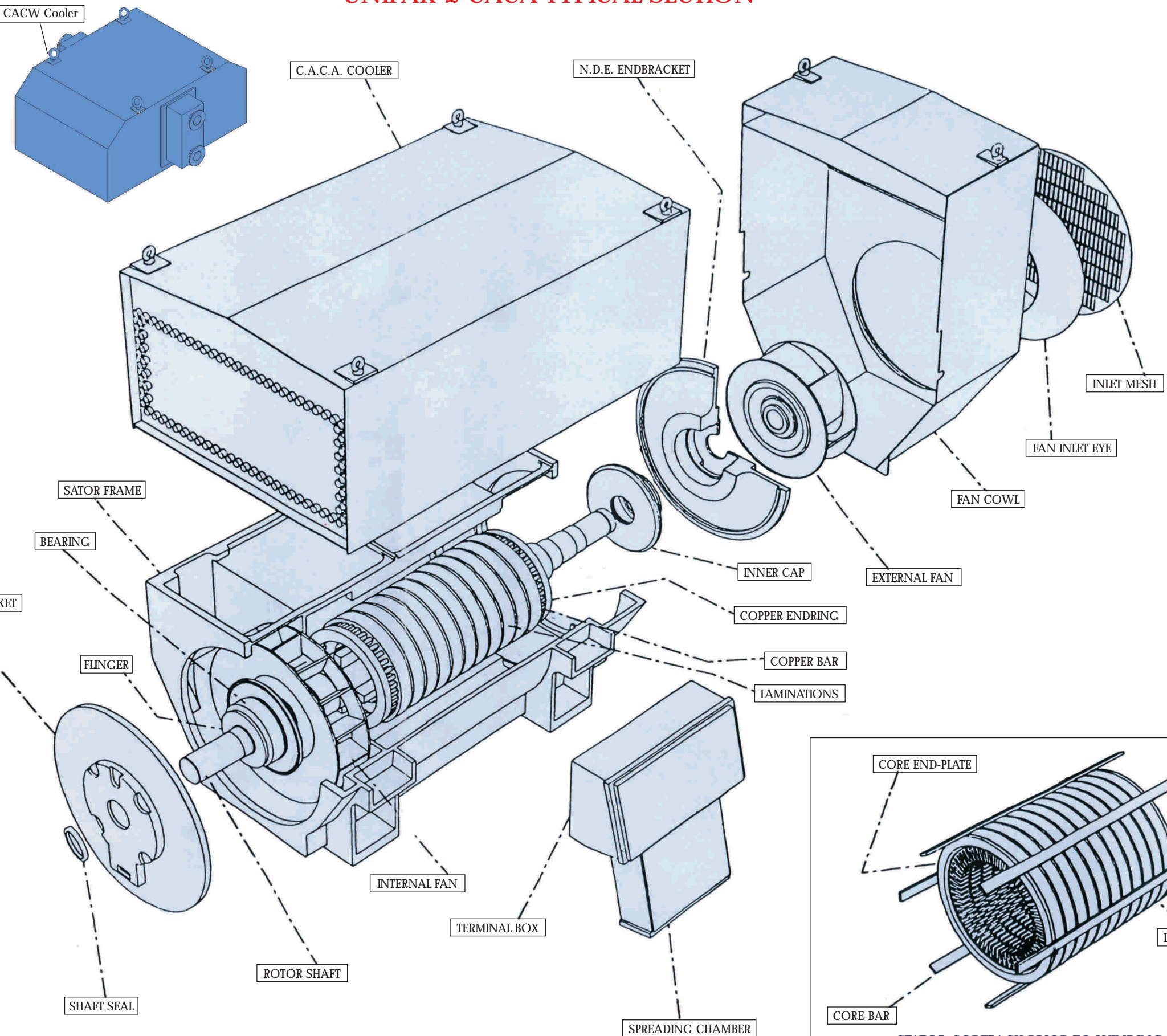
The RESIVAC Vacuum Pressure Impregnation System (VPI) is employed on all Unipak Motors. This system ensures global impregnation of the entire wound stator core assembly using a specially developed solventless epoxy resin. The process guarantees that all air and moisture is extracted under vacuum from the winding before pressure then forces resin into every void within the assembly.

Curing of the resin is carried out whilst constantly rotating the assembly in an oven to ensure even distribution. The entire impregnation operation is microprocessor controlled and data logged to ensure total reliability of the windings during service life.

