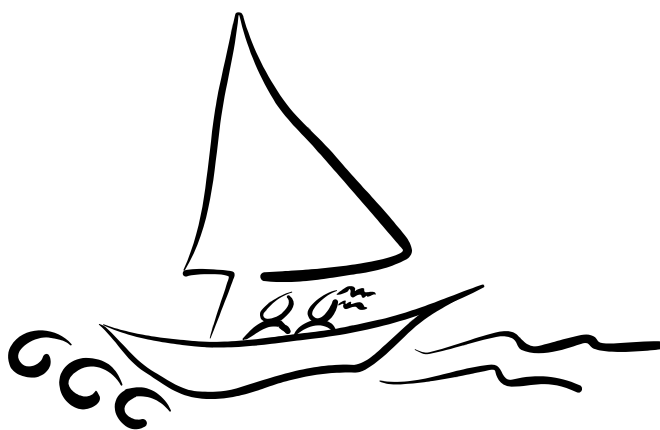


# ELECTRIC MOTORS



**Marine Motors catalogue  
Fincantieri application only**



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<b>Documents part of the Fincantieri agreement</b>	
Fincantieri Marine Motors prices list 1.2008 - rev.2 dated 30 July 2008	
Fincantieri Options Marine Motors 1.2008 - rev.2 dated 30 July 2008	
Marine Motors Catalogue Fincantieri Application only – issued on 4/2008 – Rev.0	
Marine Two speed Motors	To be advise
Marine Motors Ex Flame proof	To be advise
Marine Motors Maintenance Manual	To be advise



## Frames 63 to 400L Marine motors

### **FELM**

Felm and Its Partners are one of the leading trading and manufacturer of electric motors for the global industrial market, with motor solutions, which benefit a wide range of customers.

Our products are used in almost every industrial activity including water treatment, building services, chemical/petrochemicals, general processing and manufacturing where they drive fans, pumps, compressors and conveyors, amongst other things.

We have extensive stocks of motors in our facilities from 0,12 kW to 500 kW.

Thanks to our worldwide network We are ensuring excellent local support wherever needed.

### **Quality assurance**

Stringent quality procedures are observed from first design to finished product in accordance with the ISO9001 documented quality systems. All of our factories have been assessed to meet these requirements, a further assurance that only the highest possible standards of quality are accepted.

### **Marine motors**

Felm and Its Partners are one of the worldwide leading manufacturers of Low Voltage A.C. Electric Motors for the marine and other industries. Features developed over many years for the arduous conditions of the Sea have now been incorporated into standard motors.

These include, for example, high performance paint treatments, stainless steel nameplates, higher standards of balancing and built-in electrical protection - all particularly important to the marine industry. The standard totally enclosed motors, which meet the latest requirements for high efficiency and low noise levels, are house-proof and can be readily produced in deck watertight enclosures.

Where weight is an important consideration, open drip-proof motors are available.

Certified hazardous area motors are a speciality of the company which is also experienced in obtaining approval from most of the world's marine certifying authorities.

### **Multi-Mount of Aluminium Frames Motors up to 200**

By simply changing the position of the feet, the user is able to obtain right, left or top mounted terminal box positions and by removing the standard end-shield you can change it for a flange or face version.

### **Benefits include:**

- low power consumption
- low noise levels
- voltage on request: 380V - 400 V - 440 V - 690 V -  $\pm 10\%$
- dual frequency: 50 Hz and 60 Hz
- high power factors
- high torque with smooth acceleration and low current
- IP55 or on request IP56 protection

**Table 1**

**Standards and regulations**

The motors conform to the relevant standards and regulations, including without limitation the following:

