Supplement 1
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Specification for Electric Motor Prime Mover for Beam Pumping Unit Service

API SPECIFICATION 11L6
FIRST EDITION, JUNE 1, 1993

American
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Supplement 1 to Specification for Electric Motor Prime Mover for Beam Pumping Unit Service

This supplement covers technical changes to API Specification 11L6 (First Edition, June 1, 1993) as adopted by letter ballot of the API Subcommittee on Field Operating Equipment. Specifically, it adds as Appendix B, the Electric Motor Performance Data Request Form formerly published as API Bulletin 11L5.

Page 1, Par. 1.1. Revise to read as follows to add reference to the new Appendix B:

1.1 Coverage. This specification covers polyphase, squirrel-cage, induction motors for use as the prime mover for beam pumping units (size range of 200 HP and below). It includes a user motor data sheet (Appendix A), and an electric motor performance data request form (Appendix B). Motors to be operated from solid-state or other types of variable frequency/variable voltage power supplies for adjustable speed applications will require individual consideration to provide a satisfactory performance and are beyond the scope of this document.

Following Page 10. Add new Appendix B as shown on the next page.

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Attention Users of this Publication: Portions of this publication have been changed from the previous edition. The location of changes has been marked with a bar in the margin. In some cases the changes are significant, while in other cases the changes reflect minor editorial adjustments. The bar notations in the margins are provided as an aid to users to identify those parts of this publication that have been changed from the previous edition, but API makes no warranty as to the accuracy of such bar notations.

Note
This is the First Edition of Spec 11L6 which was adopted at the 1992 Standardization Conference as reported in Circ PS-1985 and subsequently approved by letter ballot.

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FOREWORD

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SECTION 1
SCOPE

1.1 Coverage. This specification covers polyphase, squirrel-cage, induction motors for use as the prime mover for beam pumping units (size range of 200 HP and below). Motors to be operated from solid-state or other types of variable frequency/variable voltage power supplies for adjustable speed applications will require individual consideration to provide satisfactory performance and are beyond the scope of this document.

1.2 Definitions of terms. The definitions of technical terms used in this Specification are in Reference (1).

1.3 References. This specification shall be used in conjunction with the following publications:

(1) IEEE Std. 100-88, Standard Dictionary for Electrical and Electronic Terms Fourth Edition.

(2) ANSI/NEMA MG1 — 1987 (R1989), Motors and Generators.

(3) NEMA MG13 — 1984, Frame Assignments for Alternating Current Integral Horsepower Induction Motors.

(4) NEMA MG13 — 1956, Frame Assignments for Alternating Current Integral Horsepower Induction Motors (U-Frame Descriptions).

(5) ANSI/IEEE Std 112-1984, IEEE Test Procedure for Polyphase Induction Motors and Generators.

(6) ANSI/AFBMA9-1978, Load Rating and Fatigue Life for Ball Bearings.

(7) ANSI/AFBMA 11-1978, Load Rating and Fatigue Life for Roller Bearings.

(8) ASTM B117-90, Standard Test Method of Salt Spray (Fog) Testing.

(9) ANSI/IEEE 841-86, Recommended Practice for Chemical Industry Severe Duty Squirrel-Cage Induction Motors — 600V and Below.

(10) ANSI/NFPA 70 — 1990, National Electric Code.

(11) ANSI/NEDA 12.34.1, Segregation of Losses and Smoothing of Stray-Load Loss.

(12) API Bul 11L5 — 1990, Bulletin on Electric Motor Performance Data Request Form.

SECTION 2
BASIC DESIGN

2.1 GENERAL

2.1.1 Standard Motor Specification. The standard motor design under this specification shall meet the following minimum requirements. Other options indicated in parentheses are available and outlined in this document. These options must be identified on the data sheet.