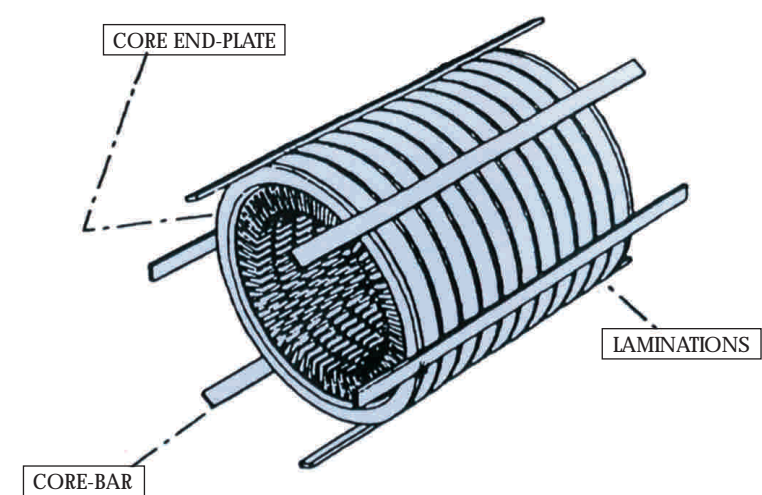
UNIPAK 2 CACA TYPICAL SECTION



TYPICAL TERMINAL ASSEMBLY



HEATER LOCATION AT EACH END OF FRAME



STATOR COREPACK PRIOR TO WINDING

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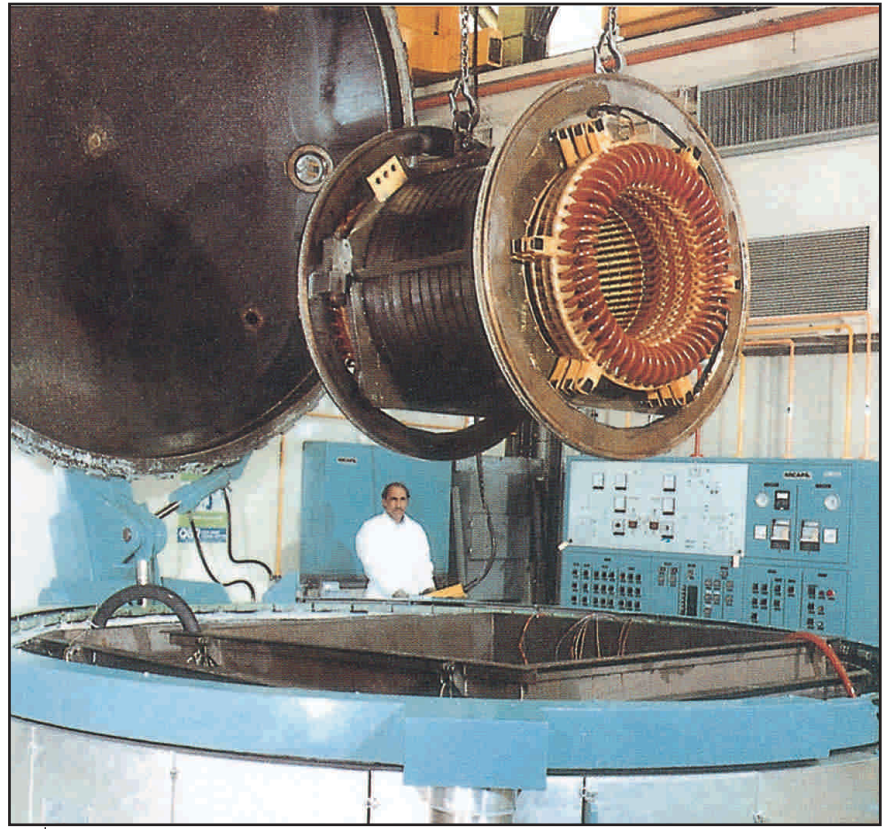
Shaft

Shafts are manufactured from carbon manganese steel bar material of grade 150M19 to BS970. Welded-on longitudinal arms are utilised. Standard motors have a single parallel shaft extension. Where appropriate, motors may utilise forged shafts and integral half-couplings.

