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S. I. No. 41 of 2014

THE CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS AMENDED)

EXTRADITION ACT (MODIFICATION) ORDER, 2014

[23*rd Day of December*, 2014] Commencement.

In exercise of the powers conferred on me by section 315 of the Constitution of the Federal Republic of Nigeria, 1999 (as amended) and all other powers enabling me in that behalf, I, DR. GOODLUCK EBELE JONATHAN, President of the Federal Republic of Nigeria, make the following Order—

1. The Extradition Act, Cap. E25, Laws of the Federation of Nigeria, 2004 (in this Order referred to as the "Principal Act") is modified as set out in this Order. Modification of the Extradition Act, Cap. E25, Laws of the Federation of Nigeria, 2004.

2. The following sections of the Principal Act are modified as follows— Modification of Certain Sections of the Principal Act.

(*a*) in section 3(9), 4(2), 6(2), 7, 8 and 9, substitute the word "magistrate" with the word "judge";

(*b*) in section 12, substitute the phrase "...the High Court of the territory in which he is..." with the word "court";

(c) in section 21(1), substitute the definition of the word "court" with the phrase "means the Federal High Court";

(*d*) in section 21(1) (*b*), substitute the word "magistrate" and its definition with the phrase "judge" means a judge of the Federal High Court";

(*e*) in sections 6, 7, 8, 9 and second schedule to the Act, substitute the word "order" in relation to the powers of the Attorney-General of the Federation with the word "apply" "apply for" or "application" as the context so requires; and

(*f*) in the second schedule to the Act, substitute the word "magistrate" wherever it appears with the word "judge".

3. This Order may be cited as the Extradition Act (Modification) Order, 2014. Citation.

MADE at Abuja this 23rd day of December, 2014.

DR. GOODLUCK EBELE JONATHAN, GCFR
President, Federal Republic of Nigeria

EXPLANATORY NOTE

(This Note does not form part of the above Act but is intended to explain its purport)

This Order seeks to modify the Extradition Act, Cap. E25, Laws of the Federation of Nigeria, 2004, to bring the provisions of the Act in conformity with Section 251 of the Constitution of the Federal Republic of Nigeria 1999.

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S. I. No. 42 of 2014

NIGERIA EXPORT PROCESSING ZONES AUTHORITY

NIGERIA INTERNATIONAL COMMERCE CITY FREE ZONE

[25*th Day of September*, 2014] Commencement.

In exercise of the powers conferred on it by Sections 10(4) and 24(2) of the Nigeria Export Processing Zones Authority Cap. N107 Laws of the Federation of Nigeria, 2004 and all other powers enabling it in that behalf, the Nigeria Export Processing Zones Authority with the approval of the Honourable Minister of Industry, Trade and Investment hereby makes the following Orders—

1. In line with Section 1 (1) of the Nigeria Export Processing Zones Authority (NEPZA) Act, the Authority has obtained Presidential approval dated 4th September, 2014 and has by this Order Licensed the Nigeria International Commerce City as a Free Zone. Licensing.

2. In this Order— Interpretation.

"*Act*" means the Nigeria Export Processing Zones Authority Act, Cap. N107 Laws of the Federation of Nigeria, 2004 ; and

"*Free Zone*" means a Zone as Licensed under the Act.

3. This Order may be cited as the Nigeria Export Processing Zones Authority, (Nigeria International Commerce City, Lagos) Order, 2014. Citation.

MADE at Abuja this 25th Day of September, 2014.

MR GBENGA KUYE
Managing Director/CEO
Nigeria Export Processing Zones Authority

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S. I. No. 43 of 2014

NIGERIA EXPORT PROCESSING ZONES AUTHORITY

CENTENARY ECONOMIC CITY FREE ZONE

[25*th Day of September*, 2014] Commencement.

In exercise of the powers conferred on it by Sections 10(4) and 24(2) of the Nigeria Export Processing Zones Authority Cap. N107 Laws of the Federation of Nigeria, 2004 and all other powers enabling it in that behalf, the Nigeria Export Processing Zones Authority with the approval of the Honourable Minister of Industry, Trade and Investment hereby makes the following Orders—

1. In line with Section 1 (1) of the Nigeria Export Processing Zones Authority (NEPZA) Act, the Authority has obtained Presidential approval dated 1st September, 2014 and has by this Order Licensed the Centenary Economic City, Abuja as a Free Zone. Licensing.

2. In this Order— Interpretation.

"*Act*" means the Nigeria Export Processing Zones Authority Act, Cap. N107 Laws of the Federation of Nigeria, 2004 ; and

"*Free Zone*" means a Zone as Licensed under the Act.

3. This Order may be cited as the Nigeria Export Processing Zones Authority, (Centenary Economic City Abuja) Order, 2014. Citation.

MADE at Abuja this 25th Day of September, 2014.

MR GBENGA KUYE
Managing Director/CEO
Nigeria Export Processing Zones Authority

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S. I. No. 44 of 2014

NIGERIA EXPORT PROCESSING ZONES AUTHORITY

OGOGORO INDUSTRIAL PARK FREE ZONE

[25*th Day of September*, 2014] Commencement.

In exercise of the powers conferred on it by Sections 10(4) and 24(2) of the Nigeria Export Processing Zones Authority Cap. N107 Laws of the Federation of Nigeria, 2004 and all other powers enabling it in that behalf, the Nigeria Export Processing Zones Authority with the approval of the Honourable Minister of Industry, Trade and Investment hereby makes the following Orders—

1. In line with Section 1 (1) of the Nigeria Export Processing Zones Authority (NEPZA) Act, the Authority has obtained Presidential approval dated 16th April, 2014 and has by this Order Licensed the Ogogoro Industrial Park as a Free Zone. Licensing.

2. In this Order— Interpretation.

"*Act*" means the Nigeria Export Processing Zones Authority Act, Cap. N107 Laws of the Federation of Nigeria, 2004 ; and

"*Free Zone*" means a Zone as Licensed under the Act.

3. This Order may be cited as the Nigeria Export Processing Zones Authority, (Ogogoro Industrial Park, Lagos) Order, 2014. Citation.

MADE at Abuja this 25th Day of September, 2014.

MR GBENGA KUYE
Managing Director/CEO
Nigeria Export Processing Zones Authority

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S. I. No. 45 of 2014

NIGERIA EXPORT PROCESSING ZONES AUTHORITY

OGIDIGBEN INDUSTRIAL PARK FREE ZONE

[25*nd Day of September*, 2014] Commencement.

In exercise of the powers conferred on it by Sections 10(4) and 24(2) of the Nigeria Export Processing Zones Authority Cap. N107 Laws of the Federation of Nigeria, 2004 and all other powers enabling it in that behalf, the Nigeria Export Processing Zones Authority with the approval of the Honourable Minister of Industry, Trade and Investment hereby makes the following Orders—

1. In line with Section 1 (1) of the Nigeria Export Processing Zones Authority (NEPZA) Act, the Authority has obtained Presidential approval dated 17th February, 2014 and has by this Order Licensed the Ogidigben Industrial Park as a Free Zone. Licensing.

2. In this Order— Interpretation.

"*Act*" means the Nigeria Export Processing Zones Authority Act, Cap. N107 Laws of the Federation of Nigeria, 2004 ; and

"*Free Zone*" means a Zone as Licensed under the Act.

3. This Order may be cited as the Nigeria Export Processing Zones Authority, (Ogidigben Industrial Park, Delta) Order, 2014. Citation.

MADE at Abuja this 25th Day of September, 2014.

MR GBENGA KUYE
Managing Director/CEO
Nigeria Export Processing Zones Authority

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S. I. No. 46 of 2014

NIGERIA EXPORT PROCESSING ZONES AUTHORITY

NAHCO FREE ZONE

[*25th Day of September*, 2014] Commencement.

In exercise of the powers conferred on it by Sections 10(4) and 24(2) of the Nigeria Export Processing Zones Authority Cap. N107 Laws of the Federation of Nigeria, 2004 and all other powers enabling it in that behalf, the Nigeria Export Processing Zones Authority with the approval of the Honourable Minister of Industry, Trade and Investment hereby makes the following Orders—

1. In line with Section 1 (1) of the Nigeria Export Processing Zones Authority (NEPZA) Act, the Authority has obtained Presidential approval dated 17th February, 2014 and has by this Order Licensed the NAHCO Free Zone. Licensing.

2. In this Order— Interpretation.

"*Act*" means the Nigeria Export Processing Zones Authority Act, Cap. N107 Laws of the Federation of Nigeria, 2004 ; and

"*Free Zone*" means a Zone as Licensed under the Act.

3. This Order may be cited as the Nigeria Export Processing Zones Authority, (NAHCO Free Zone, Lagos) Order, 2014. Citation.

MADE at Abuja this 25th Day of September, 2014.

MR GBENGA KUYE
Managing Director/CEO
Nigeria Export Processing Zones Authority

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DIPLOMATIC IMMUNITIES AND PRIVILEGES ACT CAP. D9, LAWS OF THE FEDERATION OF NIGERIA, 2004

DIPLOMATIC IMMUNITIES AND PRIVILEGES (ASSOCIATION OF NATIONAL OLYMPIC COMMITTEES OF AFRICA) ORDER, 2014

ARRANGEMENT OF PARAGRAPHS

Paragraphs :

S. I. No. 47 of 2014

DIPLOMATIC IMMUNITIES AND PRIVILEGES ACT CAP. D9, LAWS OF THE FEDERATION OF NIGERIA, 2004

DIPLOMATIC IMMUNITIES AND PRIVILEGES (ASSOCIATION OF NATIONAL OLYMPIC COMMITTEES OF AFRICA) ORDER, 2014

[*8th Day of December*, 2014] Commencement.

In exercise of the powers conferred on me by Section 11 of the Diplomatic Immunities and Privileges Act Cap. D9, Laws of the Federation of Nigeria 2004, and all other powers enabling me in that behalf, I, AMBASSADOR AMINU BASHIR WALI, Minister of Foreign Affairs, hereby make the following Order—

The Association of National Olympic Committees of Africa.

1. The Association of National Olympic Committees of Africa (hereinafter referred to as the "ANOCA" is an association of which the Federal Government of Nigeria and the governments of foreign sovereign states are members.

Legal capacity.

2.—(1) The ANOCA shall have the legal capacity of a body corporate.

(2) The ANOCA shall have immunity from suits and legal processes except where it has expressly waived its immunity and a waiver of immunity shall not be deemed to extend to any measure of execution.

Inviolability of premises and official archives.

3.—(1) The ANOCA shall have the same inviolability of official archives and residence as would be accorded to official archives and residence of an envoy of a foreign sovereign power accredited to Nigeria.

(2) Notwithstanding the provisions of sub-paragraph (1) of this paragraph, all residences, archives and assets of the ANOCA shall, for the purpose of public safety and order, be subject to the laws of Nigeria.

Exemption from certain taxes, rates and custom duties.

4.—(1) The ANOCA shall have the same exemption from taxes and rates, other than taxes on the importation of goods, as would be accorded a foreign sovereign power.

(2) Subject to the compliance with such conditions as the Minister in charge of finance may prescribe for the protection of the revenue of Nigeria, the ANOCA shall be exempted from taxes on the importation of goods directly imported by it for its official use in Nigeria or for exportation, or on the importation of any publications of the ANOCA directly imported by it.

(3) The ANOCA shall be exempted from prohibitions and restrictions on importation or exportation in the case of goods directly imported or exported by the ANOCA for its official use and in the case of any publication of the ANOCA directly imported or exported by it.

(4) The ANOCA shall have the right to avail itself, for telegraphic communications sent by it and containing only matters intended for publication by the press or for broadcasting, including communications addressed to or despatched from places outside Nigeria, of any reduced rates applicable for the corresponding service in the case of press telegrams.

Immunities and privileges of the resident representatives.

5.—(1) The representatives of member governments to the General Assembly and any committee provided for in the constitution of the ANOCA shall, while exercising their functions, enjoy—

(*a*) immunity from personal arrest or detention and from seizure of their personal baggage and inviolability of all papers and documents ;

(*b*) immunity from legal process of every kind in respect of words spoken or written and all acts done by them in their capacity as representatives ;

(*c*) the same exemption from taxes as is accorded to an envoy of a foreign sovereign power accredited to Nigeria and where any form of taxation depends on residence, the representatives shall not be deemed to be resident in Nigeria during any period when they are present in Nigeria whilst exercising their functions or during their journey to and from the place of meeting, however the exemption from taxes shall not include exemption from customs and excise duties except with respect to goods imported as personal baggage.

(2) For the purpose of the application of this Order, the expression "representatives of member governments" shall be deemed to include their official staff accompanying them as representatives, delegates, advisers or technical experts.

(3) The provisions of this paragraph shall not confer any immunity or privilege upon any person as the representative of the Federal Government of Nigeria or as a member of the staff of such a representative.

Immunities and privileges of the President. Vice-President etc. of the ANOCA.

6. Except where any privilege or immunity is waived by the ANOCA, the President, Vice Presidents, Secretary-General and Treasurer of the ANOCA, their spouses and children under the age of 21, shall be accorded immunity from any legal process, inviolability of residence and exemption or relief from taxes as would be accorded to an envoy of a foreign sovereign power accredited to Nigeria, including exemption or relief from income tax in respect of emoluments received by them as officers of the ANOCA.