Size Rating —	as specified by user 200 HP (150 kw)* and below	Ref. 2.1.3
Synchronous Speed —	1200 RPM, (900)* (1000)*	Ref. 2.1.4
Voltage —	460/796 (460)* (380)*	Ref. 2.1.5
Frequency —	60 Hz (50 Hz)*	Ref. 2.1.5
Phase —	3	Ref. 2.1.5
Enclosure —	ODP Guarded (TEFC)*	Ref. 2.1.6
NEMA Design —	D (Ultra High Slip)*	Ref. 2.1.7
Frame —	T (U)*	Ref. 2.1.8
Frame Material —	Cast Iron (Other)	Ref. 2.1.9
Insulation —	Class F — Class E Rise (Class F Encapsulated, Class H)*	Ref. 2.1.10
Service Factor —	1.15 (1.0 Ultra High Slip)*	Ref. 2.1.10
Mounting —	F2	Ref. 2.1.11
Loads —	6 (3, 9, 12)*	Ref. 2.1.12
Bearing Life —	L10 minimum 26,280 hours	Ref. 2.1.13

*Other API Acceptable Values

Except as otherwise specified, motor electrical performance and characteristics shall be in accordance with Reference (2).

2.1.2 Service Conditions. Motors conforming to this specification shall be suitable for operation in accordance with their full load rating under the following service conditions or the conditions specified on the user data sheet. (See Appendix A.)

Ambient temperature in a range of –25°C to +40°C (–13°F to 104°F)

Maximum altitude of 1000m (3300 ft.) above sea level.

Outdoor severe duty application, including blowing dust or snow, corrosive atmospheres, high humidity, and cyclic loading.

Full voltage across-the-line starting

Belted duty

Power supply variations as in 2.2.1.

2.1.3 Size Rating. Motors covered by this specification shall be rated in horsepower (HP) or kilowatt (kw) on a continuous-duty basis.

2.1.4 Synchronous Speed Rating. Synchronous speed rating at 60 Hz is 1200 RPM or as specified on the attached data sheet. (See Appendix A.) This specification covers the motor synchronous speed of 900 and 1200 RPM.

2.1.5 Voltage, Frequency and Phase Ratings. Voltage ratings shall be 460/796 or 460 Volts AC, 60 Hertz, 3 Phase or 380V, 50 Hertz, 3 Phase. The 50 Hz synchronous speed is 1000 RPM.

2.1.6 Motor enclosures shall be open drip proof or TEFC suitable for unclassified areas. As a minimum, enclosures shall meet Open Drip Proof — Guarded specifications in accordance with Reference (2) or Totally Enclosed Fan Cooled specifications in accordance with Reference (2).

2.1.7 NIMA Motor Designs and Starting Characteristics. Motors shall be NEMA Design D as specified by Reference (2) with a slip of 5% to 8% or Ultra-High Slip design. Motors shall be capable of accelerating load under conditions as specified in Reference (2).

2.1.8 Frame Assignments. Motors furnished in accordance with this specification, shall as a minimum comply with the frame size assignments as per Reference (3) for T Frame motors or according to Reference (4) for U Frame motors.

2.1.9 Motor Frame Material. For cast iron or other materials used, the motor manufacturer shall identify the material used for motor frames, and shields, and other structural parts; corrosion resistant treatment; test for corrosion resistance.

2.1.10 Insulation System. Service Factor, and Temperature Rise. The thermal rating of the insulation system shall be a minimum of Class F as defined in Reference (2). When operated at rated voltage, frequency and load, the temperature rise shall not exceed 80°C by resistance for Class F insulation, 90°C by resistance for Class F Encapsulated, or 125°C by resistance for Class H insulation in accordance with Reference (5). Standard motors shall have a 1.15 Service Factor. Ultra High Slip motors shall have a 1.0 Service Factor without exceeding the allowable temperature rise of the insulation system as determined in accordance with Reference (5).

2.1.11 Mounting. The power terminal box shall be located on the right side of the enclosure facing the shaft end of the motor in accordance with NEMA Type F-2 construction.

