

DESIGN MANUAL

SPD0029ERN-USA

PROCESS DESIGN MANUAL

ELECTRIC MOTORS

REV. : 2

DATE : 10 Jun 2011



**SAMSUNG
ENGINEERING**

SAMSUNG ENGINEERING AMERICA INC

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1. SCOPE

This manual covers the determination of electric motor types and outputs. This Basic Design Manual has been prepared based upon the principles of Japanese code. For applications to projects in foreign countries, another code may be used, for example IEC.

2. MOTOR SELECTION

Guidelines for the selection between synchronous motors (SM's) and induction motors (IM's) are as follows:

- Squirrel-cage induction motors generally shall be used to drive pumps, blowers, agitators, compressors, and other constant-speed continuously operated equipment.
- Synchronous motors generally, shall be limited to use with large size drivers of low-speed reciprocating compressors and to other applications where the power factor correction of plant loads is necessary, from an economical or design standpoint.

For a final decision, studies need to be conducted by the electrical engineers. At the basic design stage, the selection should be made by using Fig. 3-1. Synchronous speeds (rpm) can be calculated by the following equation:

$$\text{Speed (RPM)} = \frac{120 \cdot \text{frequency}}{\text{Number of poles}}$$

3. DETERMINATION OF RATED OUTPUT

Electric motors shall be rated for the brake horsepower (BHP) of the driven equipment, plus an allowance. (API Std. 610, 9TH, TABLE 11)

Rated Output	Percent of Rated BHP
Less than 22 kW	125%
22 - 55 kW	115%
Greater than 55 kW	110%

For motors 1,000 KW and smaller, selection shall be made from Table 3-1. Motors larger than this shall be rated in steps of 50 KW.

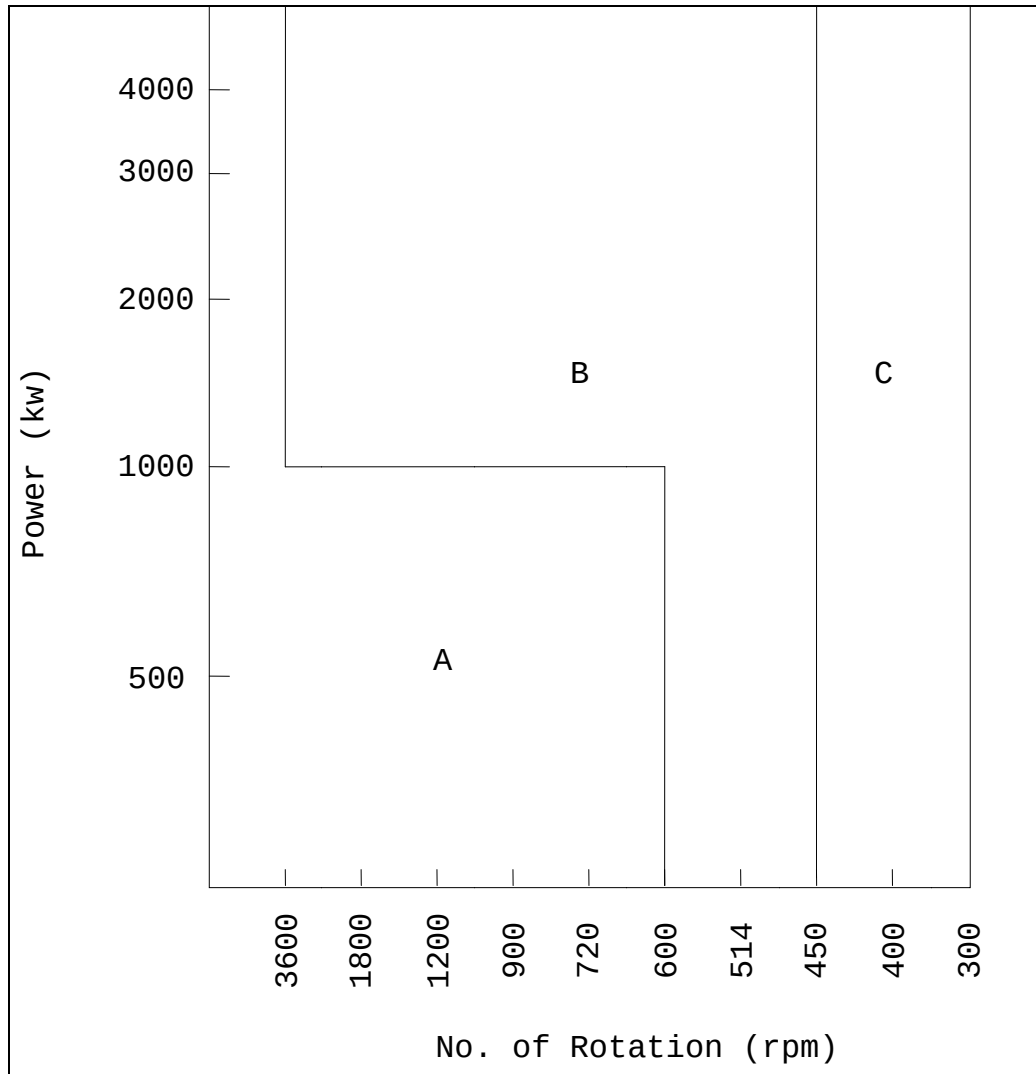


Figure 3-1 General Area of Application of Synchronous Motors and Induction Motors

