MATERIAL AND EQUIPMENT STANDARD

FOR

ROTATING ELECTRICAL MACHINES

DIRECT CURRENT MOTORS

ORIGINAL EDITION

MAY 1993

This standard specification is reviewed and updated by the relevant technical committee on May 2012. The approved modifications are included in the present issue of IPS.

FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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GENERAL DEFINITIONS

Throughout this Standard the following definitions shall apply.

COMPANY :

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER :

Means the “Company" where this standard is a part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract document.

VENDOR AND SUPPLIER:

Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR :

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR :

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

WILL:

Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

MAY:

Is used where a provision is completely discretionary.

CONTENTS : PAGE No.

1. SCOPE

This Standard Specification covers the minimum technical requirements for design manufacture, quality control, testing and finishing of low voltage D.C. motors.

It specifies mechanical and electrical requirements covering dimensions of foot mounted, series, shunt or compound D.C. motors; excited compositely or separated.

The voltage and rating will be specified in data sheet.

Only the general requirements of D.C. motors are given in this Standard Specification, the specific requirements of individual motors will be given in pertinent data sheets and or requisition.

This Standard Specification shall be used for preparation of requisitions and purchase orders, and subsequently as a guideline for the manufacturers of the equipment described.

Note:

This standard specification is reviewed and updated by the relevant technical committee on May 2012. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No 348 on May 2012. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

IEC (INTERNATIONAL ELECTROTECHNICAL COMMISSION)

IEC 60027	"Letters, Symbols to be Used in Electrical Technology"
IEC 60034-1	"Rotating Electrical Machines - Part 1: Rating and Performance"
IEC 60034-2-1	"Rotating Electrical Machines - Part 2-1: Standard Methods for Determining Losses and Efficiency from Tests (excluding Machines for Traction Vehicles)"
IEC 60034-2-2	"Rotating Electrical Machines" - Part 2-2: Specific Methods for Determining Separate Losses of Large Machines from Tests-Supplement to IEC 60034-2-1
IEC 60034.5	"Part 5 Classification of Degrees of Protection Provided by Enclosures for Rotating Machines"
IEC 60034-6	"Rotating Electrical Machines" - Part 6: Methods of Cooling (IC Code)
IEC 60034-7	"Rotating Electrical Machines" - Part 7: Classification of Types of Construction, Mounting Arrangements and Terminal Box position (IM Code)
IEC 60034.8	"Part 8 Terminal Marking and Direction of Rotation of Rotating Machines"
IEC 60034-9	"Rotating Electrical Machines" - Part 9: Noise Limits
IEC 60034.11	"Rotating Electrical Machines - Part 11: Thermal Protection"
IEC 60034.14	"Rotating Electrical Machines - Part 14: Mechanical Vibration of Certain Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity"

IEC 60072-1 "Dimensions and Output Series for Rotating Electrical Machines - Part 1: Frame Numbers 56 to 400 and Flange Numbers 55 to 1080"

IEC 60072-2 "Dimensions and Output Series for Rotating Electrical Machines - Part 2: Frame Numbers 355 to 1000 and Flange Numbers 1180 to 2360"

IEC 60072-3 "Dimensions and Output Series for Rotating Electrical Machines - Part 3: Small Built-in Motors - Flange Numbers BF10 to BF50"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 31/111 "Quantities and Units of Mechanics"

ISO 775 "Cylindrical and 1/10 Conical Shaft Ends"

Note:

Where standards other than IEC are used manufacturer shall submit the pertinent deviations from IEC Standard Specification.

3. UNITS

International system of units (SI) in accordance with IPS-E-GN-100 shall be used.

4. ENVIRONMENTAL CONDITIONS

4.1 The motor specified herein will be generally installed outdoor in areas where the presence of flammable gas or vapor is foreseen. In case where the motor will be installed indoor, it will be indicated in data sheet.

4.2 In order to permit the proper selection and installation of the electrical motors, the areas in which the motor will be installed are classified. The classification of areas shall be as per article 6 of IPS-M-EL-131(2).