Immunities and privileges of persons serving on committees or on missions on behalf of the ANOCA.

7. Except where any privilege or immunity is waived by the organisation, persons other than officials of the ANOCA, serving on committees of, or employed on missions on behalf of the ANOCA shall enjoy immunity from—

(*a*) personal arrest or detention and from seizure of their personal baggage and inviolability of all papers and documents relating to the work of the ANOCA while exercising their functions and during their journey to and from the place of meeting ; and

(*b*) legal process in respect of words spoken or written and all acts done by them in the exercise of these functions.

Other officials of the ANOCA.

8. Except where any privilege or immunity is waived by the ANOCA, officials of the ANOCA, other than those referred to in paragraph 6 of this Order, shall enjoy—

(*a*) immunity from legal process in respect of words spoken or written and all acts done by them in the course of the performance of their official functions ; and

(*b*) exemption from income tax in respect of emoluments received by them as officers or servants of the ANOCA.

General.

9. The names of the persons to whom the provisions of paragraphs 5, 6, 7 and 8 of this Order apply shall be set forth in a list compiled and published from time to time by the Minister in charge of foreign affairs and such list shall show, in regard to each person, the date as from which for the purpose of this Order he first held the office or employment in question, and the date when he ceased to hold that office or employment.

Citation.

10. This Order may be cited as the Diplomatic Immunities and Privileges (Association of National Olympic Committees of Africa) Order, 2014.

MADE in Abuja this 8th day of December, 2014.

AMBASSADOR AMINU BASHIR WALI, mni, CON
Honourable Minister of Foreign Affairs

Explanatory Note

(This note does not form part of the above Order but is intended to explain its purport)

This Order grants immunities and privileges to the Association of National Olympic Committees of Africa pursuant to Section 11 of Diplomatic Immunities and Privileges Act, Cap. D9, Laws of the Federation of Nigeria, 2004.

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CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (REGULATIONS FOR THE CONDUCT OF POLITICAL PARTY PRIMARIES), 2014

ARRANGEMENT OF REGULATIONS

Regulations :

S. I. No. 48 of 2014

CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED) ELECTORAL ACT, 2010 (AS AMENDED)

INDEPENDENT NATIONAL ELECTORAL COMMISSION (REGULATIONS FOR THE CONDUCT OF POLITICAL PARTY PRIMARIES), 2014

[27*th Day of October*, 2014] Commencement.

In exercise of the powers conferred upon it by paragraph 15 (c), Part I of the Third schedule to the Constitution of the Federal Republic of Nigeria 1999 (as altered), Section 153 of the Electoral Act 2010 (as amended) and all other powers enabling it in that behalf, the Independent National Electoral Commission (herein after referred to as "the Commission") issues the following Regulationss—

PART I—POLITICAL PARTY PRIMARIES

Party Primaries.

1. A political party seeking to participate in any election organized by the Commission shall for the purpose of selecting candidates for elective positions—

(*a*) conduct primaries ; and

(*b*) give all eligible members of the party equal opportunity to participate in the primaries of the party.

Party Rules and Conditions for Nomination.

2.—(1) A political party shall not create rules, impose conditions or set high expression of interest or nomination fees that may exclude aspirants on the basis of sex, religion, ethnicity, circumstance of birth or wealth.

(2) The Commission may of its own motion or based on a complaint made by any member of a political party—

(*a*) determine whether any of the rules, conditions or fees mentioned under sub-regulation (1) of this regulation is excessive, unreasonable or in violation of these Regulations ; and

(*b*) require that the rules, conditions or fees be amended as the Commission may determine.

(3) A Political Party conducting primaries shall ensure that aspirants for elective office who are approved to participate in its primaries are eligible to contest in elections in accordance with the Constitution of the Federal Republic of Nigeria, 1999 (as altered).

(4) No Political Party shall set criteria or conditions to pre-qualify an aspirant to contest in its primaries as candidate unless the criteria or conditions are in line with the Constitution of the Federal Republic of

Constitution of the party, as approved by the Commission, and the Regulations, Guidelines and Directives of the Commission.

(5) The Commission may of its own motion or based on a complaint made by any member of a political party determine whether any of the conditions or criteria imposed by a political party to pre- qualify an aspirant to contest its primaries is in violation of the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act 2010 (as amended), the Constitution of the Party, as approved by the Commission, and the Regulations, Guidelines and Directives of the Commission.

(6) Where a Party is in violation, the Commission may require the Party to sets aside the criteria or condition or amend it to comply with the Law.

(7) In line with the provisions of the Electoral Act, 2010 (as amended) and all other Regulations, Guidelines and Directives of the Commission, all Political parties shall hold its Primaries directly or indirectly.

Notification on Type of Primaries.

3. A political party shall, not later than 21 days to the date of its primaries, notify the Headquarters of the Commission, in writing, stating whether it wants to use either direct or indirect method in conducting its primaries.

Notice of Primaries.

4.—(1) A political party shall notify the Commission in writing, not later than 21 days to the date of the primaries, the specific location, venue, date and time for the conduct of its nomination of candidates into various elective positions.

(2) The notices mentioned in sub-regulation (1) of this regulation shall be submitted to the Headquarters of the Commission and signed by both the National Chairman and the National Secretary of the Political Party.

Required Documentation.

5. Notices of party primaries shall be accompanied by the following documents—

(*a*) list of aspirants seeking nomination to contest the relevant elective positions ;

(*b*) list of members of the Election Committee of the party conducting the primaries ;

(*c*) list of delegates for the primaries ;

(*d*) 50 copies of the guidelines or rules issued by the party for the conduct of the primaries, congresses or conventions ;

(*e*) 10 copies of the Constitution of the party certified by the Commission ;

(*f*) result sheets containing the list of elected candidates and their scores ;

(*g*) elected candidates and their scores ; and

[illegible] from time to time be determined by

Party Register for Direct Primaries.

6. A political party intending to organize its primaries by direct method shall maintain a proper and duly certified membership register, which shall be available for inspection by the Commission, the aspirants and any party member that requests same.

Indirect Primaries.

7.—(1) A political party intending to organize its primaries by indirect method shall provide to the Commission not later than 7 days to the date of the primaries, the list of electors that will form the delegates for every elective position.

(2) The list of delegates shall include the names, addresses and contact details of the said delegates.

Selection of Delegates.

8.—(1) All delegates shall be of voting age as prescribed by the Constitution of the Federal Republic of Nigeria, 1999 (as altered) and Electoral Act, 2010 (as amended).

(2) The procedure for the selection of delegates to participate in the nomination of candidates for elective positions shall be clearly stipulated in the regulation and governing rules of the party.

(3) Political parties shall comply with its Rules and Procedure for the selection of delegates, to participate in the primaries.

Conduct of Primaries, Venue and Rescheduling.

9.—(1) The primaries of a political party shall be held in the presence of officials of the Commission who shall determine whether the primaries is conducted in compliance with the provisions of the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act, 2010 (as amended) and these Regulations.

(2) All political party primaries shall be conducted strictly in compliance with—

(*a*) the Constitution of the Federal Republic of Nigeria, 1999 (as altered) ;

(*b*) the Electoral Act 2010 (as amended) ;

(*c*) the Regulations, Guidelines and Directives of the Commission ;

(*d*) relevant provisions of the Constitution of the Party ; and

(*e*) party guidelines for conduct of primaries, congresses and conventions.

(3) Conduct of primaries shall commence at the time and venue provided in the relevant notice communicated to the Commission by a political party.

(4) Rescheduling of any scheduled primary shall be by a written communication to the Commission not later than 7 days to the new date, clearly stating the reasons for rescheduling, the new date and the venue.

(5) The Chairman or Secretary of the relevant Party Electoral Committee conducting a primary shall provide a signed copy of the result sheet for the primary immediately after the declaration of the result.

(6) The result sheet mentioned under sub-regulation (5) of this regulation shall be handed over to the Commission's Monitoring Team at the venue of the primary.

(7) Political Party primaries shall be conducted in easily accessible public venues without restriction against any aspirant or delegate.

Compliance with Relevant Laws.

10.—(1) A Political Party shall only submit to the Commission as candidates, aspirants that emerged winner in its primaries, in compliance with the Constitution of the Federal Republic of Nigeria, 1999 (as altered), Electoral Act 2010 (as amended), these Regulations and its rules and regulations.

(2) The Commission shall have power to verify the claims made by a political party on its compliance with the provisions of sub-regulation (1) of this regulation.

(3) The Commission may in verifying the claims of any political party, require the political party to provide it with any specific or other additional information necessary and expedient for carrying out its functions.

(4) Where the Commission is not satisfied that a political party has carried out its primaries in accordance with the Constitution of the Federal Republic of Nigeria, 1999 (as altered), Electoral Act 2010 (as amended), its own rules and regulations or in accordance with the Regulations, Guidelines and Directives of the Commission, it shall notify the said political party of its observation within 7days of the conduct of the primaries.

(5) In notifying the Political Party, the Commission shall state the grounds for its determination of non-compliance.

(6) A political party notified in accordance with sub-regulation (5) of this regulation, shall take steps to comply with all requirements for proper primaries.

PART II—MISCELLANEOUS

Review of these Regulations.

11. These Regulations may from time to time be reviewed to conform with the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act, 2010 (as amended) and any other relevant law.

Citation.

12. These Regulations may be cited as the Independent National Electoral Commission (Regulations for the Conduct of Political Party Primaries), 2014.

ISSUED at Abuja this 27th day of October, 2014.

PROF. ATTAHIRU M. JEGA, OFR
Chairman
Independent National Electoral Commission

EXPLANATORY MEMORANDUM

(This Memorandum does not form part of these Regulations, but intends to explain its purports)

These Regulations is made to ensure compliance with the Legal Process of selection of candidates and the conduct of free, fair and transparent primaries by all Political Parties in Nigeria.

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CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR THE REGISTRATION OF POLITICAL PARTIES), 2014

ARRANGEMENT OF PARAGRAPHS

Paragraph :

S. I. No. 49 of 2014

CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR THE REGISTRATION OF POLITICAL PARTIES), 2014

[*6th Day of March*, 2014] Commencement.

In exercise of the powers conferred upon it by paragraph 15 (*b*), Part I of the Third schedule to the Constitution of the Federal Republic of Nigeria 1999 (as altered), Section 153 of the Electoral Act 2010 (as amended) and all other powers enabling it in that behalf, the Independent National Electoral Commission (herein after referred to as "the Commission") issues the following Guidelines—

Registration of Political Parties.

1. A political association may be registered in accordance with the provisions of—

(*a*) the Constitution of the Federal Republic of Nigeria, 1999 (as altered) and the Electoral Act, 2010 (as amended), set out in the abstract to these Guidelines ;

(*b*) these Guidelines ; and

(*c*) any other Regulations, Guidelines or Manual issued by the Commission.

Political Association.

2. For the propose of these Guidelines, a political association is an organization or association of persons seeking registration as a political party in order to participate in an election by meeting all the prescribed statutory requirements.

Procedure for Filling Application.

3.—(1) Political association intending to register as a political party shall first apply to the Commission for Guidelines and Regulations for the registration of a political party.

(2) The application for registration as a political party shall be made on the Commission's FORM PAI in 50 copies and shall be accompanied by documents showing the following—

(*a*) the name of the proposed political party ;

(*b*) the names, signatures and residential addresses of the Chairman and Secretary of the association filling the application ;

(*c*) evidence of payment of the prescribed non-refundable administrative fee of ₦1,000,000.00 or any other amount that may be fixed, in bank draft to the Commission ; and

(*d*) 50 copies each of the Association's Draft Constitution and Manifesto.

Condition for Registration of Political Party.

4. No Association by whatever name called shall be registered as a political party unless the association submits to the office of the Chairman of the Commission the following—

(*a*) the names, residential addresses and States of origin of members of its National and State executive committees and the records of proceedings of meeting where these officers were elected ;

(*b*) the minutes of the meeting of members of National Executive Committee indicating approval and adoption of the Name, Constitution, manifesto and Symbol or Logo of the proposed political party ;

(*c*) the name or acronym of the association shall not—

(*i*) be the same as the name or acronym of an existing party or any known registered political party or too similar as to create confusion or doubt in the mind of a voter at an election,

(*ii*) have any ethnic, religious, professional or other sectional connotation,

(*iii*) give the appearance that its activities are confined to only a certain part or parts of the country ;

(*d*) a register showing that membership is open to every citizen of Nigeria ;

(*e*) a draft copy each of the association's Constitution and Manifesto containing among other things—

(*i*) the association's name, symbol or logo, flag, motto, aims and objectives, the distinctive description and interpretation of the symbol or logo,

(*ii*) provisions for periodic elections on democratic basis of the principal officers and members of the Executive Committee or other governing bodies,

(*iii*) provision of an administrative structure for the association,

(*iv*) a provision that the membership of the National Executive or other governing bodies of the association at the National level reflect the Federal Character Principle of the Constitution of Federal Republic of Nigeria, 1999 (as altered),

(*v*) a provision showing that its Constitution and Manifesto conform with the provisions of the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act 2010 (as amended) and these Guidelines,

(*vi*) a provision on the Code of Conduct of members,

(*vii*) a provision relating to disciplinary procedure of the association stating clearly the method of expulsion, replacement, resignation and appointment of an ordinary member, party official, political office holder

including persons elected into public office on the platform of the association or party,

(*viii*) a provision relating to the method of amendment or alteration of its Constitution, and

(*ix*) a provision stating that the National Headquarters of the association is located in the Federal Capital Territory ;

(*f*) a register showing the names, contact addresses, phone numbers and e-mail addresses of persons in at least 24 states of the Federation and FCT who are members of the association, as listed in Form PA IA ;

(*g*) a membership register at its National Headquarters, which shall form part of the documents to be provided for the annual audit by firms appointed by the Commission ;

(*h*) an affidavit sworn to by the Chairman and Secretary of the association to the effect that no member of the National Executive of the association is a member of any other existing party or existing political association ;

(*i*) a bank statement indicating the Bank Account into which all income of the proposed political association has been paid and shall continue to be paid and from which all expenses are paid and shall be paid : and

(*j*) the address of its Headquarters office in Abuja and the addresses of its offices, list of its staff, list of its operational equipment and furniture in at least 24 States of the Federation, including evidence of—

(*i*) appointment of each administrative staff listed in Form PA I, and

(*ii*) lawful occupation of office accommodation.