2.1.12 Motor Leads. The preferred number of motor loads should be six; As an option for voltage and torque variations, the user may specify 3, 9, or 12 leads.

2.1.13 Bearing Life. Bearings shall be selected to provide L-10 rating life of 26,280 hours minimum (3 years continuous) per Reference (6) or Reference (7) as applicable. Calculations shall be based on external loads calculated for NEMA bolted application limits in accordance with Reference (2) and internal loads defined by the manufacturer. Regressable bearings shall be provided on frame sizes above 286T.

2.2 OTHER ELECTRICAL DESIGN CONSIDERATIONS

2.2.1 Power Supply Variations

2.2.1.1 Motors shall operate on a continuous basis at rated load with variation in the voltage or the frequency not exceeding the following conditions.

(a) ± 10% of rated voltage, with rated frequency.

(b) ± 5% of rated frequency, with rated voltage.

(c) Combination of voltage and frequency variation of 10% (sum of absolute values) of the rated values, provided that the frequency variation does not exceed ± 5% of rated frequency.

2.2.1.2 Motors shall operate on a continuous basis at rated load and frequency when the voltage unbalance at the motor terminals is less than or equal to one percent as calculated according to Reference (2).

2.2.1.3 When elevation or ambient temperatures other than specified in 2.1.2 are noted on the data sheet, the motor shall be derated in accordance with Reference (2).

2.2.2 All motors shall have nonhygroscopic insulation systems including loads and connections. Internal winding encapsulation may be specified. Coil ends shall be braced to prevent insulation cracking and fatigue from movement due to starting, operating under cyclic load conditions, and vibrations inherent to a beam pumping system.

2.2.3 The motor insulation system shall be protected against the severe conditions listed in Paragraph 2.1.2. As a minimum the insulation system must pass the Salt Spray Test as specified in Reference (8).

2.2.4 The motor leads in the motor terminal box shall be constructed of copper motor lead wire and be permanently identified.

2.3 OTHER MECHANICAL DESIGN CONSIDERATIONS

2.3.1 Bearings and Lubrication

2.3.1.1 Regreasable type bearings should be regreasable without any disassembly, and shall contain a reservoir equipped with an outlet for elimination of purged grease. Inlet and outlet openings shall have removable plugs.

2.3.1.2 Regreaseable bearings should be supplied with a grease compatible with operating conditions specified in 2.1.2. The manufacturers preferred type of grease shall be stated in the maintenance and operating instructions provided with the motor.

2.3.1.3 Temperature Rise of the bearing shall not exceed 60°C at rated load under belted conditions.

2.3.2 Rotor cage construction shall be of copper, aluminum, magnesium or their respective alloys. Rotors shall have a permanent corrosion protective coating. The shaft extension shall be protected against corrosion for shipment and extended storage by a removable protective coating.

2.3.3 Enclosures and Frames.

2.3.3.1 Motors with shipping weights over 30 pounds shall have lifting lug(s), eye bolt(s), or other suitable means on the frame for lifting.

2.3.3.2 Alignment dowels, rabbet fits or similar construction shall be provided to facilitate correct reassembly of frame components, end bells or plates, bearing housing mounting plates, and bearing housings.

2.3.3.3 On TEFC motors, non-threaded, 3/16 inch diameter hole(s) shall be provided at the low point(s) of the motor enclosure to allow for drainage of condensation. Holes larger than 3/16 inch diameter must be provided with threaded plugs or automatic drainage fittings.

