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Guidance on Practice for Motors

GP 12-20

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) GP 12-20. This Guidance on Practice (GP) is based on the following heritage documents from merged BP companies:

AMOCO (ACES)

A EL-MT-00-G	Electrical—Motors—Selection Guide
A EL-MT-00-E	Electrical—Motors—Selection Specification
A EL-MT-541-P	Electrical—Motors—Above 1000 V Induction—Supply Specification
A EL-MT-546-P	Electrical—Motors—Synchronous—Supply Specification
A EL-MT-841-P	Electrical—Motors—460 and 575 V—Supply Specification

ARCO (APCES)

ES 402-91	Squirrel Cage Induction Motors
ES 406-91	Form-Wound Brushless Synchronous Motors 500 Horsepower and Larger

BP (RPSE)

RP 12-11	Electrical Systems and Installations - Motors
GS 112-3	Guidance for Specification Low Voltage Induction Motors
GS 112-4	Guidance for Specification High Voltage Induction Motors

BP GOMDW

1400-20-EL-SP-4040	Addendum to IEEE Standard 841 Low Voltage Inductions Motors
1400-20-EL-SP-4041	Addendum to API Standard 541 Medium Voltage Inductions Motors

BP Chemical US

CP 17-3-1	Induction Motors NEMA Frame (480 V IEEE 841XL)
CP 17-3-2	Induction Motors Above 200 HP (medium voltage)
CP 17-3-3	Synchronous Motors
CP 17-3-4	Induction Motors NEMA Frame ½ to 200 HP Explosion Proof and 1/2 to 2 HP Non-Explosion Proof

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[4] IEEE 841, Standard for Petroleum and Chemical Industry – Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – Up to and Including 370 kW (500 hp)	15
[5] NEMA MG 1, Motors and Generators	15
[6] UK HSE Offshore safety notice SN 17/90, Electric motors for use in hazardous areas	15
[7] UK HSE safety notice 498/12, High voltage types Ex'n' and Ex'e' explosion protected motors operating in potentially explosive atmospheres	15



1. Scope

This GP document provides guidance for engineering design, installation, operation, and maintenance of electric motors.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP Engineering Technical Practices (ETP)

DS 12-201	Low Voltage Induction Motors Data Sheet (IEC)
DS 12-202	Low Voltage Induction Motors Data Sheet (IEEE 841)
DS 12-203	High Voltage Induction Motors Data Sheet (IEC)
DS 12-204	High Voltage Induction Motors Data Sheet (API 541)
DS 12-205	Synchronous Motors Data Sheet (IEC)
DS 12-206	Synchronous Motors Data Sheet (API 546)
GIS 12-201	Guidance on Industry Standard for Low Voltage Induction Motors (IEC)
GIS 12-202	Guidance on Industry Standard for Low Voltage Induction Motors (IEEE 841)
GIS 12-203	Guidance on Industry Standard for High Voltage Induction Motors (IEC)
GIS 12-204	Guidance on Industry Standard for High Voltage Induction Motors (API 541)
GIS 12-205	Guidance on Industry Standard for Synchronous Motors (IEC)
GIS 12-206	Guidance on Industry Standard for Synchronous Motors (API 546)
GP 12-03	Guidance on Practice for Power System Protection and Control
GP 12-10	Guidance on Practice for Switchgear and Controlgear
GP 12-25	Guidance on Practice for Earthing/Grounding
GP 12-50	Guidance on Practice for AC Drives
GP 12-55	Guidance on Practice for Inspection & Testing of Electrical Systems
GP 12-60	Guidance on Practice for Hazardous Area Electrical Installations

International Organization for Standardization

ISO 281	Rolling bearings – Dynamic load rating and rating life
ISO 1680	Acoustics – Test code for the measurement of airborne noise emitted by rotating electrical machinery.

3. Design and installation

3.1. General

Motor selection must consider requirements of the driven equipment, characteristics of supply voltage available, (e.g. single phase, three phase, HV or LV) and installation environment.



Motors should be specified with Class F insulation and Class B temperature rise. It is acceptable for machines to be supplied with Class H insulation, however in such cases the temperature rises should be to Class F limits.

By specifying insulation to operate at lower temperatures an enhanced life expectation is implied. This added temperature margin can often be used to justify a use beyond a norm e.g. unexpected arduous conditions or increased loadings. Manufacturers may include insulation systems that meet these requirements whilst other aspects of the machine design could limit over temperature capability.

Motor frames and bearing end-shields should be constructed of ferrous metals

Aluminium frames are not suitable for use in the corrosive and hostile atmospheres likely to be encountered in the petrochemical industry.

Motor parts, fasteners, bolts, nuts, etc should be corrosion resistant.

When ammonia or H₂S fumes are an environmental condition, there should be no exposed copper (or alloys with free copper) parts. Copper is subject to corrosion when exposed to ammonia or H₂S.

Motors used in very damp or wet environments, particularly under intermittent duty, should be provided with a low point drain hole.

Drain holes should be at the lowest point on the stator, subject to accessibility for removal of threaded drain plug when the machine is mounted in service position.

Drain holes on motors for use in hazardous areas should be sealed with a device approved by the Certifying Authority.

Removing and replacing drain plugs should not be impeded by the position in which the motor is mounted.

This is not always the responsibility of the motor manufacturer but often the responsibility of a 'package' (e.g. pump set) vendor who provides the mounting (e.g. bedplate) for the motor. Removal of drain plugs may invalidate the hazardous area classification of the motor.

3.2. Environmental considerations

Motors should be designed for use outdoors without protective shelter and for the following conditions:

- Altitude not exceeding 1000 m (3280 ft) above sea level
- Ambient air temperature not more than 40°C (104°F) or less than -15°C (5°F)

The exception to this is for NEMA practice areas, where induction motors specified to IEEE 841 should be suitable for use at -25 °C (-13 °F).

- Cooling water temperature not exceeding 25°C (77°F)

3.2.1. Bearings

Small and medium-sized motors should use rolling element bearings (ball or roller type).

These are easy to maintain, are reliable when properly used and are inexpensive.

Larger motors should use sleeve bearings (journal bearings), as there is a size limit for rolling element bearings that is a function of rotational speed and other factors such as bearing type, method of lubrication (sealed or grease nipple), loading, etc.

Expected life of rolling element bearings is in the range 25000 to 100000 hours L₁₀ where L₁₀ is the life that 90% of a large number of identical bearings is expected to exceed (as defined in ISO 281). Statistically 50% of bearings achieve or exceed five times the L₁₀ life. Motors fitted

