Monthly Informative Application Guidelines, with respect to *Motors & Drives* to keep you better INFORMED.

APPLICATION GUIDELINE #16

(IEEE 841-1994)

Brought to you by your Motor & Drive Specialists……

In an industry effort to improve motor reliability, a frequently reviewed and referred to standard today is **IEEE std 841-1994**. As previously mentioned in an Application Guideline, NEMA (National Electrical Manufacturers Association) is a nonprofit U.S. organization consisting of members from the manufacturing sector. One of the stated purposes of NEMA is "to promote the standardization of electrical apparatus and supplies". The NEMA working document for Low Voltage Motors is Standard No. MG1, for "Motors and Generators". NEMA standards "are intended to assist users in the proper selection and application of motors" and "adopted in the public interest to eliminate misunderstandings between the manufacturer and the purchaser. It is considered to be the most common and referred to standard for the T-frame motor.

In addition to NEMA and since it's inception, there have been many other bodies which have realized specific motor requirements and therefore assembled to create guidelines which further meet their specific industry needs. The Electrical and Electronic Manufacturers Association of Canada (EEMAC) uses MG1 with some modifications. Furthermore, and the topic of this months application guideline, The Institute of Electrical and Electronics Engineers (IEEE) - Petroleum and Chemical Industry also have created their own standard for "Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors (SCIM) – Up to and Including 500Hp".

IEEE Std 841-1994 (The following are exerts taken directly from the standard)

Introduction:

"This standard has been prepared in an effort to improve the reliability, efficiency, and performance of severe duty TEFC integral horsepower SCIM, 500Hp and below; and to promote uniform specification of such motors in petroleum and chemical industry applications. This standard reflects the thinking of representatives of the petroleum and chemical industry and their supplying motor manufacturers."

Purpose:

"The purpose of this standard is to define a specification that deals with mechanical and electrical performance, electrical insulation systems, corrosion protection, and electrical and mechanical testing for severe duty TEFC motors. Many of the specified materials and components in this standard stem from experience with severely corrosive atmospheres and the necessity for safe, quiet, reliable, high-efficiency motors."

Other sections in this standard include: 2)References, 3)Service Conditions, 4)Ratings, 5)Electrical performance, 6)Mechanical features, 7)Corrosion-resistant treatment, 8)Efficiency, 9)Tests, 10)Nameplate, 11)Space Heaters, 12)Data Exchange-User/Manufacturer

Attached is a detailed specification comparison of IEEE 841-1986, with IEEE 841-1994 and the Toshiba EQP III-841 line of motors. This gives a clear indication of what the standard includes. It should be noted, that Toshiba's complete EQPIII series line of motors are built in accordance to strict, in-house standards for vibration, shaft runout, rotor balance and machining tolerances. This means that other than documented testing, Inproseals on both DE and ODE and a few other minor mechanical enhancements, the performance, build quality and efficiency that entices most users to purchase IEEE 841 standard motors can be found on the more economical EQPIII XS or the EQPIII series motors. It is the end user's decision to determine whether they need the additional bearing protection that the EQPIII 841 motor provides. Some users are simply specifying IEEE 841 standards to try to guarantee that they get motors built to the stringent standards that **all** Toshiba motors are built to. At Toshiba, we have always felt that a high performance, premium efficiency product built to exacting manufacturing standards provides significant benefits to the end user, especially Industrial end users.