(2) where there is any alteration to the registered Constitution of a political party in accordance with paragraph 4 (1) (*e*) (*viii*)—

(*a*) it shall not be accepted, unless notice of the meeting at which the alteration was approved is given to the Commission not less than 7days before the meeting ;

(*b*) the political party shall within 30 days of the alteration, submit the amended Constitution to the Commission ; and

(*c*) 50 copies of all alterations to the Constitution of a political party shall be registered with the Commission ;

Symbol, Logo and Flag of the Association.

5. The symbol, Logo and flag of the association shall not portray any of the following—

(*a*) coat of Arms of the Federation :

(*b*) coat of Arms of any other Country :

(*c*) any device or emblem which is normally associated with any of the following—

(*i*) any official acts of Government, Armed Forces of the Federation, Nigeria Police Force or other uniformed services,

(*ii*) any tribe or ethnic group,

(*iii*) any religion or cult, and

(*iv*) regalia of a Chief etc. ;

(*d*) a portrait of any person living or dead :

(*e*) a symbol or logo which has been registered by another political party in Nigeria or political association or any public organization.

Membership of Political Association seeking to be Registered as a Political Party.

6. A person shall be eligible to be registered as member of political association seeking to be registered as a political party, where—

(*a*) he has attained the age of 18 years ;

(*b*) he is not in the Civil Service of the Federation, a State, Local Government or Area Council ;

(*c*) the membership is in his personal capacity and not by reason of being a member of a youth club, wing or vanguard etc ; and

(*d*) he is a citizen of Nigeria irrespective of his place of origin, circumstance of birth, sex, religion or ethnic grouping.

Consideration of Application for Registration.

7. On the receipt of the application and completed accompanying documents, (PA 1 and other attached documents) from the association wishing to be registered as a political party, the Commission shall consider the application and verify the claims of the association.

Verification of Claims.

8.—(1) The Commission in verifying the claims of the political association shall among other things—

(*a*) check whether the membership contravenes any of the provisions of paragraph 6 of these Guidelines ;

(*b*) ascertain whether the—

(*i*) association has officers in at least 24 States of the Federation and in the Federal Capital Territory as required under paragraph 4 of these Guidelines,

(*ii*) Constitution or ideology and Manifesto of the association comply with the provisions of the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act 2010(as amended) and these Guidelines,

(*iii*) composition of members of its Executive Committees take into account the Federal Character Principle of the Federation,

(*iv*) the name, acronym, motto, symbol, or logo do not offend the provisions of the Constitution Federal Republic of Nigeria, 1999 (as altered), the Electoral Act 2010 (as amended) and these Guidelines, and

(*v*) association is structured and committed to the principles of democracy and other social objectives as set out in Chapter 2 of the Constitution of the Federal Republic of Nigeria, 1999 (as amended).

(2) The names and addresses of the National officers of the association shall be verified and registered by the Commission.

(3) The names and addresses of the National officers of the association shall be verified and deemed registered where there is—

(*a*) proof of identity of each member with either a valid driver's license, international passport, National Identity Card or Voter's Card ;

(*b*) indigene certificate confirming that members of the National Executive Committee are indigenes of the States indicated against their names in Form PA I ;

(*c*) physical attendance of members of the National Executive Committee during verification ; and

(*d*) proof of address using a copy of a utility bill bearing the name of the National officer or Landlord.

Registration by the Commission.

9.—(1) Where the Commission is satisfied that the association has fulfilled all the conditions prescribed for registration under the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act 2010 (as amended) and these Guidelines, it shall register the association as a political party.

(2) Where the Commission is not satisfied that the association has fulfiled all the conditions prescribed for registration it shall—

(*a*) not register the association as a political party ; and

(*b*) notify the association within 7 days out of the 30 working days period for registration of association as a political party.

(3) in notifying the political association under paragraph 9(2)(*b*), the Commission shall state in writing, the grounds for its refusal to register such political association.

(4) any false declaration shall result in non-registration of a political association as a political party or the withdrawal of its certificate of registration by the commission.

(5) A political association shall comply with all statutory registration requirements within 30 working days period from the date it acknowledges the receipt of Form PA I from the Commission.

(6) The 30 working days period referred to in paragraph 9 (5) shall include the period within which the association may rectify any defect or non-conformity with the statutory requirements, provided that, the rectification of

defect or non-conformity shall not attract payment of fresh administrative fee of ₦1,000,000.00.

(7) Where an application of association is terminated it may re- apply with necessary corrections within the 30 working days period without having to pay a fresh administrative fees of ₦1,000,000.00.

Termination of Application for Registration.

10. An application by a political association may be terminated where the—

(*a*) association fails to submit all documents supporting its application at the expiration of 30 working days from the date it receives Form PA I from the Commission ; and

(*b*) Commission determines that the association has failed to comply with the constitutional conditions for registration within 30 working days from the date it submits the completed Form PA I and other supporting documents.

Citation.

11. These Guidelines may be cited as the Independent National Electoral Commission (Guidelines for the Registration of Political Parties), 2014.

(Paragraph 1)

EXTRACTS OF CONSTITUTIONAL REQUIREMENTS FOR REGISTRATION OF NEW POLITICAL PARTIES

Section 221 : No association, other than a political party, shall canvass for votes for any candidate at any election or contribute to the funds of any political party or to the election expenses of any candidate at an election.

Section 222 : No association by whatever name called shall function as a political party unless—

(*a*) the names and addresses of its national ofücers are registered with the Independent National Electoral Commission ;

(*b*) the membership of the association is open to every citizen of Nigeria irrespective of his place or origin, circumstance of birth, sex, religion or ethnic grouping :

(*c*) a copy of its constitution is registered in the principal office of the Independent National Electoral Commission in such form as may be prescribed by the Independent National Electoral Commission ;

(*d*) any alteration in its registered constitution is also registered in the principal office of the Independent National Electoral Commission within thirty (30) days of the making of such alteration :

(*e*) the name of the association, its symbol or logo does not contain any ethnic or religious connotation or give the appearance that the activities of the association are confined to a part of the geographical area of Nigeria ; and

(*f*) the headquarters of the association is situated in the Federal Capital Territory, Abuja.

Section 223—(1) The Constitution and rules of a political party shall—

(*a*) provide for the periodical election on a democratic basis of the principal officers and members of the executive committee or other governing body of the political party ; and

(*b*) ensure that the members of the executive committee or other governing body of the political party reflect the Federal Character of Nigeria.

(2) For the purpose of this Section—

(a) the election of the officers or members of the executive committee or other governing body of a political party shall be deemed to be periodical only if it is made at regular intervals of not exceeding four (4) years ; and

(*b*) the members of the Executive Committee or other governing body of the political party shall be deemed to reflect the Federal Character of Nigeria only if the members thereof belong to different States not being

less in number than two-thirds of all the States of the Federation and the Federal Capital Territory, Abuja.

Section 224—The programme as well as the aims and objects of a political party shall conform with the provisions of Chapter II of the 1999 Constitution as amended.

Section 225—(1) Every political party shall, at such times and in such manner as the Independent National Electoral Commission may require, submit to the Independent National Electoral Commission and publish a statement of its assets and liabilities.

(2) Every political party shall submit to the Independent National Electoral Commission a detailed annual statement and analysis of its sources of funds and other assets together with a similar statement of its expenditure in such form as the Commission may require.

(3) No political party shall—

(*a*) hold or possess any funds or other assets outside Nigeria ; or

(*b*) be entitled to retain any funds or assets remitted or sent to it from outside Nigeria.

(4) Any funds or other assets remitted or sent to a political party from outside Nigeria shall be paid over or transferred to the Commission within twenty-one days of its receipt with such information as the Commission may require.

(5) The Commission shall have power to give directions to political parties regarding the books or records of financial transactions which they shall keep and, to examine all such books and records.

(6) The powers conferred on the Commission under subsection (4) of this section may be exercised by it through any member of its staff or any person who is an auditor by profession, and who is not a member of a political party.

Section 226—(1) The Independent National Electoral Commission, shall in every year prepare and submit to the national Assembly a report on the accounts and balance sheet of every political party.

(2) It shall be the duty of the Commission, in preparing its report under this section, to carry out such investigations as will enable it to form an opinion as to whether proper books of accounts and proper records have been kept by any political party, and if the Commission is of the opinion that proper books of accounts have not been kept by a political party, the Commission shall so report.

(3) Every member of the Commission or its duly authorized agent shall—

(*a*) have a right of access at all times to the books and accounts and vouchers of all political parties ; and

(*b*) be entitled to require from the officers of the political party such information and explanation which to the best of his knowledge and belief are necessary for the performance of his duties under the Constitution and if the member of the commission or such agent fails or is unable to obtain all the information and explanation which to the best of his knowledge and belief are necessary for the purpose of the investigation, the Commission shall state that fact in its report.

Section 227—No association shall retain, organize, train or equip any person or group of persons for the purpose of enabling them to be employed for the use or display of physical force or coercion in promoting any political objective or interest or in such manner as to arouse reasonable apprehension that they are organized and trained or equipped for that purpose.

ELECTORAL ACT 2010 (AS AMENDED)

Section 78.—(1) A political association that complies with the provisions of the of the Constitution and this Act for the purposes of registration shall be registered as a political party, Provided that such application for registration as a political party shall be duly submitted to the Commission not later than 6 months before a general election.

(2) The Commission shall, on receipt of the documents in fulfillment of the conditions stipulated by the Constitution, immediately issue the applicant with a letter of acknowledgment stating that all necessary documents have been submitted to the Commission.

(3) If the Association has not fulfilled all the conditions under this section, the Commission shall within 30 days from the receipt of its application notify the association in writing stating the reasons for non-registration.

(4) A political association that meets the conditions stipulated in the Constitution and this Act shall be registered by the Commission as a political party within 30 days from the date of receipt of the application, and if after the 30 days such association is not registered by the Commission unless the Commission informs the association to the contrary it shall be deemed to have been registered.

(5) An association which, through the submission of false or misleading information pursuant to the provisions of this section, procures a certificate of registration shall have such certificate cancelled.

(6) An application for registration as a political party shall not be processed unless there is evidence of payment of administrative fee as may be fixed from time to time by the Commission.

(7) The Commission shall have power to de-register political parties on the following grounds—

(*i*) breach of any of the requirements for registration, and

(*ii*) for failure to win a seat in the National or State Assembly election.

Section 82—(1) The Commission shall keep a register of symbols for use at elections.

(2) The Commission shall register the symbols of a political party if it is satisfied that—

(*a*) another symbol of the same design is not registered ;

(*b*) the symbol is distinctive from any other symbol already registered ; and

(*c*) its use will not be offensive or otherwise objectionable.

(3) The Commission shall remove a symbol from the register of symbols if—

(*a*) the political party in whose name it is registered requests the removal ; or

(*b*) the Commission is of the opinion that the political party or independent candidate in whose name the symbol is registered has ceased to exist or to use the symbol.

(4) Nothing in this section shall authorized the allotment or registration for use at any election of a symbol or materials as symbol of a party, if it portrays—

(*a*) the Coat of Arms of the Federation ;

(*b*) the Coat of Arms of any other country ;

(*c*) a device or emblem which in the opinion of the Commission is normally associated with—

(*i*) the official acts of Government ;

(*ii*) any of the Armed Forces of the Federation or the Nigeria Police Force or other uninformed service ;

(*iii*) the regalia of a Chief ;

(*iv*) any tribe or ethnic group ;

(*v*) any religion or cult ;

(*vi*) any portrait of a person living or dead ; or

(*c*) any symbol or part of a symbol which under the provision of this section continues to be registered by another political party.

(5) Subject to the provisions of this section, the symbol allotted to a political party and in use immediately before the coming into force of this Act shall continue to be available to, and be used by, that political party without payment of the fee.

ISSUED at Abuja this 6th day of March, 2014.