4.3 The electrical motor shall meet the requirements of the classified areas as specified in this specification and indicated in data sheet.

4.4 The maximum and minimum ambient air temperature, relative humidity and the elevation of the location in which the motor will be installed will be indicated in data sheet. The ambient air temperature shall in no case be assumed less than 40°C.

4.5 The conditions during transport and storage will be a temperature range of -24°C to 60°C and relative humidity of up to 98%.

The equipment subjected to these extreme conditions without being operated shall not be damaged and shall operate normally under the specified conditions.

5. BASIC DESIGN

5.1 Construction

The motor shall be horizontal and have its feet down, unless specified otherwise in data sheet.

5.2 Enclosure and Cooling

Motors shall have a degree of protection IP 41 for indoor and IP 54 for outdoor as defined in IEC 34.5, and shall have one of the following enclosures and method of cooling as defined in IEC 34.6:

a) Totally enclosed (frame surface cooled with free convection IC 40).

b) Duct ventilated (inlet duct circulated by independent coolant system, IC 17), if specified in data sheet.

5.3 Connection Leads

The standard position of connecting leads shall be fixed vertical on top of the motor.

Alternatively conduit or terminal boxes may be provided when specified by purchaser.

5.4 Shaft Extension

The shaft taper shall be 1:10 to ISO/R 775.

A shaft extension key, a locking device and a nut shall be provided on drive end only.

A shaft guard (thimble) shall be provided on the non drive end.

The dimensions for the shaft extensions and key shall be in accordance with Table II of IEC 34.13.

Note:

It is recommended that the armature construction shall enable the motor shaft to be replaceable.

5.5 Armature End Play

The axial end play of the armature shall not exceed 5 mm.

5.6 Motors Supplied from Rectified Power Supplies

Motors shall be suitable for satisfactory operation at the rated out puts listed in Table III of IEC 34.13 when supplied from rectified power source.

The manufacturer/supplier shall explain in his quotation the safe guards implemented in design of his D.C motors against the ill effects of the ripple current and the high percent of the phase control of rectified D.C sources for power supply of D.C motor(s), and precautions that shall be taken by user when ordering the required rectifier.

5.7 Field Voltage

The standard rated voltage for the field windings of separately excited motors shall be as specified in data sheet. Other voltages may be agreed between the manufacturer and the purchaser.

5.8 Winding and Insulation

Unless otherwise specified, the insulation of the windings shall be class "F", but the temperature rise of the machine shall be limited to that applicable to class "B" insulation.

All winding shall be adequately supported, braced and blocked to provide sufficient rigidity during normal conditions of service.

5.9 Field Standstill Heating

When supplied at the rated voltage, the separately-excited field windings of shunt and compound motors shall be capable of full continuous excitation at standstill without exceeding the design temperature rise.

5.10 Speed Regulation

5.10.1 Adjustable speed motors

The regulation of adjustable speed motors from no-load to the basic 60 min. rating for totally enclosed motors or at the continuous rating for ventilated motors shall not exceed the values given below as appropriate.

Base speed (%)	Maximum regulation (%)
100	15
200	20
300	25

5.10.2 Compound motors

At the 60 min. rating for totally-enclosed motors or at the continuous rating for ventilated motors, the excitation shall be 50% shunt and 50% series to within the nearest whole number of series turns.

5.11 Variation in Speed Due to Heating

The variation in speed from full load cold to full load hot during a run of rated duration shall not exceed 20% of the rated speed for totally-enclosed machines or 15% of the rated speed for ventilated machines.

5.12 Variation from Rated Speed

At normal operating temperature, rated load and voltage, and at full field, the variation above or below the rated full field speed shall not exceed 7.5%.

5.13 Direction of Rotation

All motors shall be capable of operation in either direction of rotation.

5.14 Half Coupling

Design of half coupling shall be fully coordinated with manufacture of driven equipment whose address will be put in disposal of motor manufacturer.