Title	DIN/EN	IEC
Rotating electrical machines Rating and performance	DIN EN 60034-1	IEC 60034-1 IEC 60085
Determination of losses and efficiency	DIN EN 60034-2	IEC 60034-2
IP degrees of protection	DIN EN 60034-5	IEC 60034-5
Methods of cooling (IC code)	DIN EN 60034-6	IEC 60034-6
Types of construction (IM code)	DIN EN 60034-7	IEC 60034-7
Terminal markings and direction of rotation	DIN VDE 0530-8	IEC 60034-8
Noise limits	DIN EN 60034-9	IEC 60034-9
Built-in thermal protection; rules for protection		IEC 60034-11
Starting performance of single-speed three-phase cage induction motors, excluding pole-changing motors, for voltages up to and including 690V/50Hz	DIN EN 60034-12	IEC 60034-12
Mechanical vibration of certain machines with shaft heights of 56 mm and above	DIN EN 60034-14	IEC 60034-14
Standard voltages	DIN EN 60038	IEC 60038
Three-phase motors for general use with standardized dimensions and outputs	DIN EN 50347	IEC 60072 1)
Centre bores 60° with thread, DR form	DIN 332-2	
Drive-type fastenings without taper action: feather keys; keyways; deep pattern	DIN 6885-1	
Standard and Regulation: Electrical installations in ships		IEC 60092 – 301
Frame surface cooled three-phase squirrel-cage motors, IM B3 type of construction, with rolling-contact bearings; output classification for explosion-protected design in increased safety protection “e”	DIN 42673-2	

1) IEC 60072 only provides for dimensions, but does not define any output classifications.

**Environment Enclosure**

All motors have degrees of IP 55 protection as defined in IEC EN 60034-5

**Motor cooling**

Motors are cooled in accordance with EN 60034-6. The normal arrangement is IC411 (Totally Enclosed Fan Ventilated) via a fan mounted at the non-drive end. Alternative methods of cooling available on request.

**Supply Voltage and Total Harmonic Distortion**

Motors proposed in this catalogue are projected to work with one of the following supply voltage:

V. 380 Hz. 50                      V. 400 Hz. 50                      V. 440 Hz. 60                      V. 690 Hz. 60

The normal variation admitted shall remain within: Voltage +/- 10% - Frequency +/- 2%

Maximum Total Harmonic Distortion (THD) level admitted on supply tension can be equal to 10% for motors listed in this catalogue.

Higher harmonic distortions are permitted after preventive verification by FELM.

The troop between distribution power and motor terminals must be contained within the value fixed by Naval Registers.



## European directives

### European directives apply in varying degrees to A.C. induction motors.

Felm comply in the following manner

**Table 2**

Compliance with European directives applying to AC induction motors				
Directives	Low voltage (LV)	Machinery (MD)	Electromagnetic compatibility (EMC)	ATEX
Reference numbers	73/23/EEC 93/68/EEC	89/392/EEC 91/368/EEC 93/44/EEC 93/68/EEC	89/336/EEC 92/31/EEC 93/68/EEC	94/9/EC
Motor CE marked Standards	Yes EN 60034	No Not applicable	No EN 60034-1	YES EN 50014 EN50018 EN50019 EN 50021 EN50281
Documentation for customers' technical file	Declaration of conformity	Certificate of incorporation	Statement (1)	Declaration of conformity
Safety instructions with every motor	Yes	Yes	Yes	Yes
Comment	Relevant electrical equipment operating between 50 to 1000 volts AC	Statement (2)	Component	Hazardous atmosphere equipment - mandatory after July 2003

Motors operating from a correctly applied, sinusoidal (AC) supply meet the requirements of the EMC directive and are within the limits specified in standard EN 60034-1

When installed in accordance with our customer safety and installation and maintenance instructions, they can be put into service only when the machinery into which they are being incorporated, has been declared to be in conformity with the machinery directive in accordance with Article 4(2) and Annex IIB of that Directive (98/37/EEC)

#### Component Electromagnetic compatibility (EMC)

(1) Motors operating from a correctly applied, sinusoidal (AC) supply meet the requirements of the EMC directive and are within the limits specified in standard EN 60034-1

(2) When installed in accordance with our customer safety and installation and maintenance instructions, they can be put into service only when the machinery into which they are being incorporated, has been declared to be in conformity with the machinery directive in accordance with Article 4(2) and Annex IIB of that Directive. (98/37/EEC) 94/9/EC



### Marine duty motors

The motors described in this catalogue are designed and rated for use on board merchant and passenger ships built anywhere in the world and in accordance with the requirements of the major marine classification authorities.