2.3.4 Paint Requirements

2.3.4.1 Manufacturer's standard paint color shall be as specificed on the data sheet. (See Appendix A)

2.3.5 Accessories

2.3.5.1 Motor nameplates, attachment hardware and connection diagram shall be stainless steel and shall be located on the same side of the motor above the terminal box. Nameplates with permanent markings shall contain the following data in accordance with NEC 430-7(a), (b) and NEMA MG1.37-40, and this specification:

API Monogram and License Number
Manufacturers Name
Rated volts and full load amps
Motors for dual voltage use slash between voltages and amperes
Rated frequency and number of phases
Rated full load speed
Rated temperature rise or the insulation system class and rated ambient temperature
Duty cycle rating
Rated horsepower
Locked Rotor Indicating Code letter
A motor provided with winding temperature detectors and complying with NFPA70 National Electrical Code Section 430-32(a)(2) or (c)(2), shall be marked "Thermally Protected."
Manufacturer's (Model Number or Serial Number)
Type and Frame designation
NEMA Design Letter
Service Factor
Enclosure Type
Drive Shaft Bearing
Opposite Drive Shaft Bearing
Motor terminal connection diagram for each voltage
Manufacture date or date code

2.3.5.2 Terminal housings shall be rotatable at a maximum of 90 degree increments and shall have a securable bolted or screwed gasketed cover. The terminal box shall be provided with conduit entrance hole(s) sized in accordance with Reference (2). On TEFC motors a moisture resistant barrier shall separate the terminal housing and the motor cavity.

2.3.5.3 For open motors, rodent barriers shall be placed over frame and bracket openings. Barriers shall be made of stainless or hot dipped galvanized steel. The openings shall prevent the passage of a rod 1/2 inch in diameter.

2.3.5.4 Fastening devices and other external hardware shall be stainless steel, hot dipped galvanized, or cadmium plated materials. Fans on the TEFC motors shall be constructed from non-sparking materials.

2.3.5.5 An external grounding connection point shall be provided by drilled and tapped 3/8"-16 UNC hole, located opposite the drive end or on the same side as the junction box in a part of the metal that is an integral part of the frame. An internal grounding lug in accordance with, Reference (2) shall be installed inside the terminal housing. When specified on the user data sheet, the manufacturer shall install an external ground lug sized in accordance with Reference (10).

2.3.5.6 When motor space heaters are specified on the user data sheet, they shall be designed to maintain a temperature of 5°C above ambient as specified in Reference (9) or required by Reference (10). (See Appendix A).

2.3.5.7 Temperature Protection. If thermal motor protection is specified, the motor shall be protected by a minimum of one operative, hermetically sealed, winding temperature detector per phase, set to operate and open the motor control circuit at the maximum operating temperature of the insulating system.

SECTION 3
TESTS

3.1 Motor Testing Requirements. The original manufacturer of the equipment governed by this specification shall institute an equipment testing program to assure that the equipment meets the quality control objectives of the manufacturer. The testing of the equipment shall conform to the IEEE Standard Test Procedure for Polyphase Induction Motors and Generators, Reference (5).

3.1.1 Routine tests required and the test methods shall be selected by the manufacturer. These tests shall include, but not be limited to, the following:

Insulation Resistance Test
High Potential Test*
Winding Resistance Test
No Load Current and Power Test
Locked Rotor Current and Power*
Current Balance Test
Vibration Test

*The test values obtained during these tests must be within minimums and tolerances specified in Reference (2).

3.1.2 Each of the motor designs shall be initially tested in compliance with Reference (5), Method B (Dynamometer), Reference (11), and Reference (12) for efficiency, to determine the motor performance data. The motor performance data shall be furnished upon request. These tests shall include the following:

Temperature Rise Test
Efficiency
Losses
Power Factor
Locked Rotor Torque
Breakdown Torque

3.1.2.1 The motors shall also be initially tested for the non-standard conditions required in API Bulletin 11L5. The test results shall be reported in the form of API Bulletin 11L5 and furnished to the customer when requested.

3.1.3 Whenever the design is modified to the extent that it effects the motor performance data as specified in 3.1.2.1, the new design shall be retested as required in Sections 3.1.2 and 3.1.2.1.