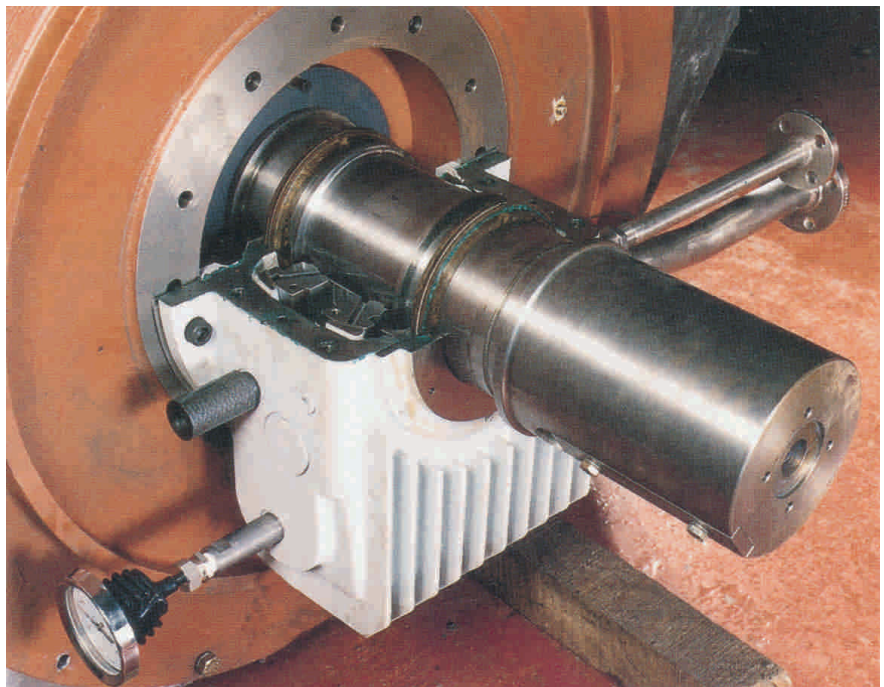
Bearings and Lubrication

Plain white metal or rolling element endshield-mounted bearings are available to suit appropriate motor application and speed.

Plain bearings incorporating specially developed multiple labyrinth floating oil and air-seals ensure that dynamic changes of motor internal pressure do not adversely affect the lubrication system and allow IP55 degree of protection as standard. Centre flange bearings are used on larger machines giving considerable benefits of improved rotor dynamic performance and overall motor efficiency. Plain bearings are insulated at the spherical seating on both bearings, enabling simple testing of insulation integrity. In operation, an earth connection at the drive-end avoids any build-up of voltage. Either rolling element or plain bearings are available on slower speed machines and are selected for minimum maintenance and to avoid the need for external lubrication systems.