- (A). Induction Motors
- (B). Investment Cost IM < SM
Operating Cost IM > SM
- (C). Synchronous Motors

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4. RATED VOLTAGES AND RATED OUTPUTS

Fig. 4-1 has been provided in connection with both optimum voltage from economic standpoint and ease of manufacturing. Those which fall on overlapped portions must be decided by discussion with the electrical engineers because they are related with the power distribution facilities and the number of motors.

5. CLASSIFICATION OF HAZARDOUS AREAS AND PROTECTION TYPES

5.1. Classification of Hazardous Areas

Refer to NEC's Hazardous Area Classification.

5.2. Protection Types

Protection types are specified in NEC.

5.3. Selection of Explosion-protected Constructions

For use in Class 1 hazardous areas, the required explosion-protected constructions shall be determined in accordance with the following table:

Hazardous Area	Class 1 Areas Division I		Class 2 Areas Division II	
	XP	SP	XP	SP
Sparking (Note 1)	O	X	O	O (Note 2)
Non-sparking (Note 1)	O	X	O	O
Canned motor	O	X	O	O

Where,

O: Suitable

X: Unsuitable

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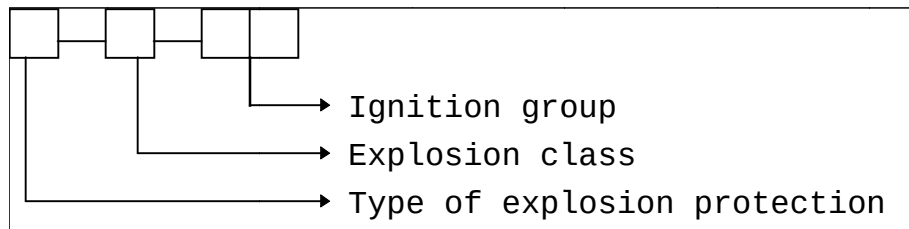
Note 1: Sparking sources such as slip rings, commutators, and starting switches.

Note 2: Sliding contacts, switching mechanism, or similar arc-producing devices shall be provided with enclosures of flame-proof construction.

5.4. Symbols for Type of Explosion protected Construction

In each individual case, explosion protected construction shall meet degrees of hazard of all flammable gases and vapors of combustible liquids which may be present, in accordance with area classification drawings.

Symbols for type of explosion protected construction and for explosion class and ignition group of explosive gases shall be as follows:



The contents of the symbol (letters and digits) are as explained in Table 5-1.

5.5. Explosion Classes and Ignitability

Classifications are made for flammable gases and vapors as shown in Table 5-2.

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6. TABLES AND FIGURES

6.1. Table 3-1. Standard Rated Output Values of Electric Motors

a) SCOPE OF APPLICATION

This standard covers the rated outputs of 0.004 kW - 1,000 kW motors.

b) STANDARD OUTPUTS

The standard values of the rated outputs of electric motors shall be selected from among those given in the table below.

Note: The values parenthesized can be used for the time being.

Standard Rated Output Values of Electric Motors, kW						
0.004	0.06	(0.4)	15	132	335	600
0.008	(0.065)	0.55	18.5	150	355	630
(0.01)	(0.075)	0.75	22	160	375	670
0.015	0.09	1.1	30	185	400	710
(0.02)	(0.1)	1.5	37	200	425	750
0.03	0.12	2.2	45	220	450	800
(0.035)	0.18	3.7	55	250	475	850
(0.04)	(0.2)	5.5	75	280	500	900
0.045	0.25	7.5	90	300	530	950
(0.05)	0.37	11	110	315	560	1000

6.2. Table 5-1 Symbols for Type of Explosion Protected Construction

	Sorting	Symbols	
Type of explosion protection	Flameproof Oil-immersed Pressurized Intrinsic safety Intrinsic safety Special		d o f e i s
Explosion Class	Explosion class 1 Explosion class 2 Explosion class 3	3n	1 2 3a 3b 3c
Ignition group	Ignition group G1 Ignition group G2 Ignition group G3 Ignition group G4 Ignition group G5		G1 G2 G3 G4 G5