APPENDIX A
MOTOR DATA SHEET

Motor Data Sheet. Appendix A is the motor data sheet that the unit shall submit to the manufacturer in addition to these specifications in order to describe particular requirements or application.

API 11: PUMPING UNIT MOTOR SPECIFICATION
USER DATA SHEET (2/7/92)

Horsepower: (Up to 200)* _____ **Volts:** ○ 460V ❑ (230-800)* _____

Phase: ○ 3-phase ❑ 1-phase **Synchronous Speed:** ○ 1200 ❑ (900-1800)* _____

Frequency: ○ 60 Hz ❑ 50 Hz **Service Factor:** ○ 1.15 ❑ (1.0-1.25)* _____

Frame Material: ○ Cast Iron ❑ Steel ❑ Aluminum **Frame Type:** ○ T ❑ U

Enclosure: ○ Open Drip-proof Guarded ❑ TEFC

Area of Classification: ○ UnClassified

❑ Class I Division 1 ❑ Class I Division 2 Group (A,B,C,D)* _____

Torque & Slip: ○ NEMA D 5%-8% ❑ NEMA C ❑ Ultra High Slip

Environmental Exposures to: ○ Paragraph 2.1.2

❑ Salt laden air ❑ Heavy Snow ❑ Blowing Sand ❑ Fungus

❑ Elevations above 3300ft (1000 meters) _____

❑ Low Temp <-13°F (-25°C) _____ ❑ High Temp >104°F (40°C) _____

Leads: ○ 3 Leads ❑ 6 Leads ❑ 9 Leads ❑ 12 Leads

Bearing Type: ○ Sealed up to 25 HP, Regreasable 30 HP and above

❑ Sealed ❑ Regreasable

Optional Accessories:

❑ Heaters 120VAC ❑ Heaters 230VAC ❑ Heaters 460VAC

❑ Accessible Grease Plug Extension ❑ Manufacturer Provides Grounding Lug

User Preference:

○ Paint-Color Manufacturer's Standard ❑ Paint - White ❑ Paint - (other color)* _____

❑ 2 Winding Temperature Detectors per Phase

❑ End-turn Encapsulation ❑ Stainless Steel Rodent Barrier

API Monogram Required on the Nameplate ○ Yes ❑ No

API Bulletin 11-5 Required with Quotation ○ Yes ❑ No

Certified Temperature & Performance Test Required with Quotation ○ Yes ❑ No

○ API Standard Unless Specified Otherwise on the User Data Sheet

❑ API Acceptable Specifications

* API Acceptable Range

Comments: _____

APPENDIX B—ELECTRIC MOTOR PERFORMANCE DATA REQUEST FORM

Manufacturer _____ Description _____

Size/HP _____ Mode _____ NEMA Rating _____ Frame _____

Voltage _____ Phases _____ Frequency (hz) _____

Model No. _____ Service Factor _____ Enclosure _____

Locked rotor torque (in-lbs.) _____ Locked rotor current (amps) _____

Stator temp. at full load (°C) _____ Ambient temp. during test (°C) _____

Class insulation _____ Minimum slow down speed (rpm) _____

Rotor and shaft inertia (lb ft-ft) _____

Breakdown torque (in-lb) (if applicable) _____ Breakdown speed (rpm) (if applicable) _____

Pull up torque (in-lb) (if applicable) _____ Pull up speed (rpm) (if applicable) _____

Measurement at	Speed (rpm)	Torque (in-lb)	Current (amps)	Power Factor (%/100)
110% of synchronous speed				
105% of synchronous speed				
Synchronous speed				
25% of full load torque				
50% of full load torque				
75% of full load torque				
Full load torque				
125% of full load torque*				
150% of full load torque*				
175% of full load torque*				
200% of full load torque*				

*Or terminate when minimum slow down speed or breakdown torque speed is reached.

❑ Typical Data

❑ Test Data

Test date _____ Approved by _____

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