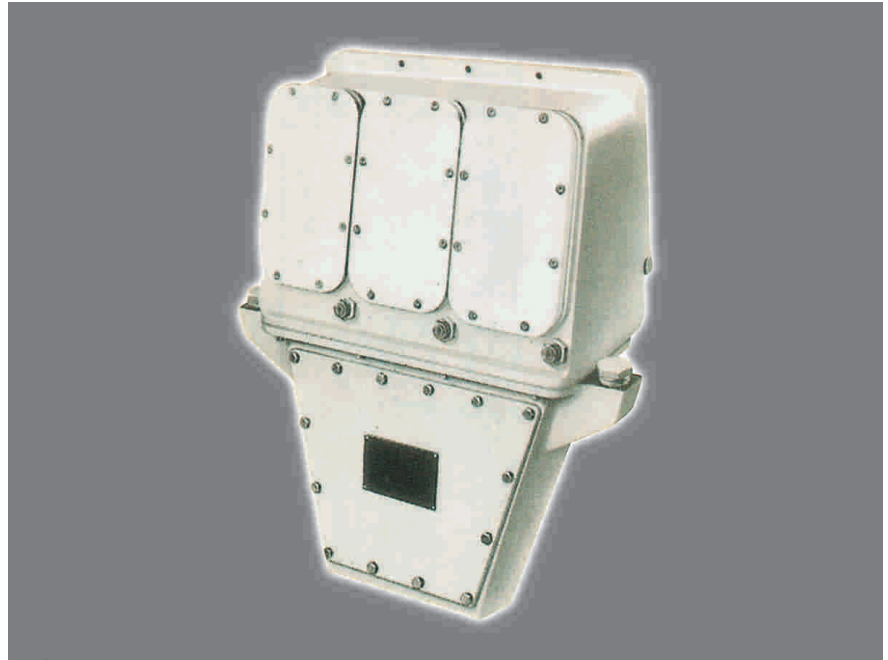
Impregnation Vessel



Bearing arrangement

Terminations

Fault rated elastomeric connectors (with or without mechanical protection), steel weatherproof boxes, phase insulated or fault rated phase segregated terminal boxes, and terminal boxes including provision of, or for surge diverters, current transformers etc. can be provided where appropriate. Winding neutral terminations may be concealed behind a cover or brought out to an external chamber to allow for the fitting of current transformers etc. where required. Terminal boxes can be provided on either side of the machine, and are able to accept cable entry from any of 4x90 degree positions.



Phase segregated Terminal Box

Paint System

Surfaces are degreased, then blast cleaned to ISO 8501 and ISO 8503, which deline surface cleanliness and roughness. Surfaces are then primed using a modified synthetic resin red oxide primer to a dry film.

A single finish coat of two pack Epoxy Point is applied.

Auxiliaries

Anti-condensation heaters meet type IN requirements as standard and are easily withdrawable for maintenance without dismantling the motor. Bearing temperature, vibration monitoring, cooling system performance is available as required.

Line Voltage kV	0,2-0, 5 μ s wavefront		greater than 1.0 μ s wavefront	
	kV	p.u.*	kV	p.u.*
3.3	13.47	5	18.86	7
4.16	17.00	5	23.77	7
6.6	17.00	3	32.33	6
11.0	26.94	3	49.39	5.5
13.2	32.33	3	59.27	5.5
13.8	33.80	3	61.96	5.5

Impulse withstand levels for standard Resivac stator windings.

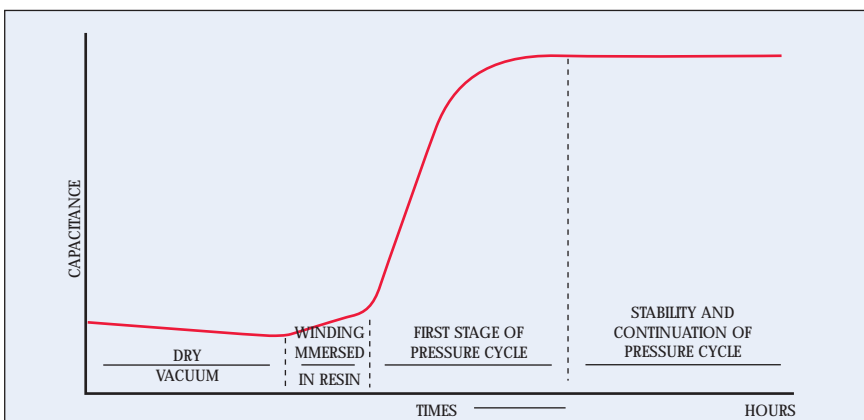
(*p.u.=per unit; 1 p.u. is equal to the peak value of the phase voltage.)

Total Quality

We are manufacturing complete range of HT motors with quality assurance plan endorsed by major consultants of our country. Also over principals of Rugby had laid down stringent acceptance norms in each stage of production for the above motors. All input materials are critically tested in-house as per National/International standards to ensure error free end product.