PROF. ATTAHIRU M. JEGA, OFR
Chairman
Independent National Electoral Commission

EXPLANATORY MEMORANDUM

(This memorandum does not form part of these Guidelines, it tends to explain its puport)

These Guidelines makes provision for the procedure and requirement to be complied with by an association seeking to be registered as a political party in Nigeria.

Federal Republic of Nigeria Official Gazette

No. 129 Lagos - 24th January, 2014 Vol. 101

Government Notice No. 247

The following is published as supplement to this *Gazette* :

S.I. No.	*Short Title*	*Page*
50	Independent National Electoral Commission (Manual for Monitoring Political Party Congresses, Conventions and Primaries), 2014 ..	B565-571

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CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (MANUAL FOR MONITORING POLITICAL PARTY CONGRESSES, CONVENTIONS AND PRIMARIES), 2014

ARRANGEMENT OF PARAGRAPHS

Paragraph :

S. I. No. 50 of 2014

CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (MANUAL FOR MONITORING POLITICAL PARTY CONGRESSES, CONVENTIONS AND PRIMARIES), 2014

[21*st Day of January*, 2014] Commencement.

In exercise of the powers conferred upon it by paragraph 15 (c), Part I of the Third Schedule to the Constitution of the Federal Republic of Nigeria 1999 (as altered), Section 153 of the Electoral Act 2010 (as altered) and all other powers enabling it in that behalf, the Independent National Electoral Commission (herein after referred to as "the Commission") issues the following Manual—

1. These Manual shall guide the Commission monitors in carrying out effective monitoring and reporting of— Purpose of these Manual.

(*a*) Party Congresses at Ward, LGA or Area Council and State Levels ;

(*b*) Party Primaries ; and

(*c*) Party National Conventions.

2.—(1) In line with the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Electoral Act, 2010 (as amended), the Regulations, Guidelines and Manuals relating to conventions, congresses, conferences and meetings of registered political parties, issued by the Commission, a political party shall give the Commission 21 days notice of its conventions, congresses, conferences or meetings, in accordance with Section 85 of the Electoral Act, 2010 (as amended)— Party Monitoring.

(*a*) stating the venue, date and time of the convention, congress, conference or meeting ;

(*b*) signed by the National Chairman, Secretary or other authorized signatories of the Party ; and

(*c*) accompanied with the Copy of its Constitution certified by the Commission.

(2) The Monitor shall—

(*a*) verify whether the convention, congress, conference or meeting is for all members of the party or for delegates ; and

(*b*) determine whether—

(*i*) the criterion for the selection of delegates has been met, and

(*ii*) any other procedure for the Convention, Congress, Conference or ... conforms with the constitution and guidelines of the party ;

(*c*) for the purpose of ensuring compliance with the party constitution, check the motions moved and resolutions adopted, attached to the notice submitted to the Commission ; and

(*d*) study the Guidelines for the conventions, congresses, conferences or meetings to effectively report on the level of conformity with the party's constitution.

Requirement for Party Monitoring.

3.—(1) The Monitors shall, in the performance of their duties under paragraph 1 of these Manual, be in possession of the following—

(*a*) a copy of the Constitution of the Federal Republic of Nigeria, 1999 (as altered) ;

(*b*) a copy of the Electoral Act, 2010 (as amended) ;

(*c*) a copy of these Manual or any relevant Guidelines or Regulations for political parties ;

(*d*) political parties Code of Conduct ;

(*e*) copies of—

(*i*) form PR-Form for recording attendance at meetings of party executive committees,

(*ii*) form PE 1A-Record of Elected Party National Executive Committee (NEC),

(*iii*) form PE 1B-Record of Elected Party State Executive Committee (SEC), or

(*iv*) form PE 1C-Record of Elected Party Local Executive Committee (LGEC) ;

(*f*) copies of the notification and the annexures ;

(*g*) copies of attendance at meetings of the Political Party (NEC) PR1 ;

(*h*) name, acronym, logo and constitution of the registered political party ;

(*i*) guidelines for congresses or conventions issued by the political party ; and

(*j*) the Commissions approved reporting format and checklist.

(2) The Monitor shall—

(*a*) arrive and locate the venue a day before the convention, congress, conference or meeting ;

(*b*) identify and secure accommodation away from the hotel used by the Party for their business to avoid the perception of bias and compromise ;

(*c*) have and secure writing materials before any of the programs, mentioned under sub-paragraph (2) (*a*) of this paragraph ;

(*d*) be at the venue on time and take on board any unexpected change of venue by the political party ; and

(*e*) package dry ration and other necessaries for use in the course of his duties and avoid accepting food and other necessaries from a political party.

(3) Where the venue of the convention, congress, conference or meeting has been changed, the Monitor shall cross-check and be sure that the change was communicated to the Commission within 7 days of the change.

(4) Where the change mentioned under sub-paragraph (3) is not communicated to the Commission, in line with Section 85 (2) of the Electoral Act, 2010 (as amended), the Commission may, with or without prior notice to the political party attend and observe the convention, congress, conference or meeting convened by the political party for the purposes of—

(*a*) electing members of its executive committees or other governing bodies ;

(*b*) nominating candidates for an election at any level ; and

(*c*) approving a merger with any other registered political party.

Procedure and Goal of Monitoring.

4.—(1) Monitoring activities shall be conducted in a manner that avoid any impression that the Monitor is personally interested in the outcome of the process and election of a particular candidate.

(2) The Monitor shall—

(*a*) obtain the list of the Convention Planning Committee and cross-check whether it is the same with that forwarded to the Commission in the letter of notification ;

(*b*) obtain Agenda of the meeting, the list of delegates, list of candidates contesting for any position and guidelines for the convention, congress, conference, primary or meeting and cross-check whether it is the same with that forwarded to the Commission ;

(*c*) clarify the persons or delegates expected to vote at the convention congress, conference or meeting and the mode of voting ;

(*d*) confirm whether the mode of voting is in conformity with the Electoral Act, 2010 (as amended), guidelines, the constitution of the party and other relevant laws ;

(*e*) check whether there is a provision in the guidelines or the constitution of the party for the accreditation of delegates ;

(*f*) keep a record of the number of persons accredited and the number of persons that voted ;

(*g*) obtain a list of candidates contesting election for various positions and cross-check with the list forwarded to the Commission ;

(*h*) enquire from Planning Committee Chairperson and Secretary to find out whether the list of candidates was given to them prior to the program, during the program or not given to them at all ; and

(*i*) check whether the party made adequate arrangements for the security of the venue and the delegates.

(3) The Monitor shall, before leaving the venue of the convention, conference or meeting, collect the following documents duly signed by the appropriate officer of the party—

(*a*) list of party executive committee ; and

(*b*) list of elected party—

(*i*) National Executive Committee (NEC),
(*ii*) State Executive Committee (SEC), and
(*iii*) Local Executive Committee (LGEC).

(4) The Monitor shall leave the venue where he perceives danger to his person, treat to his life or property.

Filing of Report and Document.

5.—(1) The Monitor shall—

(*a*) ensure that the checklist is correctly filled and that all the forms are in his possession ;

(*b*) properly, cross-check whether there is any missing item or document ;

(*c*) develop a skeletal note during the event and record observations on time to avoid losing the essential information of the monitoring ;

(*d*) make a draft of the report within one day of the conclusion of his duties ;

(*e*) report on the event in conformity with the reporting format of the Election and Party Monitoring Department of the Commission ;

(*f*) submit the draft of the report to the appropriate officer ; and

(*g*) submit four (4) clean copies of the report to the Commission through the Party Monitoring Division of the Election and Party Monitoring Department.

Final Report.

6. At the Conclusion of the monitoring, the following documents shall be attached to the final report—

(*a*) timetable and schedule of activities of General Elections ;

(*b*) these manual or any relevant Guidelines and Regulations for Political Parties ;

(*c*) copies of form PR-Form for recording attendance at meeting of party executives committees ;

(*d*) copies of—

(*i*) form PE 1A—Record of Elected Party National Executive Committee (NEC),

(*ii*) form PE 1B—Record of Elected Party State Executive Committee (SEC), or

(*iii*) form PE 1C—Record of Elected Party National Executive Committee (LGEC) ;

(*e*) copies of the notification and all the annexure ;

(*f*) checklist for monitoring conventions and congresses of political parties ; and

(*g*) checklist for election monitoring.

Review of Manual.

7. These Manual may be reviewed in compliance with relevant Laws, from time to time by the Commission.

Citation.

8. These Manual may be cited as the Independent National Electoral Commission (Manual for Monitoring Political Party Congresses, Conventions and Primaries), 2014.

ISSUED at Abuja this 21st day of January, 2014.

PROF ATTAHIRU M. JEGA, OFR
Chairman
Independent National Electoral Commission

EXPLANATORY MEMORANDUM

(This memorandum does not form part of these Manual but intends to explain its puports)

These Manual guides the election Monitors for the effective monitoring of political party congresses, conventions and primaries.

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CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR ELECTION OBSERVATION), 2014

ARRANGEMENT OF PARAGRAPHS

Paragraph :

S. I. No. 51 of 2014

CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR ELECTION OBSERVATION), 2014

[13*th Day of March*, 2014] Commencement.

In exercise of the powers conferred upon it by Section 153 of the Electoral Act 2010 (as amended) and all other powers enabling it in that behalf, the Independent National Electoral Commission (herein after referred to as "the Commission") issues the following Guidelines—

Election Observation.

1.—(1) In other to ensure a free, fair and transparent election, elections conducted by the Commission shall be observed by accredited domestic and foreign observers.

(2) Election observation includes—

(*a*) observation of the processes and activities organized before, during and after elections ;

(*b*) collation of facts and observations that have been noted ;

(*c*) interpretation of the facts gathered in accordance with relevant laws governing elections ; and

(*d*) detailing the findings collated and the interpretations arising from the reports.

(3) Election observers shall be guided by the Schedule to these Guidelines.

Purpose of Observation.

2. The purpose of election observation shall include the following—

(*a*) provision of information for analyzing an election process ;

(*b*) focusing on the electoral process and discourages malpractices ;

(*c*) provision of information that assist other countries to improve their electoral process ;

(*d*) helping the observed state to identify mistakes and recognize the progress made ;

(*e*) reinforcing the common standards and universal benchmarks on what elections should be ;

(*f*) enhancing transparency and reinforcing the integrity and credibility of the electoral process ; and

(*g*) empowering the citizens groups to observe elections as a means of conferring legitimacy on elected governments.

Checklist of an Election Observer.

3. An observer in an election conducted by the Commission, shall be abreast of the—

(*a*) legal and institutional framework;

(*b*) electoral and political environment;

(*c*) arrangements affecting the safety and security of election officials, voters and other participants;

(*d*) management of electoral logistics;

(*e*) integrity of the electoral preparations, including voter registration and voter education;

(*f*) degree of political competitiveness;

(*g*) inclusiveness of the electoral system, civic education and the extent of participation by citizens;

(*h*) extent of human right violations and election related violence;

(*i*) evidence of any violence, intimidation, interference with private exercise of the franchise;

(*j*) professionalism of security agencies;

(*k*) extent to which security has affected the participation of the people in the electoral process;

(*l*) conduct of the Commission, political parties and other relevant agencies;

(*m*) integrity of the conduct of the poll, including voting, counting, collation, and declaration of result; and

(*n*) resolution of electoral disputes.

Accreditation of Observers.

4. The Commission shall be the sole body responsible for accreditation of both the domestic and international observers in Nigeria.

Application for Accreditation of Observers.

5. The following bodies shall have the right to apply to observe the electoral process—

(*a*) regional, continental and international organizations;

(*b*) representatives of foreign missions;

(*c*) Nigerian organizations; and

(*d*) any other body deemed to be qualified by the Commission.

Procedure for Application.

6.—(1) The Commission shall call for application and the closing date for the application in the National dailies and on the website of the Commission.

(2) All International Observers shall apply for accreditation at the Commission's head office in Abuja.

(3) Domestic observers shall apply for accreditation at the Commission's head Office in Abuja or through the Commission's office, in their States or Federal Capital Territory as the case may be.

(4) Application by observer group shall be in a prescribed form EMOC 01 available at the Commission's website.

(5) The forms shall be returned to the Elections and Party Monitoring Department at the Commission's Headquarters.

(6) Eligible bodies applying for observation shall be responsible for making sure that application forms and relevant attachments are completed and sent to the correct address.

(7) All successful observer groups shall be duly informed of their accreditation through the National dailies and on the Commission's website.

(8) The observation group may then submit names of proposed observers for accreditation by INEC on EMOC 02, to be collected at the Elections and Party Monitoring Department (EPM).

(9) A full deployment plan with names of members and location of assignment shall be submitted by the observer group.

Content of Application for Accreditation.

7.—(1) The content of application for accreditation shall include—

(*a*) name, address and contact details of the eligible body ;

(*b*) name of the head of the eligible body and evidence of similar past experiences ;

(*c*) the type of activity covered by the body and evidence of similar past experiences ;

(*d*) name and contact details of the contact person delegated by the body ;

(*e*) in case of international groups, the date for the arrival of members and the number of members in the team ;

(*f*) the official or Registration documents ; and

(*g*) any other relevant details as may be determined by the Commission.