These requirements generally concern limits to winding temperature rise with given ambient temperatures, which determine the motor frame size for a given output. For certain larger motors, some authorities specify normalised shaft steel to give greater consistency.

The requirements for witnessed tests, type tests, certification etc, differ between authorities and can all be accommodated. However, these exceptional demands must be made clear at the time of ordering.

The table opposite gives a list of the major classifying authorities and a summary of their specific requirements. Other classifications available on request, please contact Felm for details.

**Table 3**

Standards for TEFV and open drip proof				
Classifying authority	Service	Ambient temp °C	Permissible Temp rise K Class F	Key special requirements Witnessed tests for essential service
Lloyds Register of Shipping (LRS)	Non-essential Essential	45	95	>100kW
Det Norske Veritas (DNV)	Non-essential Essential	45	100	>100kW
Germanischer Lloyd (GL)	Non-essential Essential	45	100	>50kW
American Bureau of Shipping (ABS)	Non-essential Essential	50	95	>100kW
Korean Register of Shipping (KRS)	Non-essential Essential	45	95	All motors
Chinese Classification Societies (CCS)	Non-essential Essential	45	95	>50kW
Russian Shipping (RS)	Non-essential Essential	45	100	All motors
Bureau Veritas (BV)	Non-essential Essential	45	100	>100kW
Registro Italiano Navale (RINA)	Non-essential Essential	45	100	>100kW
Nippon Kaiji Kyokai (NKK)	Non-essential Essential	45	100	> 100kW

**Table 4**

**Marine motor features**

	<b>Cast iron</b>	<b>Aluminium</b>	<b>Drip proof cast iron</b>
<b>Frequency</b>	50/60Hz	50/60Hz	50/60Hz
<b>Enclosure</b>	IP55	IP55	IP23
<b>Cooling method</b>	IC411 TEFV	IC411 TEFV	-
<b>T-box position</b>	Top	Top	Top
<b>Lubrication</b>	250-400 through greasing	Available on request	Through greasing -relief at DE
<b>Balance</b>	Grade N	Grade N	Grade N
<b>Bearings</b>	Ball/ball C3 clearance	Ball/ball C3 clearance	Ball/ball C3 clearance
<b>Drain holes</b>	160-400	80-180	-
<b>Temperature rise</b>	Class B (80°C)	Class B (80°C)	Class B (80°C)
<b>Insulation class</b>	Class F (155°C)	Class F (155°C)	Class F (155°C)
<b>Duty cycle</b>	S1 continuous rated	S1 continuous rated	S1 continuous rated
<b>Service factor SF</b>	1,1 (Class F – 90°C)	1,1 (Class F – 90°C)	1,1 (Class F – 90°C)
<b>Earth facility</b>	Internal and external	Internal and external	Internal and external
<b>Thermal protection</b>	63-400 PTC fitted as standard	Available on request	160 – 355 PTC fitted as standard

**Construction and materials**

Felm motors can be offered for marine use in either aluminium or cast iron material, the choice being determined by factors such as weight, appearance, efficiency, applications etc.

There are differences in the availability of some features (see table opposite), however, the quality of materials used in the motors and the tolerances applied to their manufacture are consistently high.

The paint finish and winding protection are chosen to suit the harsh marine environments in which the motors have to perform.

**Marine motors  
Specification**

**Insulation and thermal rating**

Felm motors are manufactured using Class F insulating materials, giving a maximum operating temperature, including ambient of 145°C. Class H insulation, 165°C maximum temperature is available as option.

Motor ratings depend upon:

- ambient temperature
- type of service
- maximum operating temperate, i.e. Class B (120°C), Class F (145°C)
- certifying authorities’ special arrangements
- supply variations, i.e. tolerance on voltage and frequency

To simplify selection, it is assumed that standard supply conditions of voltage are +/-10%. Refer to output data on technical table.

**Ambient temperatures**

If low (<-30°C) or high (>55°C), ambient temperatures are to be experienced, it may be necessary to use special materials, i.e. grease, shaft steel etc.

This depends largely on the operational requirements of the vessel or its equipment.





### Thermal protection devices

To protect motor windings against a variety of operational malfunctions, motors and associated control gear can be fitted with protection devices.