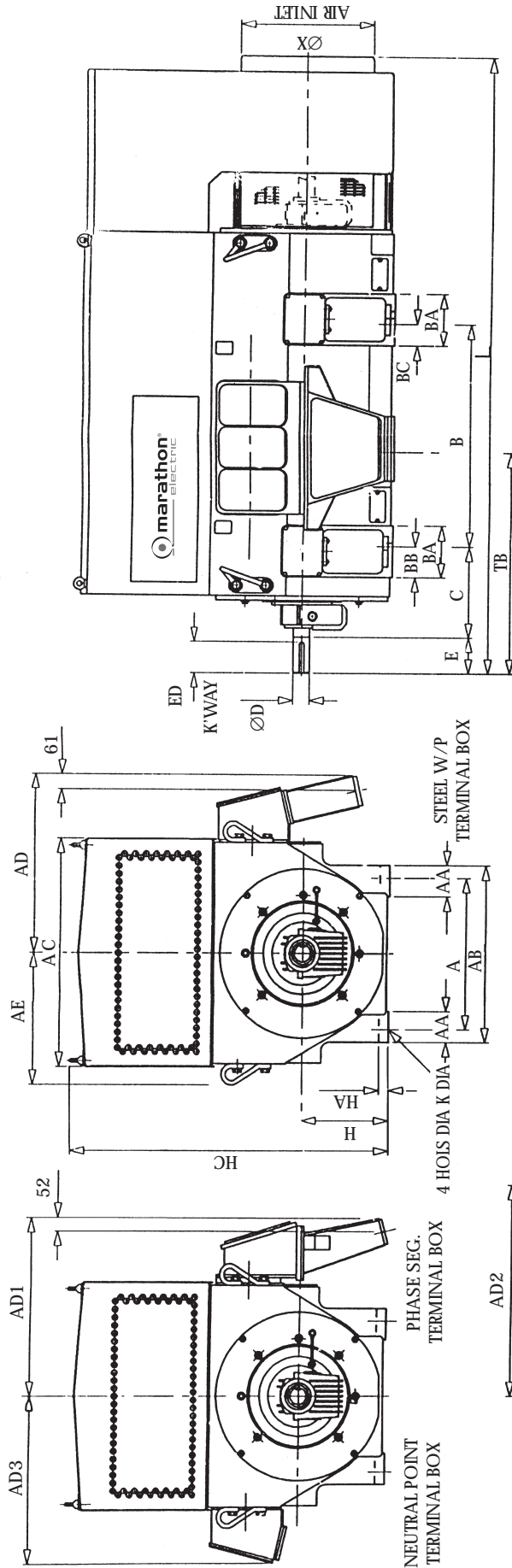
Full range of Unipak motors are routine tested at rated voltage and power in our test plant. Type testing can be done upto 4000 KW, 11KV, 4 pole.

Our customers are welcome to be associated during stage inspection or final inspection during manufacture of every stage.



Graph of winding capacitance to earth during the impregnation process showing the sharp increase when pressure is applied.

Unipak 2 Overall Dimensions



FRAME	A	B	C	AA	AB	AC	AD	AD1	AD2	AD3	AE	BA	BB	BC	D	E	ED	H	HA	HC	K	L	TB	X
355U710	610	710	355	125	710	894	722	704	838	673	533	200	120	80	65	140	119	355	38	1311	28	2282	859	670
355U900	610	900	355	125	710	894	722	704	838	673	533	200	120	120	65	140	119	355	38	1311	28	2390	875	670
400U800	686	800	475	156	826	1010	778	760	894	729	590	240	150	85	85	170	155	400	40	1484	35	2760	1035	750
400U1000	686	1000	475	156	826	1010	778	760	894	729	590	240	150	155	85	170	155	400	40	1484	35	2869	1035	750
450U900	750	900	500	162	908	1125	833	815	949	784	646	260	150	110	100	210	174	450	45	1711	35	2989	1150	830
450U1120	750	1120	500	162	908	1125	833	815	949	784	646	260	150	110	100	210	174	450	45	1711	35	3189	1230	830
500U1000	850	1000	530	203	1042	1270	906	888	1022	857	719	260	160	100	120	210	194	500	45	1898	35	3225	1220	930
500U1250	850	1250	530	203	1042	1270	906	888	1022	857	719	260	160	100	120	210	194	500	45	1898	35	3445	1220	930
560U1120	950	1120	600	230	1180	1515	1050	1030	1166	1000	890	320	130	130	140	200	180	560	45	2150	42	3550	1415	1075