(2) The following documents shall be annexed to the application form—

(*a*) a completed Authorization form for the Contact person, identifying him—

(*i*) as representative of the eligible body,

(*ii*) to receive and submit all documents and applications required, and

(*iii*) be responsible for signing all necessary documentations ;

(*b*) a completed pledge of observers for each observer, including name, nationality, date of birth and passport information, signed by the proposed observer confirming the receipt of sufficient training from the observation body and to abide by the Commission's Code of Conduct for Observers ;

(*c*) two recent passport size photographs for each proposed observer and a copy of the proposed observer's passport or formal Identity card issued by the observation body, containing at the back of the passport, the observer's name and the name of the eligible body to which he belongs ; and

(*d*) any other document that may be necessary for effective and efficient accreditation.

The Authorised Committee.

8.—(1) EMOC is the Authorised Committee established to manage and administer applications for electoral observation.

(2) EMOC shall examine all applications for observation and submit its recommendations to INEC regarding the approval of registration of eligible bodies as Observation Groups and the accreditation of their members or rejection of the applications stating the reason in a clear manner.

(3) The Commission may approve or reject the recommendations submitted by EMOC.

(4) EMOC shall notify the representative of the body of the decision.

(5) Pursuant to INEC's approval, EMOC shall issue the necessary accreditation cards and shall maintain a data base of all accredited observers.

Accreditation Cards.

9.—(1) The observer cards issued by the Commission shall contain the—

(*a*) commission's logo ;

(*b*) name of the observer ;

(*c*) name of the body the observer represents ;

(*d*) recent photo of the observer ;

(*e*) date of expiration of the card ;

(*f*) Commission's official stamp ; and

(*g*) serial number of the card.

(2) The accreditation cards shall be distributed to individual observers by officers of the Commission at the State or LGA offices of the Commission in the presence of the contact person for each observer group, few days to the polling day.

Rejection of Application for Accreditation.

10. An application for accreditation shall be rejected, where—

(*a*) it was submitted after the deadline for submission ;

(*b*) the application submitted is incomplete, inaccurate or submitted by an ineligible body ; or

(*c*) the eligible body does not meet the conditions provided for in these Guidelines or any other relevant regulations, procedures or the Code of Conduct, stipulated by the Commission.

Revocation of Accreditation.

11. The Commission may revoke the accreditation of any observer, where—

(*a*) his name is repeated in any of the accreditation lists of observers ;

(*b*) he violates the provisions of the Regulations, procedures or code of conduct for observers ;

(*c*) he obstructs the electoral process ; or

(*d*) asks the voters of their voting preferences while observing at polling stations.

Rights of Observers.

12. An accredited observer or observer group shall have the right to—

(*a*) get a copy of the code of conduct and a package of basic information issued by the Commission ;

(*b*) observe all phases of the electoral process with access to all registration or polling and collation centres ;

(*c*) obtain meaningful information from electoral authorities at all levels ;

(*d*) issue public observation reports and statements concerning the progress of the electoral process ;

(*e*) freedom of movement throughout Nigeria ;

(*f*) wear Observers' Identification tag issued by the Commission showing the name, picture and affiliate organization of the observer ;

(*g*) gain access to and observe proceedings at any polling station or vote collation centre subject to any reasonable restriction that may be imposed by the Commission ; and

(*h*) within practicable limits, request to inspect and verify election materials.

Code of Conduct for Observers.

13.—(1) In line with the African Union principle and the ECOWAS Guidelines and Declaration of Principles for International Observers, endorsed by various inter-governmental and international organizations, domestic and international observers shall—

(*a*) respect the sovereignty of the Nigerian people to establish their own government and fundamental rights guarantees, contained in the Nigerian Constitution enabling citizens of Nigeria to vote and be voted for in exercise of this sovereignty ;

(*b*) respect the laws of Nigeria and the authority of the bodies charged with the administering the electoral process, by—

(*i*) following lawful instructions from the Nigeria's governmental, security and electoral officials, and

(*ii*) maintaining respectful attitudes towards electoral officials and other national authorities ;

(*c*) abide by these Guidelines and any other terms of reference or instructions given to them by their organization ;

(*d*) attend all Commission's briefings to which they are invited, familiarize themselves with the applicable laws, ensure that they transmit information from such briefings and laws to all deployed observers and carefully adhere to the methodologies employed by their observer mission ;

(*e*) report to the leadership of their organization any conflict of interests or any improper conduct by other observers who are part of their mission, where the observer is unable to maintain impartiality on account of any bias or preference in relation to political parties, candidates or the authorities or any issue connected to the elections ;

(*f*) maintain strict impartiality in the conduct of their duties and should not at any time, publicly express or exhibit any bias or preference in relation to national authorities, parties, candidates or any issue in contention to the election process ;

(*g*) undertake their duties in an unobtrusive manner and not knowingly or wilfully interfere in the electoral process, provided that nothing in these Guidelines shall take off their right to bring irregularities to the attention of the election officers, in compliance with relevant laws ;

(*h*) base their conclusions on their personal observation or clear and convincing facts, not from speculations, hearsay or exclusively from media or internet-based report that the observer has not personally verified ;

(*i*) not prejudge the outcome of the election ;

(*j*) display identification provided by the Commission at all times during election duties and provide other forms of identification required or requested for by any national authority ;

(*k*) refrain from making any personal comments to the media on what they observed during elections before the election observation mission makes their statement ;

(*l*) not accept any gift or favours that may influence their work ;

(*m*) at all times, during the period of observation, including private time away from work, exercise sound judgment and display a high level of personal discretion ;

(*n*) not attempt to take part in the actual administration of the election ;

(*o*) attempt to play active role in resolving disputes or complaints to avoid the possibility of compromising the observer group's eventual position on the matter ;

(*p*) not take any unnecessary or undue risks ;

(*q*) be responsible for their safety and security ;

(*r*) not enjoy immunity from prosecution or criminal responsibility for electoral offences or any other offences recognized under the laws of the Federal Republic of Nigeria ; and

(*s*) be very careful and exercise utmost sense of discretion in their choice of words in describing the elections.

(2) Where any observer contravenes the provisions of these guidelines—

(*a*) the Commission may cancel his accreditation ; and

(*b*) in the case of an act that constitutes an offence under the Nigerian law, he shall be prosecuted.

Duties and Responsibilities of Observers.

14.—(1) Organisations applying for accreditation for observer teams shall bear the costs associated with organising and deploying its observation mission and teams.

(2) The international election observers and their sponsor organizations shall make their travel plans and fulfill the necessary immigration requirements necessary for obtaining entry clearance to visit Nigeria.

(3) The local election observers shall be responsible for transporting their observers to and from the respective polling centres where they are deployed.

(4) The Commission shall not play any role in the deployment of observers except for providing basic information required for deployment, including the map of polling stations.

(5) The observers shall arrange for their adequate logistics support.

(6) The observer shall not handle any election document in the polling station or physically assist the voting or counting process.

(7) An observer on election observation duty shall—

(*a*) wear the accreditation badge in a visible manner ;

(*b*) on arrival, introduce himself to the polling officer, collation officer and any other officer in charge of the centre or duty station ;

(*c*) ensure that a good working relationship that assist the process of observation is established with the electoral officers ;

(*d*) comply with the instructions of officials at the polling stations, unless the instructions are manifestly unlawful, provided that where he is dis-

(*f*) the observation report shall indicate where possible, the extent of improvement over the previous ones or otherwise ; and

(*g*) make, addressed and submit a copy of the interim and final reports emanating from the election to the office of the Chairman of the Commission.

Responsibility of the Commission.

16. To ensure synergy between the Commission and the observers in the conduct of elections, the Commission shall—

(*a*) provide all the necessary assistance to enable international observers to sufficiently prepare and fulfill immigration requirements, for the purpose of observation, provided that the Commission shall not be responsible for securing entry clearance for international observers or ensuring compliance with immigration requirements for international travel into Nigeria ;

(*b*) issue invitation letters to international observer missions that complies with the conditions for accreditation ;

(*c*) guarantee—

(*i*) unimpeded access to observers to all the stages and processes of the election,

(*ii*) reasonable access to all persons concerned with election process who are within the authority of the Commission, and

(*iii*) that the election observers shall have access to all the Commission's literature and instructions on the elections ;

(*d*) provide basic information kits on the election to all observer groups, including the list of polling stations, collation centres, the Commission's contact officers and electoral maps ;

(*e*) ensure that observers receive adequate information concerning the arrangements for the elections ;

(*f*) designate at the Headquarters in Abuja and all the State offices, an officer or unit with responsibility for liaison with observers ; and

(*g*) not be responsible for the personal safety and security of observers.

Part II—Election Activities

Observation of Voter Registration.

17. Domestic observers shall ensure—

(*a*) the compliance of electoral officers with national constitutional requirements and international standard and rules and procedures issued by the Commission for the registration of individuals ;

(*b*) that eligible persons are given sufficient opportunity to register to vote without discrimination in relation to gender, ethnicity, religion, physical disability, etc. ;

(*c*) that there is no incidence of double or multiple registration by an individual ; and

(*d*) that individuals are given the opportunity or have access to verify their names in the register.

Party Primaries and Candidates' Selection Process.

18. The observers shall ensure that political parties—

(*a*) complies with Regulations and Guidelines of the Commission in relation to announcement of dates and other requirements for party conventions and congresses ;

(*b*) complies with rules and procedures enshrined in the Constitution of the political parties, the Electoral Act 2010 (as amended) and other extant provisions of the law ;

(*c*) are transparent in the counting of votes and announcement of results ;

(*d*) treat all the candidates at the primaries equally ;

(*e*) do no use money or any incentives that confer advantage on some candidates over others ;

(*f*) adhere to internal procedures for addressing grievances arising from party primaries ; and

(*g*) resolve the disputes arising from party primaries.

Observation of Elections on Election Day.

19. The election observers shall, on the election day, observe the—

(*a*) timely arrival of poll officials and lay-out of polling stations ;

(*b*) commencement of accreditation and polling processes ;

(*c*) conduct and professionalism of poll officials ;

(*d*) conduct and professionalism of security agents ;

(*e*) availability of election materials ;

(*f*) compliance with election Guidelines by poll officials ;

(*g*) secrecy of ballot ;

(*h*) degree of political competitiveness ; and

(*i*) degree of inclusiveness and ease of participation by all eligible voters, including physically challenged people.

Counting, Collation and Declaration of Results.

20. The election observers shall examine the—

(*a*) transparency of conducting vote count ;

(*b*) access of observers, agents and proxies of parties and candidates to counting and collation centres ;

(*c*) number of votes in relation to number of registered voters ;

(*d*) presence of unauthorized persons at counting and collation centres ;

(*e*) public announcement of results collated ; and

(*f*) procedure laid down in the regulations for tabulation and transmission of results.

Post-election Disputes.

21. The election observers may—

(*a*) capture details of formal complaints or petitions filed before Election Tribunals or Court ;

(*b*) observe whether proceedings are conducted in public and open to all interested parties ;

(*c*) observe whether fairness and even treatment by adjudicating authorities or courts to all the parties, including complainant, witnesses and interested parties ; and

(*e*) observe whether the judicial decisions and rulings are consistent with rulings in similar cases.

Interpretation.

22. In these Guidelines—

"*accreditation card*" means an identification card issued by the Commission that qualifies the person to whom it is issued to participate in the election process as an accredited observer.

"*Chairman*" means the Chief Executive Officer of the Commission, who is also the Chief Electoral Officer of Nigeria ;

"*Code of Conduct*" means the Code of Conduct for Observers issued by the Commission ;

"*Contact Person*" means the person designated by the Eligible Body to receive and submit all documents and correspondence from, or to, INEC and sign all documents needed for the accreditation process ;

"*Election Monitoring and Observation Committee* (*EMOC*)" means the Committee established by the Commission to manage and administer all observation, registration and accreditation processes ;

"*Elections and Party Monitoring Department* (*EPM*)" means the department in the Commission charged with the responsibilities of processing applications from observer groups ;

"*Electoral Process*" means all processes related to the implementation of all phases of the electoral cycle, such as voter registration, registration of political parties, candidate nomination, polling, counting of votes and compilation of results ;

"*Eligible Bodies*" means bodies that are eligible to apply to the Commission to participate in the observation of the electoral process ;

"*INEC*" means the Independent National Electoral Commission ;

"*Headquarters*" means the Commission Headquarters in Abuja ;

"*Observer*" means a person sponsored by an organization and accredited by the Commission to observe elections within the Guidelines issued by the Commission : and

"*Observation*" means the gathering of information regarding the electoral process, without intervening in the process itself and issuing comments and reports on the conduct of the process and the basis of information collected by persons accredited by the Commission for such mission.

Citation.

23. These Guidelines may be cited as the Independent National Electoral Commission (Guidelines for Election Observation), 2014.

Schedule 1

POLITICAL AND ELECTORAL SYSTEM IN NIGERIA

Nigeria is a Federation comprising 36 States and a Federal Capital Territory (FCT), Abuja. In all there are 774 Local Government Areas. INEC conducts elections for executive and legislative positions in Federal and State Governments. In addition, INEC is responsible for conducting elections into the Area Councils in the Federal Capital Territory, Abuja.