5.15 Nameplate

5.15.1 Each motor shall be provided with nameplate/s securely fixed to the non-removable part of the motor frame

5.15.2 The nameplate/s shall be made of stainless steel.

5.15.3 Nameplates shall be durably marked with the items specified in IEC 60034-1 as far as they apply, and shall also include the following items. The items need not all be on the same plate.

5.15.4 When special features are embodied, a plate showing appropriate instructions shall be fixed to the motor frame.

5.15.5 In addition to motor nameplate/s, a separate identification plate engraved with the motor identification number given on data sheet shall be attached to the non-removable part of the frame. It shall be possible to replace such plate by a similar plate.

5.15.6 The following minimum information shall be given on all rating plates.

1) The manufacturer's name, and order No.

2) The year of manufacture which may be included in the serial number.

3) The manufacturer's serial number.

4) The manufacturer's type designation.

5) The frame designation and shaft taper.

6) The number and date of the specification.

7) The rated D.C. voltage and current.

8) The rated power, and efficient.

9) The time rating at rated load.

10) Type and size of bearings

11) The speed at rated output (rev/min.).

12) The maximum safe operating speed (rev/min.).

13) Field winding connections (shunt, compound, or series, and separate or composite excitation).

14) The excitation voltage.

15) The class of insulation.

16) The mass of the motor (kg).

17) The type of enclosure (as supplied).

18) The airflow (m^3 /s) and pressure (Pa) for continuous rating, ventilated.

19) Maximum ambient air temperature, if other than 40oC

20) Degree of protection IP code of the motor enclosure and terminal box

21) Type of lubricant and lubricating intervals

22) Explosion protection type of the machine, terminal box and auxiliary devices in accordance with the recommendations of IEC 60079 series.

23) Gas group and temperature group of the motor in accordance with IEC 60079 series.

6. TESTS AND INSPECTION

6.1 The equipment under this specification shall be factory tested. Certified copies of test reports and/or certificates shall be submitted to the purchaser. The numbers of certified copies required will be specified by the purchaser in the purchase order.

6.2 The purchaser's inspectors shall be granted the right for inspection at any stage of manufacture and testing.

6.3 Purchaser will require the presence of his nominated representative to witness the final inspection and performance tests. For such purpose a type test on an identical machine is acceptable. The supplier shall inform the date of such tests at least four weeks in advance.

6.4 Type tests and routine tests shall be carried out according to the recommendations of IEC 60034 and the relevant IEC publications referred to therein.

The manufacturer/supplier shall submit documentary evidence of certificate of type tests showing compliance with relevant section of IEC publication 60034 for following tests:

1. No load losses and current
2. Temperature rise
3. Test to establish efficiency
4. Momentary overload
5. Commutation
6. High voltage
7. Vibration

The following final routine tests and checks shall be carried out before dispatch:

1. Measurement of winding resistance (cold)
2. Measurement of winding resistance (hot)
3. No load losses and current
4. Commutation
5. Noise measurement
6. Examination of bearing
7. Examination of accessories.
8. Insulation resistance test on windings
9. Bearing temperature rise
10. Locked rotor current
11. Locked rotor torque
12. Torque speed curve
13. Vibration severity
14. Bearings inspection

7. INFORMATION FOR MANUFACTURER/SUPPLIER

See data sheet.

8. SPARE PARTS

8.1 Together with the supply of motors under this specification, a complete set of spare parts for commissioning shall be supplied for each motor. The supplied spare parts shall comply with the same specifications as the original parts and shall be fully interchangeable with the original parts without any modification. Spare parts shall be preserved to prevent deterioration during transport and storage in a humid tropical atmosphere.

8.2 The vendor shall also supply a list of recommended spare parts for two years of operation.

9. DOCUMENTATION

9.1 The vendor shall supply the necessary information with the quotation to enable evaluation of the submitted proposal. General documents/drawings are not acceptable unless they are revised to show the equipment proposed.