Thermistors, which are temperature-dependant, semi-conductor devices which are embedded in the motor windings, are in fact fitted as standard in many larger frame sizes. (See table 4)

### Tropical protection

Standard motors will operate satisfactorily in the tropical environments experienced by many ships.

Where environmental conditions are conducive to the formation of fungal growth, algae or condensation, totally enclosed motors with extra tropic proof treatments are recommended as additional protection. The use of drain holes to assist in the release of any condensation is also recommended.

Where the motor is to be left standing for long periods of time in damp conditions, or subject to condensation forming atmospheres, it is recommended that anti-condensation heaters are fitted and energised to prevent condensation forming in the motor enclosure.

For more arduous applications, Felm & Partners have additional solutions, with special and anticorrosive treatment, which enables the motor to operate satisfactorily in extreme tropical and high Humidity conditions.

### Anti-condensation heaters

Anti-condensation heaters are normally switched when the supply to the motors is interrupted.

The leads are in main terminal box. Normal feeding is 220/240 V.

Table 5

	Power 240 V		Power 240 V
Frames	Watt	Frames	Watt
80-100	20	225-280	60
112-160	40	315	2 X 80
180-200	50	355	3 x 80
		400	4 x 80

### Anticorrosive treatment

The Anticorrosive treatment specification has been applied to most of Felm marine motor range.

This specification has been designed to enable the motor to operate and survive in the most arduous maritime conditions, and includes the following features as standard:

- IP55 weatherproof protection
- Anti-corrosive paint systems to suit each constructional material internal and external surface of motors
- Stainless steel nameplate
- C3 clearance bearings
- Internal and external earth terminals
- Tapped hole in shaft end
- Drain hole

Marine classification authorities impose differing restrictions on equipment use, and limits on ambient temperatures and on motor winding temperature rise (See table 3).

See the Table 6 for the Protective Treatment **JF-H5201** used for our motors.

Standard finishing paint colour is RAL 5010





Table 6

**Painting Cycle (TH)**

Doc No : 0600000017

Suitable for High Humidity and Marine duty  
General Painting process (TH) described as above;

**External Painting:**

Final external painting thickness should be calculated as below:

- 1 - Thickness of primary painting (bottom painting)
- 2 - Thickness of 2<sup>nd</sup> painting (putty thickness maybe included)
- 3 - Final Painting

Generally, the total thickness of surface painting are:

Frame 132 and below-----not less than 100µm;

Frame 160~560-----not less than 120µm

On special request the 250µm thickness could be used to protect the motors for special environmental ambient.

*Painting description:*

*Primary Painting---Phosphor –treated bottom painting X0602 ; Rust-Resistant Painting X06-2 ; Epoxy Red Bottom Painting H06-2 ; Epoxy Rich Zinc Bottom Painting H5201;*

*Final painting: 2 components (A/B) Polyester Ethane Painting;*

*Color can be under request from customer, according to RAL and Munsell standard;*

**Inner Surfaces:**

Painted with Rust-resistant and corrosive-resistant: Polyester Cadmium Dried Magnetism Red Painting JF-182(6KV and below) & Class F Mildew-Resistant JF-183-1(10KV and above), to be sure suitable for High Humidity Application (Marine Duty etc)



**Table 6**

**MATERIALS**

**Table 7**

The components of the FELM aluminium and cast iron series motors are made of the materials described in the following table			
<b>Aluminium motors</b>			
Frame size	63~132	160~200	
frame	Aluminium		
B3 DE end-shield	Aluminium	Aluminium	
B5 DE end-shield	Cast iron	Cast iron	
B14 DE end-shield	Cast iron	Cast iron	
NDE end-shield	Cast iron	Cast iron	
Fan cowl	Steel	Steel	
Fan	Plastic	Plastic	
Terminal box	Aluminium	Aluminium	
Nameplate	Stainless steel		
<b>Cast iron motors</b>			
Frame size	63~71	80~355	400
frame	Cast iron	Cast iron	Cast iron
B3 DE end-shield	Cast iron	Cast iron	Cast iron
B5 DE end-shield	no	Cast iron	Cast iron
B14 DE end-shield	Cast iron	Cast iron	Cast iron
NDE end-shield	Cast iron	Cast iron	Cast iron
Fan cowl	Steel	Steel	Steel
Fan	Plastic	Plastic	Aluminium
Terminal box	Cast iron	Cast iron	Cast iron
Nameplate	Stainless steel		