Elections into Local Government Areas in the 36 States of Nigeria are conducted by the State Independent Electoral Commissions, which are outside of INEC's authority.

1. EXECUTIVE OFFICES

For each election, the country is divided into constituencies with respect to positions in the executive arm of government. The entire country is however, treated as one constituency for the Presidential elections. The Chairman of INEC is statutorily designated as the Chief Electoral Officer in the Presidential Elections. Each of the 36 States constitutes a constituency for the purpose of elections into the offices of the Governors at the State level. Each Area Council in the FCT is also treated as a constituency for the purpose of electing an Area Council Chairman.

Nigeria's 1999 Constitution (as amended), prescribes the conditions that candidates must fulfil in order to be declared winners in an election into an executive office. These conditions are as follows—

(*a*) *President*: A person is duly elected as president, where, if there are more than one candidates, he/she scores a majority of votes as well as at least one-quarter of the votes cast in each of two-thirds of the States of the Federation. Where, however, there is only one candidate, he must obtain a majority of YES votes over NO votes as well as not less than one-quarter of the votes cast at the election in each of at least two-thirds of all States in the country and the Federal Capital Territory.

(*b*)*Run-off* (*1st and 2nd*): In default of a candidate being elected as stated in paragraph(a) above, a second election run-off shall be held within seven days as follows—

(*i*) Election between the candidate that scores the highest number of votes and another with highest majority of votes in the highest number of States. Where there is more than one candidate with the highest number of states, the candidate with the highest total votes among them shall be second candidate.

(*ii*) A failure of either of the candidates to meet the majority of votes and score of over a quarter of votes cast in each of at least two-thirds of

all the States and the FCT, winner of two-thirds and last run-off elections shall be the candidate who scores the majority of votes cast in the election.

(*c*) *Governor* : A person is elected Governor, where, if there are two or more candidates, he secures a majority of votes in addition to one-quarter of the votes cast in each of at least two-thirds of all the Local Government Areas of the State. However, in the case of single candidates, to be elected Governor, the candidate must score a majority of YES votes over NO votes cast in a minimum of two-thirds of all the Local Government Areas in the state.

(*d*) *Run-off* (*s*) (*1st* and *2nd*) : The failure of a single candidate to be elected, results in fresh nominations. In the case of more than one candidate, there shall be a run-off election between the candidates who secured the highest number of votes cast and the candidate who secured the majority of votes in the highest number of Local Government Areas. Where those with the highest number of Local Government Ares are more than one, the candidate with the next highest total votes cast at the election shall be the second candidate. Two other run-offs are organized where there is no clear winner in the first run-off. The candidate with a majority of the votes cast at the third run-offs is elected the Governor of the State.

2. LEGISLATIVE OFFICES

INEC also organizes elections into legislative positions at the Federal and State levels as well as for councillorships of the Area Councils in the FCT. The Federal legislature is bi-cameral, comprising a Senate and a House of Representatives.

(*a*) The Senate has 109 members. Each State of the Federation comprises three Senatorial Zones, (however, the FCT had the one zone) each zone being recognised as a separate constituency for purposes of electing one Senator.

(*b*) The House of Representatives comprises 360 members elected from 360 Federal Constituencies. Each State and the FCT are divided for this purpose into different Federal Constituencies. Each Federal Constituency elects or returns one member to the House of Representatives.

(*c*) Each State has a House of Assembly as its legislative arm of Government. Members of the House of Assembly are elected from State Constituencies, which are different and much smaller than Federal Constituencies.

(*d*) In the FCT, for the purpose of fulfilling the legislative functions of Local Government in the Area Councils, Councillors are elected for each of the Wards. A Ward is a constituency for the purpose of electing a Councillor in the Area Council elections in the FCT.

The legislative candidates become winners the moment they score a simple majority over their opponents. This is commonly referred to as the First Past The Post (FPTP) electoral systems. The Executive positions are, however, determined by specific majorities as follows—

(*a*) *National Assembly :* The National Assembly shall comprise—

(*i*) 109 Senators, *i.e.* three Senators per State while FCT has only one Senator ;

(*ii*) 360 Members of the House of Representatives, representing 360 constituencies delimited according to population "as nearly equal as possible".

(*b*) *State Houses of Asembly* : There are 990 members of the 36 State House of Assembly. Each member represents a State Constituency.

3. Chairman and Councillors in the Six Area Councils of FCT, Abuja

The Federal Capital Territory, Abuja is made up of six (6)Area Councils headed by elected Chairmen and Councillors.

The administration of elections to the offices of the Chairmen / Councillors is regulated by the Electoral Act 2010 (as amended).

4. The Voting Method

In every election, every voter is entitled to have their vote counted and every vote must count. INEC continuously strives for ways and means to make the voting method increasingly effective. The Commission has, therefore, adopted the open-secret ballot system as prescribed by the Electoral Act 2010 (as amended).

Nigeria currently has 120,000 polling stations. Each Polling Station is headed by one Presiding Officer and assisted by two Assistant Presiding Officers. This is in addition to the security agencies and political party agents who must be in every polling station. Supervisory Presiding Officers are engaged to supervise a number of polling units within each registration area. At the close of voting, the Presiding Officer counts the votes in the presence of party agents and the results made public in each polling station. Thereafter, the results are transmitted to the collation centres for collation before formal declaration.

Schedule II

ECOWAS PRINCIPLES OF DEMOCRATIC ELECTIONS

(1) The EMB should be independent and neutral and should have the confidence of all the political actors.

(2) No substantial modification should be made to the electoral laws during the last six (6) months before the holding of an election, except with the consent of a majority of the political actors.

(3) Elections must be organized on the dates or at the periods fixed by the electoral law.

(4) Women have equal rights with men to vote and be voted for, and to hold public office at all levels of governance.

(5) A reliable voters list must be produced, drawing upon a reliable registry of births and deaths.

(6) The voters list should be prepared in a transparent and verifiable manner, with the collaboration of the political parties.

(7) The electorate should have access to the list of voters, whenever the need arises.

(8) The preparation and conduct of elections and the announcement of results should be done in a transparent manner.

(9) Adequate arrangements should be made to hear and dispose of petitions relating to the conduct of elections and the announcement of results.

(10) Election-related civil society organizations should be involved in educating the public on the need for peaceful elections.

(11) A candidate or party that loses an election should concede defeat in accordance with the electoral law.

(12) All holders of power at all levels should refrain from acts of intimidation or harassment against defeated candidates or their supporters.

Schedule III

AFRICAN UNION DECLARATION ON THE PRINCIPLES GOVERNING DEMOCRATIC ELECTIONS IN AFRICA—AHG/DECL.1 (XXXVIII) I.

1. PREAMBLE

We, the Heads of State and Government of the Organization of African Unity, meeting in Durban, South Africa, at the 38th Ordinary Session of the Assembly of the OAU, have considered the Report of the Secretary General on strengthening the role of the OAU in election observation and monitoring and the advancement of the democratization process.

Considering the principles and objectives of the African Union enshrined in the Constitutive Act of the African Union, particularly in its Articles 3 and 4 ;

Reaffirming the Algiers Decision of July 1999 and the Lomé Declaration of July 2000 on the Framework for an OAU response to unconstitutional changes of Government, which laid down a set of common values and principles for democratic governance ;

Considering the CSSDCA Solemn Declaration adopted by the Assembly of Heads of State and Government of the OAU in Lomé, Togo, in July 2000, which underpins the OAU's agenda of promoting democracy and democratic institutions in Africa ;

Considering the New African Initiative (NAI) now referred to as the New Partnership for the African's Development (NEPAD) adopted by the Assembly of the Heads of State and Government in Lusaka, Zambia, in July 2001, by which, through the Democracy and Political Governance Initiative, African Leaders under took to promote and protect democracy and human rights in their respective countries and regions, by developing clear standards of accountability and participatory governance at the national and sub-regional levels ;

Reaffirming the importance of the Universal Declaration of Human Rights adopted in December 1948, as well as the International Covenant on Civil and Political Rights adopted in December 1966, which recognized the will of the people expressed through free and fair elections as the basis of the authority of government ;

Reaffirming also the significance of the African Charter on Human and Peoples' Rights adopted in Nairobi, Kenya, in June 1981, which recognized the right of every citizen to participate freely in the government of his or her country whether directly or through democratically elected representatives ;

Recalling the Declaration of the Assembly of Heads of State and Government of the Organization of African Unity on the Political and Socio-economic Situation in Africa and the Fundamental Changes Taking Place in the World, adopted in Addis Ababa, Ethiopia, in July 1990 wherein OAU Member States undertook to continue with the democratization of African societies and the consolidation of the democratic institutions;

Recalling further the African Charter for Popular Participation in Development adopted in Addis Ababa, Ethiopia, in July 1990, which emphasized the need to involve the people of Africa in the spheres of economic and political governance;

Referring to the Cairo Agenda for Action adopted in Cairo, Egypt, in 1995, which stressed the imperative of ensuring good governance through popular participation based on the respect for human rights and dignity, free and fair elections, as well as on the respect of the principles of freedom of the press, speech, association and conscience;

Cognizant of the fact that each Member State has the sovereign right to choose its political system in accordance with the will of its people and in conformity with the Constitutive Act of the African Union and the universally accepted principles of democracy;

Considering the ever-growing role already played by the OAU in the observation/monitoring of elections and the need to strengthen the Organization's efforts in advancing democracy in Africa;

Agree and endorse the following Principles Governing Democratic Elections in Africa.

II. Principles of Democratic Elections

(1) Democratic elections are the basis of the authority of any representative Government.

(2) Regular elections constitute a key element of the democratization process and therefore, are essential ingredients for good governance, the rule of law, the maintenance and promotion of peace, security, stability and development.

(3) The holding of democratic elections is an important dimension in conflict prevention, management and resolution.

(4) Democratic elections should be conducted.

(5) Freely and fairly.

(6) Under democratic constitutions and in compliance with supportive legal instruments.

(7) Under a system of separation of powers that ensures in particular, the independence of the judiciary.

(8) At regular intervals, as provided for in National Constitutions.

(9) By impartial, all-inclusive competent accountable electoral institutions staffed by well-trained personnel and equipped with adequate logistics.

III. Responsibilities of the Member States

We commit our Governments to—

(*a*) Take necessary measures to ensure the scrupulous implementation of the above principles, in accordance with the constitutional processes of our respective countries;

(*b*) Establish where none exists, appropriate institutions where issues such as codes of conduct, citizenship, residency, age requirements for eligible voters, compilation of voters' registers, etc would be addressed;

(*c*) Establish impartial, all-inclusive, competent and accountable national electoral bodies staffed by qualified personnel, as well as competent legal entities including effective constitutional courts to arbitrate in the event of disputes arising from the conduct of elections;

(*d*) Safeguard the human and civil liberties of all citizens including the freedom of movement, assembly, association, expression ,and campaigning as well as access to the media on the part of all Stakeholders, during electoral processes;

(*e*) Promote civic and voters' education on the democratic principles and values in close cooperation with the civil society groups and other relevant Stakeholders;

(*f*) Take all necessary measures and precautions to prevent the perpetration of fraud, rigging or any other illegal practices throughout the whole electoral process, in order to maintain peace and security;

(*g*) Ensure the availability of adequate logistics and resources for carrying out democratic elections, as well as ensure that adequate provision of funding for all registered political parties to enable them organize their work, including participation in electoral process;

(*h*) Ensure that adequate security is provided to all parties participating in elections;

(*i*) Ensure the transparency and integrity of the entire electoral process by facilitating the deployment of representatives of political parties and individual candidates at polling and counting stations and by accrediting national and/other observers/monitors;

(*j*) Encourage the participation of African women in all aspects of the electoral process in accordance with the national laws.

IV. ELECTIONS—RIGHTS AND OBLIGATIONS

(1) We reaffirm the following rights and obligations under which democratic elections are conducted.

(2) Every citizen shall have the right to participate freely in the government of his or her country, either directly or through freely elected representatives in accordance with the provisions of the law.

(3) Every citizen has the right to fully participate in the electoral processes of the country, including the right to vote or be voted for, according to the laws of the country and as guaranteed by the Constitution, without any kind of discrimination.

(4) Every citizen shall have the right to free association and assembly in accordance with the law.

(5) Every citizen shall have the freedom to establish or to be a member of a political party or Organization in accordance with the law.

(6) Individuals or political parties shall have the right to freedom of movement, to campaign and to express political opinions with full access to the media and information within the limits of the laws of the land.

(7) Individual or political parties shall have the right to appeal and to obtain timely hearing against all proven electoral malpractices to the competent judicial authorities in accordance with the electoral laws of the country.

(8) Candidates or political parties shall have the right to be represented at polling and counting stations by duly designated agents or representatives.

(9) No individual or political party shall engage in any act that may lead to violence or deprive others of their constitutional rights and freedoms. Hence all Stakeholders should refrain from, among others, using abusive language and/or incitement to hate or defamatory allegations and provocative language. These acts should be sanctioned by designated electoral authorities.

(10) All Stakeholders in electoral contests shall publicly renounce the practice of granting favours, to the voting public for the purpose of influencing the outcome of elections.