The documents to be supplied with the quotation shall at least include the following:

a) Completed enquiry data sheet/s.

b) Summary of exceptions/deviations to this standard specification.

c) Brochures and catalogues containing description of typical motors.

d) Torque-speed curves.

e) Preliminary dimensional drawings.

f) Approximate shipping weights and sizes.

g) Copies of relevant certification documents.

9.2 The documents which shall be supplied together with the equipment shall at least include the following:

a) Updated and completed enquiry data sheet/s.

b) General arrangement drawings showing main dimensions, arrangement of components and terminal boxes.

c) Windings connection diagrams

d) List of components, showing complete reordering information for all replaceable parts.

e) Bearing arrangement drawing with bearing replacement procedure.

f) Installation, operation and maintenance instruction/s.

g) Recommended spare parts list for two years of operation.

h) Test reports for type tests and routine tests.

i) Certificates of conformity for Ex type motors.

10. SHIPMENT

10.1 The supplier of the equipment under this specification is the sole responsible for packaging and preparation for shipment.

10.2 The packaging and preparation for shipment shall be adequate to avoid mechanical damage during transport and handling.

10.3 Motors shall be shipped with bearing lubricated.

10.4 Rotors shall be locked during shipping to avoid damage to the bearings.

10.5 Depending on motor size and weight, motors shall be securely fastened to a hardwood skid or pallet suitable for fork truck handling, and shall be covered for protection against dirt and moisture during transport and outdoor storage.

10.6 Open cable entries on motor terminal box shall be adequately sealed before the motor is dispatched from the manufacturer's works.

10.7 Each motor package/container shall be provided with permanently attached identification tag containing necessary information together with the motor identification number indicated in data sheet Appendix A.

10.8 Silica gel or similar dehydrating compound shall be enclosed in each motor package/container.

10.9 Shipping documents with exact description of equipment for custom release shall be supplied, with the equipment.

11. GUARANTEE

11.1 The supplier of the equipment under this specification shall guarantee the equipment and shall replace any damaged equipment/parts resulting from poor workmanship and/or faulty design.

11.2 The supplier shall replace any equipment/part failed under the following conditions:

- Failure under startup and commissioning tests performed according to IEC recommendations.

- Failure under normal usage for a period of 12 months, not exceeding 18 months from the date of dispatch from the manufacturers works.

DATA SHEET FOR DIRECT CURRENT MOTORS

PROJECT NAME.....

SPECIFICATION NUMBER.....

AREA CLASSIFICATION TO IEC 79

.....

MOTOR TITLE.....

FRAME SIZE.....

MOUNTING : horizontal / verti-Cal……..

SITE RATING......kW (See environmental condition)

RATED VOLTAGE…….....VOLT ±10%

SOURCE OF SUPPLY:

D.C. genera-tor……rectifier.....,,.....

voltage of field winding of separately excited motor.....

METHOD OF EARTHING:

…….....

SPEED......rpm

TYPE OF MOTOR :

Series.....composite excitation.....separate excitation

shunt.....composite excitation.....separate excitation

compound.....composite excitation.....separate excitation

TYPE OF DUTY:

Continuous.....intermittent.....short time.....

TYPE OF BEARING :

DIRECTION OF ROTATION :

Clock-wise..... Anticlockwise.....

CLASS OF INSULATION:

PERMISSIBLE NOISE LEVEL:.....dB (A).....

DEGREES OF INGRESS PROTECTION TO IEC 34.5:.....

(to be continued)

MEANS OF COOLING TO IEC 34.6:.....

THE POSITION OF TERMINAL BOX VIEWED FROM THE DRIVE END:……..

……..

THE ORIENTATION OF TERMINAL BOX:.....

.....

…

DESCRIPTION OF:

Cable and core.....cable gland.....

Conduit and wire.....

ACCESSORIES:

Drain plug.....

Lifting eye bolt.....

Earthing bolt.....

MOMENT OF INERTIA ($I = mr^2$) OF DRIVEN MACHINE.....kgm^2

NATURE LOAD:.....

.....

ISSUE OF HALF COUPLING:……..

.....