**Table 8**

**De-ratings for high temperature**

Ambient temperature	45°C	50°C	55°C	60°C
Class B	100%	96%	92%	87%
Class F	100%	100%	100%	95%

**Table 9**

**De-ratings for altitude**

Altitude	2000 mt.	3000 mt.	4000 mt.
Class B	94%	85%	75%
Class F	100%	100%	95%

**Limited Service S2**

**Table 10**

For work in limited Service S2, the indicated rating can be increased the power reported on the Catalogue

Frames	Power increase in Percent		
	60'	30'	10'
63 - 132		15%	25%
160 - 225	10%	25%	40%
250 - 400	15%	30%	40%



**CONSECUTIVE STARTINGS**

**Table 12**

The table below shows the allowed starting times per hour equally distributed starting from cold and warm motor conditions respectively and considering:																
- Three consecutive cold starting;																
- Two consecutive warm starting.																
Starting times [s] - Aluminium Motors									Starting times [s] – Cast Iron Motors							
2 poles		4 poles		6 poles		8 poles		frame size	2 poles		4 poles		6 poles		8 poles	
c	w	c	w	c	w	c	w		c	w	c	w	c	w	c	w
9	3	15	5	20	8	30	11	63~71	7	2,5	10	4	15	6,5	15	6,5
5	2,5	5	2,5	9	4	20	5	80~132	4	2	4	2	7	3,5	7	3,5
10	3,5	15	5	20	8	25	10	160~250	10	3,5	15	5	20	8	25	10
15	5	18	6	20	8	25	10	280~315	15	5	18	6	20	8	25	10
contact FELM								355~400	contact FELM							
c: cold starting; w: warm starting; - : not applicable																

**BALANCING AND VIBRATION GRADES**

**Table 13**

The motors are dynamically balanced with a half key applied to the shaft extension, in accordance with standard IEC 60034-14, to vibration severity grade an in standard configuration.			
The following table indicates the maximum rms. vibration speed values (vrms.) with respect to the various shaft heights and vibration grades.			
Large vibrations may occur on motors installed on board, due to various factors such as unsuitable foundations or reactions caused by the driven load. In such cases checks should also be carried out on each element of the installation.			
Motors can be supplied with either grade B on request.			
600rpm – 3600rpm			
Maximum rms. value of vibration speed (vrms.) for shaft height H in mm [mm/s]			
Vibration grade	$63 \leq \text{Frames} \leq 132$	$132 < \text{Frames} \leq 280$	$280 < \text{Frames} \leq 400$
A	1,6	2,2	2,8
B	0,7	1,1	1,8



**Bearings and Lubrication intervals**

The theoretical lifetime of bearings, in according to ISO 281/1 standard, of horizontal construction and without external forces is in excess 50.000 hours.

All motors are equipped with preloaded spring to absorb all sorts of vibration caused by ship movements and to consent a regular running even in constant ship inclination of 25° and temporally of 35°.

The Cast iron motors < 225 and Aluminium motors < 200 frames size mount respectively double sealed and double screen deep-groove ball bearing greased for life. The corresponding grease life under normal operating condition for a motor with horizontal shaft, at 60 Hz and ambient temperature of + 45°C is:

– 10.000 h. for 2 poles motors – 20.000 for > 4 poles motors

Cast iron Motors frames 250 – 400 have re-greasing bearing. The re-lubrication intervals of motors with re-greasing system are for all type of bearings:

**Table 15**

Re-Lubrication Periods in hours (h)											
2pole		4pole		6pole		8pole		10pole		12pole	
50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz	50 Hz	60 Hz
3000 rpm	3600 rpm	1800 rpm	1500 rpm	1000 rpm	1200 rpm	750 rpm	900 rpm	600 rpm	720 rpm	500 rpm	600 rpm
2000	2000	4000	4000	4000	4000	4000	4000	4000	4000	4000	4000

The values refer to normal operating condition for a horizontal mounting position with ambient temperature + 45°C.