(11) In covering the electoral process, the media should maintain impartiality and refrain from broadcasting and publishing abusive language, incitement to hate, and other forms of provocative language that may lead to violence.

(12) Every candidate and political party shall respect the impartiality of the public media by undertaking to refrain from any act which might constrain or limit their electoral adversaries from using the facilities and resources of the public media to air their campaign messages.

(13) Every individual and political party participating in elections shall recognize the authority of the Electoral Commission or any statutory body empowered to oversee the electoral process and accordingly render full cooperation to such a Commission/Body in order to facilitate their duties.

(14) Every citizen and political party shall accept the results of elections proclaimed to have been free and fair by the competent national bodies as provided for in the Constitution and the electoral laws and accordingly respect the final decision of the competent Electoral Authorities or, challenge the result appropriately according to the law.

V. Election Observation and Monitoring by the OAU

We request the OAU to be fully engaged in the strengthening of the democratization process, particularly by observing and monitoring elections in our Member States, according to the following guidelines—

(1) The observation and monitoring of elections shall be undertaken subject to a memorandum of understanding between the OAU General Secretariat and the host country in accordance with the principles enshrined in this declaration and the laws of the host country.

(2) In performing their obligations, the election observers or monitors shall be guided by detailed guidelines to be prepared by the General Secretariat drawing inspiration from the essential thrust of this declaration, the specific mandates and terms of reference determined by the particular case in question as well as the wider legal framework of the country staging elections.

(3) Member States should ensure that invitations to the OAU to participate in election observation or monitoring are sent at least two months before the date of the election.

(4) Member States should refrain from imposing any fees and/or charges on OAU observers i.e. registration/accreditation fees etc. and facilitate easy access of observers/monitors to locations of electoral events/activities and unhindered in the performance of their tasks.

(5) The General Secretariat shall have the right to decline invitations to monitor elections which in its considered opinion, do not measure up to the normative standards enunciated in this Declaration.

VI. Role and Mandate of the General Secretariat

Further request the OAU Secretary General to take all necessary measures to ensure the implementation of this Declaration by undertaking, in particular, the following activities—

(*a*) Strengthen its role in the observation and monitoring of elections within the legal framework of the host country, in accordance with the memorandum of understanding reached with that country ;

(*b*) Mobilize extra-budgetary funds to augment the General Secretariat resource base so as to facilitate the implementation of this Declaration ;

(*c*) Undertake a feasibility study on the establishment of a Democratization and Electoral Assistance Fund, to facilitate a successful implementation of this Declaration ;

(*d*) Undertake a feasibility study on the establishment within the OAU General Secretariat of a Democratization and Election Monitoring Unit that will also discharge issues on good governance ;

(*e*) Compile and maintain a roster of African Experts in the field of election observation and monitoring and democratization in general in order to deploy competent and professional observers and to avail itself of their services whenever necessary. Member States on their part are requested to assist by making the names of their experts available to the General Secretariat ;

(*f*) Work out better standards of procedures, preparations and treatment for personnel selected to serve on OAU observer missions ;

(*g*) Promote cooperation and work in partnership with African Organizations and International Organizations, as well as national institutions, non-governmental Organizations and civil society groups involved in the election monitoring and observation work ;

(*h*) Publish and make the General Secretariat Reports on the observation/ monitoring of elections and other related activities open to all Member States and the public at large, as a means of consolidating electoral and democratic processes on the continent.

ISSUED at Abuja this 13th day of March, 2014.

PROF ATTAHIRU M. JEGA, OFR
Chairman
Independent National Electoral Commission

EXPLANATORY MEMORANDUM

(This Memorandum does not form part of these Guidelines, but intends to explain its purports)

These Guidelines is to ensures the conduct of a free, fair and credible election, provide an impartial and accurate assessment of the nature of election processes, provide opportunity for constructive criticism of the election process and compliance with relevant laws by the observers.

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No. 131 **Lagos - 28th October, 2014** **Vol. 101**

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CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)
INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR POLITICAL RALLIES AND CAMPAIGNS), 2014

ARRANGEMENT OF PARAGRAPHS

Paragraph :

S. I. No. 52 of 2014

CONSTITUTION OF THE FEDERAL REPUBLIC OF NIGERIA, 1999 (AS ALTERED)
ELECTORAL ACT, 2010 (AS AMENDED)

INDEPENDENT NATIONAL ELECTORAL COMMISSION (GUIDELINES FOR POLITICAL RALLIES AND CAMPAIGNS), 2014

[27*th Day of October*, 2014] Commencement.

In exercise of the powers conferred upon it by paragraph 15 (*f*), Part I of the Third Schedule to the Constitution of the Federal Republic of Nigeria, 1999 (as altered), Section 153 of the Electoral Act, 2010 (as amended) and all other powers enabling it in that behalf, the Independent National Electoral Commission (herein after referred to as"the Commission") issues the following Guidelines—

Power to Monitor Political Rallies, Campaigns etc.

1. The Commission shall monitor political campaigns, rallies, and processions and keep record of the activities of registered political parties.

Sponsors and Aspirants.

2.—(1) A political party in line with section 221 of the Constitution of the Federal Republic of Nigeria, 1999 (as altered)shall have power to sponsor a candidate and canvass for vote.

(2) An aspirant seeking sponsorship as candidate shall have the right to solicit for support from his political party members by—

(*a*) holding private fund raising, reception, courtesy calls, visits, display of party flag, emblem, slogan, posters or bill boards ; or

(*b*) social media.

(3) In compliance with the Act, an aspirant shall not solicit for vote or advance his aspirations for any specific elective office before the release of the Time-table for elections.

(4) A Political party member wishing to be sponsored or nominated as candidate for elective office may aspire for sponsorship under the platform of his party by the methods mentioned in sub-paragraph (2) of this paragraph at the headquarters of the political party office, ward, Local Government and State offices throughout the Federation.

Campaign Material.

3. Campaign material may include—

(*a*) posters, handbills, pamphlets, apparels and sundry objects ;

(*b*) audio and visuals, like video recordings, music and sounds, radio and television jingle ; or

(*c*) virtual, like computer generated designs, images and animations.

Public Fund and Public Facility.

4. A public fund and public facility shall be used only in compliance with the provisions of the Act.

Political Rally or Procession.

5.—(1) A political rally or convention may be organized by a political party candidate, aspirant, member or supporter as a means of publicly projecting to the electorates, their candidate, ideas, programmes, policies or preferences as contained in their manifesto, symbols, flags, logos or emblems in accordance with the law.

(2) Political rallies or processions may include the use of—

(*a*) public media advertisement by public or media organization ;

(*b*) internet advertising, house to house calls on voters ;

(*c*) public marches, public gathering, public reception, public fund raising, courtesy calls, public display of party flag ;

(*d*) public entertainment, posters, handbills, billboard in public places like market, schools, streets, highways, air display, audio, video, painted vehicles ;

(*e*) public address system in vehicle, fences of private houses ; and

(*f*) other social media.

(3) Public political rallies or processions shall not hold before the release of election time table, unless at appointed time agreed between the political party and the Commission, in compliance with relevant laws, these guidelines or any other Guidelines, Manual or Regulations issued by the Commission.

(4) A person is a candidate at election, where he—

(*a*) is a member of a political party ;

(*b*) is sponsored by the political party ;

(*c*) is nominated by the political party through the process of party primaries or adjudged to be a candidate by a competent Court or Tribunal ; and

(*d*) has satisfied other requirements or qualification for elective office stipulated under the Constitution of the Federal Republic of Nigeria, 1999 (as altered), the Act, or any relevant law.

Political Campaign.

6.—(1) A political party and its candidates, members or supporters, may publicly canvass for votes from registered voters for elective offices upon release of notice of elections by the Commission.

(2) Political campaign may be conducted using the methods stipulated under paragraph 3 of these Guidelines.

(3) No person shall engage in political campaign prior to the release of notice of election or 90 days to a general election.

(4) An association not registered as political party shall not engage in political campaign.

Hate Speech and Discrimination.

7. No aspirant, candidate or political party shall use hate speech or image or project ideas that are discriminatory on the grounds of birth, sex, religion or ethnic origin during campaigns, meetings, rallies or procession.

Use of Social Media for Campaign.

8.—(1) A party may use social media for campaign, including the use of—

(*a*) collaborative project like Wikipedia ;

(*b*) blogs and micro blogs like Twitter ;

(*c*) content communities, like YouTube ;

(*d*) social networking sites like Facebook ; or

(*e*) virtual game words like Apps.

(2) The use of social media for campaign shall be in compliance with the Act, in relation to election campaign.

Monitoring of Social Media Campaigning.

9. The Commission shall from time to time require candidate or political parties to file affidavit about their social media sites in a prescribe form issued by the Commission, containing the following information—

(*a*) contact telephone numbers ;

(*b*) e-mail addresses ;

(*c*) webpage addresses and those of their sponsors ;

(*d*) social media accounts and those of affiliates or supporters ; and

(*e*) details of social media sites over a period of time.

Pre-Certification of Public Political Advertisement.

10.—(1) Every political party, aspirant, candidate or supporter intending to issue information or political advertisement for the purpose of campaign, rallies or procession on the television channels, radio or electronic media, cable television, the internet or any social media, shall apply to the Commission for pre – certification in compliance with the Act.

(2) Any advertisement or promotional campaign content by a political party, aspirant, candidate or supporter, posted on social or electronic media without pre-certification with the Commission contravenes these guidelines and shall be fine in accordance with the Act.

Monitoring Expenditure.

11.—(1) To ensure the correct estimate of any campaign, the Commission may from time to time request media houses for detailed information on the political advertisement expenditure of a political party, aspirant, candidate, entity, individuals or supporters.

(2) It shall be the responsibility of political party, aspirant or candidate to ensure that accurate record are kept of their transactions with the media houses, provided that the information requested under sub-paragraph (1) of this paragraph shall be given to the Commission.

Reporting the Violation of Campaign Rules.

12. Party agents, candidates, supporters, accredited election observers, individuals, organizations, entities or media may report the violation of campaign rules or these Guidelines with a sworn affidavit to the Commission.

Submission of Campaign Materials and Receipt.

13. Every candidate shall submit to the Commission—

(*a*) copies of all his campaign materials ; and

(*b*) copies of receipts indicating the cost of material attached to the audited accounts of the campaign expenses.

Objective of Political Rally and Procession.

14.—(1) The objective of political rally and procession shall be to project, offer, sensitize and create awareness about the party as an entity, the party logo, emblem, flag, slogan or its programme as distinguishable from other parties.

(2) A political party shall not canvass for vote for a specific candidate or aspirant at rallies and processions, except projecting its manifesto.

(3) The conduct of political rally or procession shall be within the period allowed by the Commission upon application by a political party.

Procedure for Conducting Political Rally or Procession.

15.—(1) A political party shall issue written notice for each political rally or procession to the Commissioner of police of the state or FCT indicating the exact time and venue of the rally or procession and pledging peaceful conduct and control against violence or nuisance.

(2) All political party shall, prior to its rally, meeting, procession or gathering in public, file the details of its rally, meeting, procession or gathering in public with the Commission, through the—

(*a*) electoral officer at the Local Government Area or Area council ;

(*b*) resident electoral officer at the State ; or

(*c*) Commission's headquarters in Abuja.

(3) All rallies or procession shall hold in the daytime and end before 7 pm.

Target Audience for Rally or Procession.

16. The target audience for rally or procession shall be the general public or specific group, including the women, youth, physically challenged and other relevant group.

Objective of Political Campaign.

17.—(1) The objective of political campaign shall be to canvass for vote in favour of a political party or candidate contesting for an elective office with other political party or candidate.

(2) No political campaign shall commence by any political party unless—

(*a*) the time table for election have been release and candidates have emerged through primaries conducted by the political party ; and

(*b*) the name or list of candidates is submitted to the Commission.

(3) A Political party shall comply with the statutory time to commence campaigns of 90 days and end 24 hours to the day of general elections.

Procedure for Conducting Political Campaign.

18.—(1) A political party or candidate shall forward the notice of political campaign to the Commission at least 48 hours to the day of campaign, stating the venue, time, date, agenda and list of organizing committee.

(2) Political campaign shall be—

(*a*) in compliance with relevant laws, regulations, including code of conducts for political party and regulations made by media regulators ; and

(*b*) issue based, as contained in the manifesto of the party and its Constitution.

Target Audience for Campaign.

19. The target audience for political campaigns shall be the registered voters.

Limitation on Expenses.

20. Political campaigns shall have limitation on election expenses and candidate expenditure as provided by law, and the Commission shall enforce compliance with the limitation.

Clash of Date, Time or Venue.

21.—(1) Where there is conflict in the date, time or venue of the activities of different political parties, their representatives shall meet in the presence of law enforcement Agency to resolve the issue amicably without recourse to intimidation, force or violence.

(2) Where they are unable to resolve the conflict amicably between themselves, the Commission shall request the political party that submitted its notice later in time to reschedule its campaign, meeting, rally, procession, congress, convention or any other activity, for effective monitoring.