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SPECIFICATION COMPARISON

IEEE 841-1986	IEEE 841 - 1994	Toshiba EQP III 841
1-200HP	1-500 HP	1-200 HP
600V and below	200 through 4160V	600V and below
NEMA Design B	NEMA Design B	NEMA Design B and C
No IP requirement	IP54 140T through 280T Frame	**IP55 140T and larger**
No IP requirement	IP55 320T Frame and larger	**IP55 140T and larger**
No Labyrinth seal requirement	No Labyrinth seal required	**Inpro Seal 140T and larger DE & ODE**
No IP requirement for T-Box	IP55 Terminal Box	IP55 Terminal Box
Class F lead wire not specified	Class F lead wire	Class F lead wire (155°C)
No requirement for lead terminals	No requirement for lead terminals	**Lead terminals provided for all ratings**
No requirement for cable length	No requirement for cable length	**Min. 12" lead cable**
Class B rise at 1.0 SF	Class B rise at 1.0 SF	**Class B rise at 1.15 SF**
Class 'F' insulation system	Class 'F' insulation system	**Class 'H' components used**
Paint system to pass ASTM B 117-73 96 hr.	Paint system to pass ASTM B 117-90 96 hr.	**Epoxy paint system passed 200 hr. ASTM B 117-90**
26,280 hr. B10 Life (Belt Drive)	26,280 hr. B10 Life (Belt Drive)	**50,000 hr. B10 Life (Belt Drive)**
Bearing size not specified	Bearing size not specified	**300 series bearings DE & NDE**
Internal bearing cap not specified	Internal bearing cap 140T and larger	Internal bearing cap 140T and larger
C-3 Clearance fit not specified	C-3 Clearance fit bearings	C-3 Clearance fit bearings
Recommended 45° C bearing temp. 4-8 pole	45° C bearing temp. 4-8 pole	**45° C bearing temp. 4-8 pole, 2 pole 400T and smaller**
Recommended 50° C bearing temp. 2 pole	50° C bearing temp. 2 pole	**50° C bearing temp. 2 pole 440T and larger**
Polyurea grease	Polyurea grease	Polyurea grease
No grounding provision on frame	Grounding provision on frame	**UL listed ground terminal on frame**
Ground terminal in T-Box	Ground terminal in T-Box	**UL listed ground terminal in T-Box**
No shaft runout requirement	Shaft runout 1/2 NEMA Standard	Shaft runout 1/2 NEMA Standard
Non sparking bronze or plastic fan	Non sparking bronze or plastic fan	Non sparking glass reinforced nylon fan
T-box Standard NEMA volume	T-box volume 2 times NEMA volume	**T-Box volume 2 times NEMA volume or greater**
90 dBA sound power level	90 dBA sound power level	90 dBA sound power level
3/16 holes or automatic drains	Replaceable Corrosion resistant	**(2) Brass drain and breather plugs** automatic drains
100% vibration tested	100% vibration tested	100% vibration tested
Test report not required to shipped	Test report shipped with all motors	Test report shipped with all motors

IEEE 841-1986	IEEE 841 - 1994	Toshiba EQP III 841
NEMA MG1 1978 Section 12.05 in mils	.08 in/sec. Unfiltered 2-6 pole	.08 in/sec. Unfiltered 2-6 pole
NEMA MG1 1978 Section 12.05 in mils	.06 in/sec. Unfiltered 8 pole	.06 in/sec. Unfiltered 8 pole
NEMA MG1 1978 Section 12.05 in mils	.05 in/sec filtered at 2f frequencies	.05 in/sec filtered at 2f frequencies
NEMA MG1 1978 Section 12.05 in mils	.06 in/sec unfiltered axial vibration	.06 in/sec unfiltered axial vibration

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Highest available efficiency (energy efficient)	Table 1 nominal efficiency	**Exceeds table**
Minimum guaranteed efficiency (20% losses)	Minimum guaranteed efficiency (20% losses)	**Minimum guaranteed efficiency**. 1-10 Hp (20% losses) ≥**15 Hp(10% losses)**
Extended grease fittings ODE	Extended grease fittings ODE	**Extended grease fittings DE and ODE**
Type of grease plug not specified	Type of grease plug not specified	**Automatic grease relief provided**
Name plate pass 720 hr ASTM B 117-73 test	Name plate pass 720 hr ASTM B 117-90 test	304 stainless steel name plate, passed 720 hr ASTM B 117-90
UL recognized not required	UL recognized not required	**UL recognized 1004**
CSA not mentioned	CSA not mentioned	**CSA approved**
Core burnout temperature not specified	Core burnout temperature not specified	**1000°F burnout capability**
Moisture resistant barrier	Moisture resistant barrier	**Neoprene lead seperator**
Nameplate list AFBMA number, date of manufacturing and IEEE 841 label	Nameplate list AFBMA number, date of manufacturing and IEEE 841 label	**Nameplate list AFBMA number, date of manufacturing , IEEE 841 label, bearing size, max KVAR, 3/4 load efficiency - raised letters**
Hardware grade not mentioned	Hardware grade not mentioned	**Grade 5 hardware (except 140 - 250T through bolts)**
Phase sequence not mentioned	Phase sequence not mentioned	**Phase sequence auxiliary nameplate**

One of the biggest apparent benefits in specifying IEEE-841 is the more stringent vibration requirements. However, if random vibration testing on any of the Toshiba EQP-III line of motors was performed, the results would indicate vibration levels which exceed the requirements of IEEE, this is primarily due to Toshiba's philosophy on quality and zero defects process's.

Motor Speed (RPM)	NEMA MG1-7.08.1 Unfiltered Vibration (in/sec peak velocity)	NEMA Max. Amplitude (P-P Mils)	IEEE-841 1994 Unfiltered Vibration (in/sec peak velocity)	Typical Vibration EQP III, XS & 841 (in/sec peak velocity)
3600	0.15	1	0.08	≤0.08
1800	0.15	1.5	0.08	≤0.08
1200	0.15	2	0.08	≤0.08
900	0.12		0.06	≤0.06
720	0.09		Not spec'd	
600	0.08		Not spec'd	