FELM

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MARINE MOTORS

05/2021 rev.1

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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.
Like last proposal to the market New Motors range is offered to the market with Motors in according to the New efficiency rule IE3. More data are offered in the next pages.
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.

Benefits include:

- high power
- low power consumption
- low noise levels
- voltage: 690 V
- IE3 efficiency value in according to the rules and the tolerances the New Standard IEC 60034-30
- frequency: 60 Hz
- high torque with smooth acceleration and low current
- IP55 or on request IP56-65-66 protection

MARINE MOTORS

Standards and regulations

The motors conform to the relevant standards and regulations: **Table 1**

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
VFD installed appropriate motor construction		IEC 60034-25
Rotating electrical machines new efficiency class – IE code	DIN EN 60034-30	IEC 60034-30
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 ship		IEC 60092
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.
Motors installed on weather decks and those used for grinders, pulpers and axial flow fans shall be completely enclosed (IP 56 protection).
The Motors and cubicles for window washing system shall be IP66 rate.

Motor cooling

Motors are cooled in accordance with EN 60034-6. The normal arrangement is IC411 TEFV .

IE3 - type FM3, FM3VP

New International Standard Efficiency Level IE3 IEC 60034-30

Prepared by IEC technical committee 2: Rotating machinery

The new international standard, IEC 60034-30:2008, defines efficiency classes IE1, IE2 and IE3 for three-phase motors. This ensures a common international basis for the design and classification of motors as well as for national legislative activities. At the same time, the IEC developed improved methods for determining the efficiency of these motors.

The international standards IEC 60034-30:2008 (classification) and IEC 60034-2-1:2007 (measuring methods) have been adopted as European standards without any changes as EN 60034-30:2009 and

EN 60034-2-1:2007. For the sake of simplicity, the following sections will refer to the IEC standards only.

FELM grant the IE3 Efficiency value for max + 50°C ambient temperature.

FELM IE3 Efficiency Motors type:

FM3, FM3VP Cast Iron Frames

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

Felm comply in the following manner
Table 8

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	Yes	No	No	YES
Standards	EN 60034	Not applicable	EN 60034-1	EN60079-0 EN60079-1 EN60079-7
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

(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 general details

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 9

Standards for TEFV and open drip proof				
Classifying authority	Service	Rotating Machines 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	45	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

All Electric Motors are tested and FELM's test Reports are provided for all the machines supplied. The mentioned documentations are supplied with the Technical Documentation.

- ≤99KW all the machine intended for "Essential Services" are to be type approved and manufacturer certificated shall be issued.
- For all rotating machine for "Non Essential Services", individual manufacturer certificate shall be issued.
- ≥100KW intended for "Essential Services" are to be type approved by Lloyd's Register classifying authority.

EXAMPLE

(below data may change based on Fincantieri Hull number ref)

General Technical specifications

- Asynchronous squirrel cage motors comply with IEC standard: IEC 60034-1, IEC 60034-30 and IEC 60092-301.
- Efficiency class IE3 in accordance to IEC 60034-30.
- Motors type “FM3” for DOL starting.
- Motors type “FM3VP” for inverter duty.
- Motors type “FMD” for two speed motors – IE1
- Cast-Iron housing, main terminal box with blind plate without threaded holes.
- Bigger main terminal box for framesize 280 & 315.
- Duty S1.
- Enclosure IP55 (IP56 only on request by customer for motors installed on weather deck) .
- Cooling IC411.
- Insulation class F.
- Temperature rise class F.
- Ambient temperature -25°C + 45°C.
- Tropicalization for humidity 90%.
- Drain holes ≥160 frames.
- Heaters V220/1ph with terminals in separate aux. t.box with junction type NI 884824C fitted as below:
    - For all motors ≥40KW.
    - For motors on weather deck with IP56.
- Terminal board with 6 pin.
- Connection: Star - V.690Y/60Hz, DOL Starting.
- Painting process: according to painting cycle 0600000017 Final colour RAL7035 thickness as below:
    - For motors framesize ≤132 total thickness 100 Micron.
    - For motors framesize ≥160 total thickness 120 Micron.
- Main Terminal box with blind plate, without threaded holes.
- Aux. terminal box, were fitted, with junction type NI 884824C.
- Earthing bolt: N°1 external on housing and N°1 inside main terminal box.
- Ball bearings for all frames.
- Ball bearings “grease packed for life” ≤225 frames.
- Grease lubrication with grease nipples ≥250 frames.
- Two speed motors will have two separate windings.
- Inverter duty motors will have reinforced windings suitable to resist of a voltage peak of V2500 as per IEC60034-25 curve B.
- Classifying authority: Lloyd’s Register.
- ≤99KW all the machine intended for “Essential Services” are to be type approved and manufacturer certificate shall be issued.
- For all rotating machine for “Non Essential Services”, individual manufacturer certificate shall be issued.
- ≥100KW intended for “Essential Services” are to be type approved by classifying authority.
- All different data, refer to FELM Marine motors catalogue Hull 6319.
- Noise level at 1m on no load max 85dB(A)
- 3xPTC (150°C) with terminals in main T.box shall be fitted in windings as per following details:
    - As standard ≥ framesize 160 .
    - For all the motors for “Essential Services” .
    - For all motors inverter duty.

Marine motor general features	
	Cast iron frame 80-355.
Voltage/Frequency	V690Y/60Hz - terminal board with 6 pin (other voltages available on request).
Efficiency	IE3.
Type FM3	DOL starting motors.
Type FM3VP	Inverter duty motors with reinforced windings.
Amb temp	-25° C +45° C.
Enclosure	cast iron frame standard IP55 (IP56 or IP66 only on request) .
Main t.box	Main t.box provided with blind plate without holes .
Aux t.box	When fitted is provided with junction type NI 884824C (plastic cable gland available only on request).
Cooling method	IC411 TEFV Totally Enclosed Fan Ventilated.
T-box position	On Top - with bigger main t.box for framesize 280 & 315.
Lubrication	≤frames 225 ball bearing greased for life / ≥ frames 250 through grease nipple.
Vibrations	Grade A.
Bearings	All frame with ball bearings (roller bearing available on request).
Bearings	Frame ≥280 Inverter duty motors provided with insulated bearing at NDE .
Drain holes	≥ Frames 160.
Temperaturerise	Class F.
Insulation class	Class F.
Duty cycle	S1 continuous rated.
Earth bolt	Provided in main t.box and on motor frame.
Heaters V220/1ph	≥40kw in aux t.box. for Essential Service and IP56 motors. (When for Non Essential Services only if requested by the customer.
PTC(150° C) Thermal Protection	In main t.box. As standard for ≥Framesize 160. For all motors essential service and all motors for inverter duty.
Final colour	RAL7035 (other colours available on request)

Insulation and thermal rating

Felm motors are manufactured using Class F insulating materials, giving a maximum operating temperature, including ambient of 155° C.

Motor Winding Insulation Level:

- < 500V: at least 1.500 V.
- > 500V: at least 2.500 V.

Motor ratings depend upon:

- ambient temperature
- type of service
- maximum operating temperate, i.e. Class F (155° 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 (> + 60° 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.

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