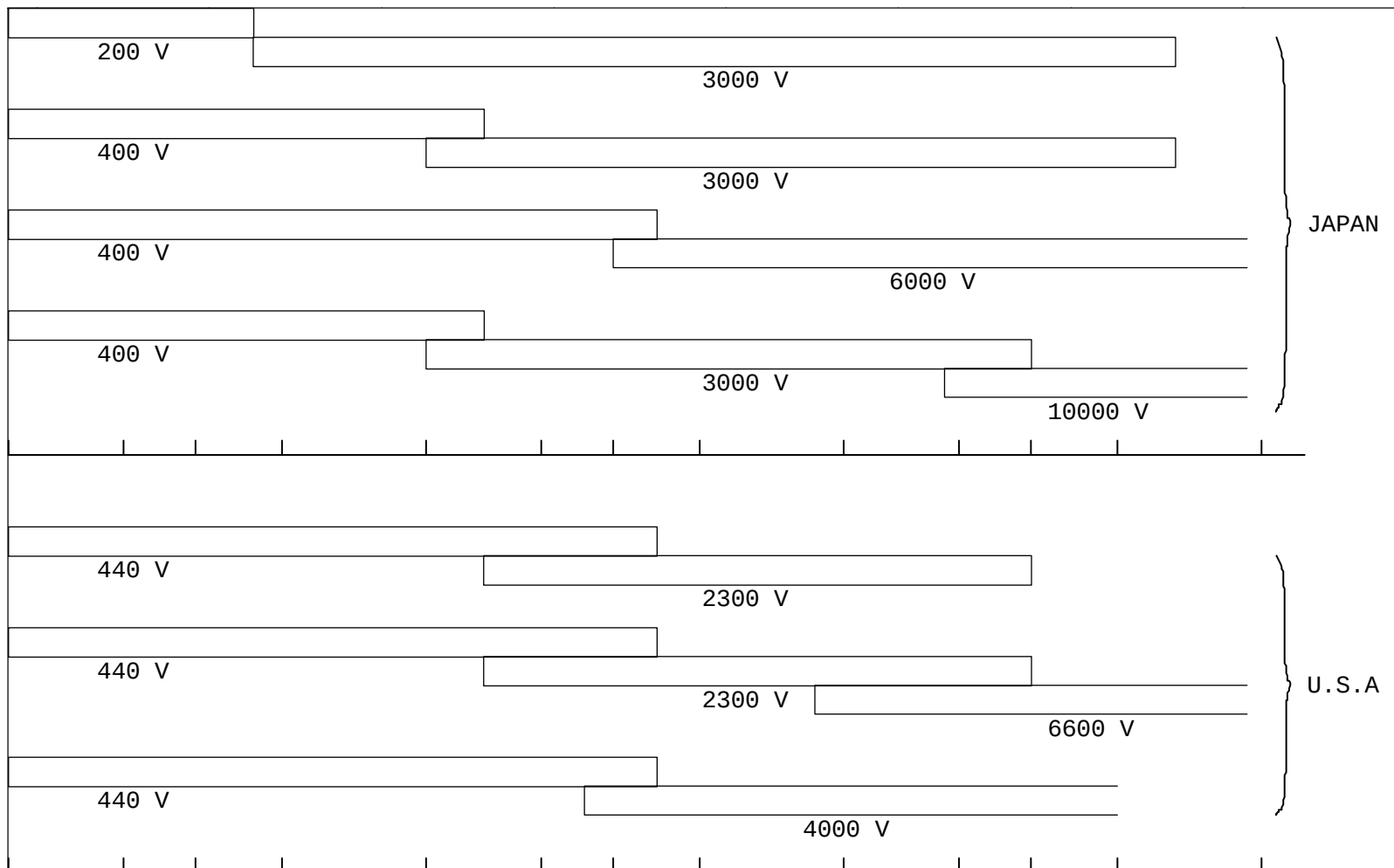
Note: In the case of explosion class 3, 3a means water gas and hydrogen: 3b means carbon disulfide: 3c means acetylene; and 3n denotes all the gases in this class.

6.3. Table 5-2 Explosion Classes and Ignitability

Ignitability	G1	G2	G3	G4	G5
Temp. Rise Limits.	320°C	200°C	120°C	70°C	40°C
Ignition Point					
Explosion Class	Over 450°C	300-400°C	200-300°C	135-200°C	100-135°C
1	Acetone ammonia carbon monoxide ethane acetic acid ethyl acetate toluene propane benzene methanol methane	Ethanol iso-amyl-acetate 1-butanol butane acetic anhydride	Gasoline hexane	Acetaldehyde Ethyl-ether	
2	Coal gas	Ethylene ethylene oxide			
3	Hydrogen water gas	Acetylene			CS2

Note: Electric motors are designed and manufactured for G3 or G4 unless otherwise specified.

6.4. Fig. 4.1 Output and Voltages



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7. REVISION HISTORY

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