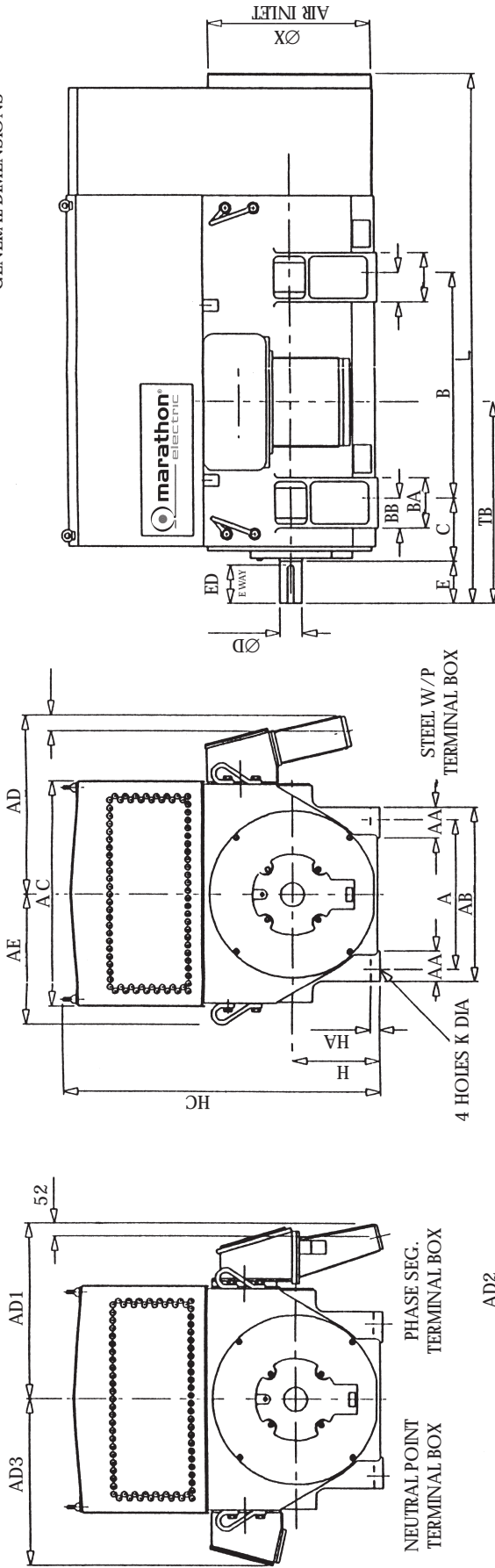
NOTE : FOR GA DRAWING ABOVE 560 MM CENTER HEIGHT, PLEASE REFER TO WORKS.

WHEN 4 X 90° ADAPTOR
FITTD ADD 178mm TO
DIMS AD, AD1 OR AD2 FOR BOX WIDTH

L DIMENSION IS WITH
STANDARD FAN FITTED

4 TO 12 POLE ROLLING
ELEMENT BEARINGS
GENERAL DIMENSIONS

Unipak 2 Overall Dimensions

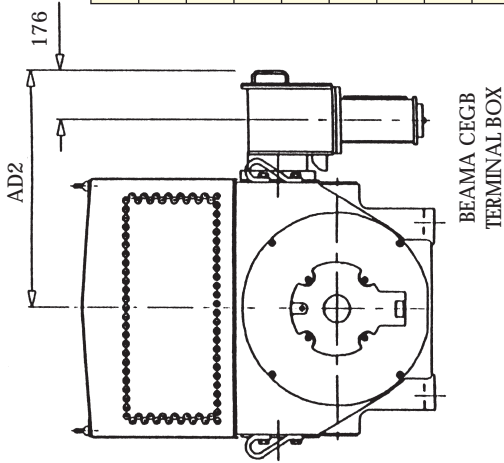


FRAME	A	B	C	AA	AB	AC	AD	AD1	AD2	AD3	AE	BA	BB	BC	D	E	ED	H	HA	HC	K	L	TB	X
355U710	610	710	254	125	710	894	722	704	838	673	533	200	120	80	95	170	155	355	38	1311	28	2016	788	670
355U900	610	900	254	125	710	894	722	704	838	673	533	200	120	120	95	170	155	355	38	1331	28	2123	804	670
400U800	686	800	280	156	826	1010	778	760	894	729	591	240	150	85	100	210	194	400	40	1484	35	2198	880	750
400U1000	686	1000	280	156	826	1010	778	760	894	729	591	240	150	155	100	210	194	400	40	1484	35	2307	880	750
450U900	750	900	315	162	908	1125	833	815	949	784	646	260	150	110	120	210	176	450	45	1711	35	2485	965	830
450U1120	750	1120	315	162	908	1125	833	815	949	784	646	260	150	110	120	210	176	450	45	1711	35	2685	1045	830
500U1000	850	1000	335	203	1042	1270	906	888	1022	857	719	260	160	100	130	250	216	500	45	1898	35	2760	1065	930
500U1250	850	1250	335	203	1042	1270	906	888	1022	857	719	260	160	100	130	250	216	500	45	1898	35	2940	1065	930
560U1120	950	1120	355	230	1180	1515	1030	1166	1000	890	890	320	130	130	160	240	220	560	45	2150	42	3340	1210	1075

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Vertical UNIPACK2 Motor



Specialized custom built motors • Specialists in short cycle deliveries

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