**Table 16**

Re-Lubrication greasing quantity per Bearing														
Bearing Type	6309	6311	6312	6313	6314	6315	6316	6317	6319	6320	6322	6326	6328	6330
QTY (gr.)	15	20	22	24	26	28	32	38	45	52	60	85	95	120
Bearing Type	NU 309	NU 311	NU 312	NU313	NU314	NU315	NU316	NU317	NU319	NU320	NU322			
QTY (gr.)	15	20	22	24	26	26	28	38	45	52	60			

**Table 17**

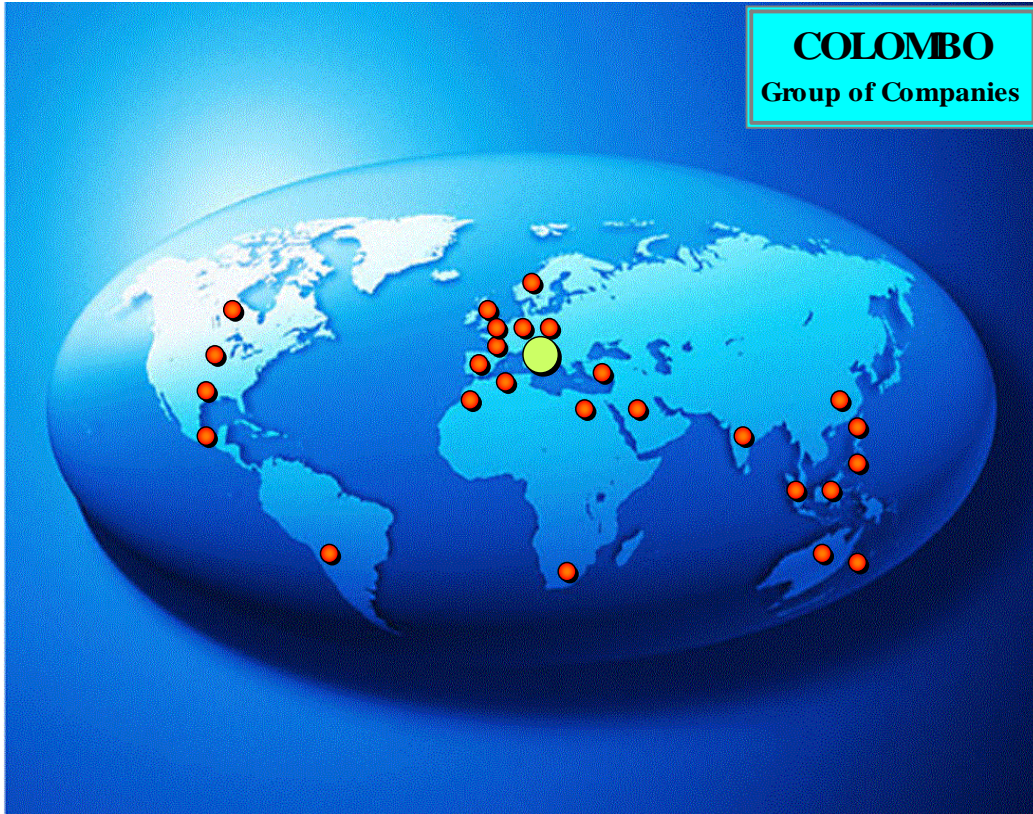
Recommended Grease		
Used and advised lubricants are the following:		
Lubricant type	Quality	Min./Max operating ambient °C
Standard grease	Unirex R3 - ESSO	- 30 to + 165
Recommended grease	Alvania G2 - Shell	- 25 to + 140
	Mobilux 2 - Mobil	- 30 to + 120

**Recommendation**

It is necessary to remove old grease from grease drain boxes. It should be done regularly in relation to bearing lubrication. Grease drain box to be discharged just before the new grease is to be pressed in. For better and more technical details refer to the Felm Bearing maintenance and lubrication instruction.



*Our flexibility to meet any challenge*



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