(3) The Commission may request any political party to reschedule its campaign, meeting, rally, procession, congress, convention or any other activity in the interest of the parties and the public or to avoid clashing with other statutory functions of the Commission required to be performed within a specified time.

Review of Guidelines.

22. These Guidelines may, where necessary, be reviewed from time to time by the Commission.

Interpretation.

23. In these Guidelines—

"*Act*" means the Electoral Act, 2010 (as amended) ;

"*Aspirant*" means any member of a political party seeking sponsorship and support to be a candidate for an elective office in an election ;

"*Campaign Material*" means any tangible or intangible material that conveys an aspiration to contest or actual participation in a contest for a political office with the support or sponsorship of a political party ;

"*Political Party Supporter*" means persons who agree, choose or support a political party programme, policy or project and partake in campaign or canvass for vote for the political party or its candidate ;

"*Private*" means a particular person or group, not open to, controlled by or associated with the public, public office or charged to public fund ;

"*Public*" means ordinary people in the Federation of Nigeria, Government and the services it provides for the people ; and

"*Social Media*" means any means of interaction among people in which text, voice or image are created, shared or exchanged in virtual communities and networks.

Citation.

24. These Guidelines may be cited as the Independent National Electoral Commission (Guidelines for Political Rallies and Campaigns), 2014.

ISSUED at Abuja this 27th day of October, 2014.

PROF ATTAHIRU M. JEGA, OFR
Chairman
Independent National Electoral Commission

EXPLANATORY MEMORANDUM

(This Memorandum does not form part of these Guidelines, but intends to explain its puports)

These Guidelines spelt out conditions for the conduct of political rallies, procession and campaigns and assist the election monitors and observers to easily establish the level of compliance or non-compliance by political parties, candidates and supporters.

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Official Gazette

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WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004

AUTOMATED TELLER MACHINE/CASH DISPENSER AND NOTE COUNTING MACHINE REGULATIONS, 2014

Under Section 8 (1) (*b*), (*d*), (*f*) *and* 47 (2) (*b*)

ARRANGEMENT OF REGULATIONS

Regulation :

S. I. No. 53 of 2015

WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004

AUTOMATED TELLER MACHINE/CASH DISPENSER AND NOTE COUNTING MACHINE REGULATIONS, 2014

[*4th Day of November*, 2014] Commencement.

In exercise of the powers conferred upon me by Sections 8 and 47 of the Weights and Measures Act (CAP. W3 LFN 2004), Laws of the Federation of Nigeria, 2004 and all other powers enabling me in the behalf, I, OLUSEGUN AGANGA, Minister of Industry, Trade and Investment, hereby make the following Regulations—

PART I—GENERAL PROVISIONS

Classification of Automated Teller Machine (ATM) and Note Counting Machine.

1. An Automated Teller Machine/Cash Dispenser is an embedded device that provides the customers of a financial institution an access to financial transactions in a public place without the need for a human Clerk or Bank Teller while Note Counting Machine is an instrument that Count(s) Treasury Bills and able to reflect actual number counted in a prominent position of the instrument and they shall be disposed as such that the user can obtain a clear and unobstructed view of all the operations of the Machine.

Marking.

2. Every Automated Teller Machine/Cash Dispenser Machines accepted for Verification shall be clearly and permanently marked with—

(*i*) The name of the Manufacturer ;

(*ii*) The type or Make of the Instrument ;

(*iii*) Model Number and Serial Number of the Instrument ;

(*iv*) The purpose of its use.

Materials and Principles of Construction.

3. Automated Teller Machine/Cash Dispenser Machines should be made wholly of Materials with sufficient gauge and strength to withstand ordinary wear and tear in the normal course of trade.

Duty on Owners of ATM and Note Counting Machine.

4.—(1) The Owner of an ATM/Cash dispenser and Note Counting Machine shall keep and maintain in accurate condition records of all transactions for a period of two years in line with the provision of Section 10(4) of the Weights and Measures Act Cap. W3 LFN 2004.

(2) The Owner of an ATM/Cash Dispenser and Note Counting Machine shall submit to the Superintendent of the Weights and Measures Department Type-Approval Certificate before initial Verification in accordance with Section 7 of the Weights and Measures Act.

Purpose of ATM and Note Counting Machine.

5.—(1) Within premises of any description, an ATM/Cash Dispenser shall be able to weigh, count and dispense denominations of Currency or Coins loaded as a means of facilitating business transactions.

(2) Note Counting Machine shall be able to count by number all denominations of Currency or Coins loaded in the trough as a means of facilitating business transactions.

Legal Metrology Requirement.

6.—(1) ATM shall have Audit trail and log to facilitate dispenser accuracy investigation and reconciliation.

(2) All Cash Dispenser Machine shall have constant and consistent illumination to enable user see/know the number of note(s) dispensed.

(3) All ATM shall at all reasonable time on request be able to print out amount withdrawn, date of withdrawal and surcharges.

(4) The amount withdrawn by the user should be legibly displayed on the screen to correspond with the amount requested for by the use of selection button.

(5) ATM/Cash Dispenser construction and design should have a fail-safe such that when user make withdrawer and takes their Cash, it is not possible to forget their Card.

(6) ATM/Cash Dispenser interfaces shall have the desired high level of usability/user friendly, it should be flexible, legible, expressive and easy to use.

(7) ATM/Cash Dispenser interface (Navigation Menus) shall be 'best of breed' menu system with excellent usability.

(8) The interfaces menu indicating the amount to be withdrawn should correspond directly with the button arrow.

(9) If the user makes an error while using the system by inputting wrong amount figures, the system should be able to recover by providing good error messages and using reversible action to apply users to correct their own errors.

(10) All ATM/Cash Dispenser shall have control that permits Cash to come out first to user before exit of the Card.

(11) In the case of a dispute complain of by user of ATM in respect of inaccurate dispensed Cash, the Journal Information and other similar Information that might aid the accuracy of the dispenser mechanism shall be printed out at the instance of the Weights and Measures Inspector and be retained/maintained by the Inspector and Owner for two (2) years.

(12) ATM/Cash Dispenser shall indicate the direction for which card should be inserted.

(13) Note Counting Machine should have totalizer display window at a prominent/conspicuous position at the upper-most part of the Instrument, or as an ancillary.

(14) A power failure should not in any way affect the accuracy of Cash dispensed by ATM.

(15) ATM/Cash Dispenser deposit Cassettes shall have Legal Metrological control that ensure immediate close and lock, of the various sizes of checks, envelops and documents in standard form, automatically when removed from the Depositor.

Verification of ATM/ Cash Dispenser and Note Counting Machine.

7.—(1) The Cash dispensing mechanism of the ATM shall be tested where practicable, in accordance with the requirements of this regulation, but in any case, the accuracy of an ATM and Note Counting Machine shall be ascertained by the Inspector under practical working conditions.

(2) Verification of ATM/Cash Dispenser and Note Counting Machine shall take into consideration—

(*a*) Sensor that evaluate the thickness of each Note ;

(*b*) The electric eye that counts each Note as it exits the dispenser chamber ;

(*c*) Ensure proper function of a Cheque Processing Module and Batch Note Acceptor that allow the Customer to make deposit ;

(*d*) Inspector's verification may include determination of the number of reject notes by ATM as a high reject rate gives indication of a faulty dispenser mechanism.

(3) Verification of ATM/Cash dispenser and Note Counting Machine should ensure consistence and repeatability in dispensing Cash.

(4) Software Verification should be carried out to ensure accuracy of the Sensor that evaluates the thickness of the Notes and the electric eye that count the Notes as it exist.

Permissible Error.

8. Maximum Permissible Error for ATM/Cash Dispenser and Note Counting Machine.

S/N	*Type of Action*	*Response Time Before Session Ends*	*Note or Coin Counting Error*
1.	Prompt Instruction after Transaction.	+-10Seconds	
2.	Withdrawal.	——	±0
3.	Deposit.	——	±0
4.	Note Counting Capability.	——	±0

Stamping of ATM/Cash Dispenser and Note Counting Machine.

9. When ATM/Cash Dispenser and Note Counting Machine complies with the requirements of these regulations, an Inspector shall affix his stamp in such a manner as to seal the dispensing Mechanism and any other parts of the Instrument that may affect the accuracy of the dispenser while the Note Counting Machine will be affixed with the seal as may be directed by the Superintendent of the Weights and Measures and where Software is involved, Software sealing procedure should be applied.

PART II—SUPPLEMENTARY

Interpretation.

10.—(1) In these Regulations unless the context otherwise requires—

"*ATM*" means Automated Teller Machine, a Self-Service banking terminal that accepts deposits and dispenses cash.

"*ATM Dispenser*" includes cassettes, stacks, which releases cash to the consumer, through the slot in the fascia.

"*ATM Interface*" means Communication between the User and the ATM.

"*Audit Trail and Log*" means a journalizing system which could be a sealed flash memory device based on proprietary standards or an actual printer which accrues all records of activities, including access timestamps, number of bills dispensed, surcharge, etc. in a Chronological order.

"*Best of Breed ATM Menu*" means ATM navigation menus which enables a User to achieve excellent usability.

"*Bill or Note High Reject Rate*" means to indicate a problem with the bill when it is outside its permissible thickness and with the dispenser Mechanism.

"*Cash Dispensing Mechanism Electric Eye*" means a mechanism which counts each bill as it exist the dispenser.

"*Cash Dispensing Mechanism Sensor*" means evaluate the thickness of each bill and able to determine the maximum and minimum thickness of such bill "GPS" means Global Positioning System.

"*Deposit Cassette*" means the receiver of deposit envelops inserted into the deposit slot of an ATM.

"*Fail Safe*" means a mechanism built in or programmed in an ATM that ensures that a user does not respond to a command after a transaction within a maximum permissible term ends.

"*Inspector*" means the Inspector of Weights and Measures appointed under the Weights and Measures Act.

"*Superintendent*" means the Superintendent of Weights and Measures appointed under the Weights and Measures Act.

"*Maximum Permissible Error*" means an extreme value of an error permitted by the specification as stated in this regulation.

"*Verification*" means the procedure (other than type approval) that includes the examination and marking and/or issuing of a verification certificate that ascertains and confirms that the measuring instrument complies with the statutory requirements.

(2) Words and expressions used herein but not defined shall have the same meaning assigned to them in the Act and Regulations.

Short Title.

11. These Regulations may be cited as the Weights and Measures Banking Sector Legal Custody Transfer Regulations, 2014 and shall apply throughout the Federal Republic of Nigeria.

MADE at Abuja this 4th day of November, 2014.

Signed
OLUSEGUN AGANGA
Minister of Industry, Trade and Investment

EXPLANATORY NOTE

(*This Explanatory Note does not form part of these Regulations but is intended to explain their purport*)

These Regulations prescribe the Verification/Test for the Banking Sector by the Inspectors of the Weights and Measures Department of the Federal Ministry of Industry, Trade and Investment.

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WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004)

TELECOMMUNICATION SYSTEM CLOCK, TIME, DATE SYNCHRONIZATION, TOTAL METERING AND BILLING SYSTEMS AND DATA USAGE REGULATIONS, 2014

Under Section 8 (1) (*b*), (*d*), (*f*) AND 47 (2) (*b*)

ARRANGEMENT OF REGULATIONS

Regulation :

S. I. No. 54 of 2015

WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004)

TELECOMMUNICATION SYSTEM CLOCK, TIME, DATE SYNCHRONIZATION, TOTAL METERING AND BILLING SYSTEMS AND DATA USAGE REGULATIONS, 2014

[*4th Day of November*, 2014] Commencement.

In exercise of the powers conferred upon me by Sections 8 and 47 of the Weights and Measures Act (CAP. W3 LFN 2004), Laws of the Federation of Nigeria, 2004 and all other powers enabling me in the behalf, I, OLUSEGUN AGANGA, Minister of Industry, Trade and Investment, hereby make the following Regulations—

PART I—GENERAL PROVISIONS

Scope and Acceptability.

1. These Regulations shall apply to all Telecom Service Providers for the purpose of Synchronization of Clock, Time, Date, Total Metering and Billing System and Data Usage of Telecommunication System(s) for the verification of accurate and reconciliation of Call Data Record/Internet Protocol Detail Records, as determined by the Weights and Measures Department from time to time.

Submission of Information.

2.—(*a*) All Telecom Service Providers shall provide the information of their Telecommunication System to the Department as follows—

(*i*) Clock, Time and Date Synchronization Architecture ; and

(*ii*) Degree of Accuracy for the purpose of :

(*i*) Registration of Instrument ;
(*ii*) Type Approval Evaluation ;
(*iii*) Initial Verification ;
(*iv*) Periodic Verification/on-line monitoring.

(*b*) The Weights and Measures Department shall conduct manual test/ inspections which may be replaced with an automated process (on-line monitoring) subject to the availability of new technological innovations ;

(*c*) On the basis of the complaints filed against a Telecom Service Provider for inaccuracy of metering and billing, the Department shall initiate an investigation process as may appear expedient for the purpose of determining whether or not the provisions of the Act are being complied with ;

(*d*) The Weights and Measures Inspector shall perform routine test to ensure that the Telecom Service Provider's Time, Date and Tariff are accurate.

(*e*) All Telecom Service Providers shall provide unhindered access to the authorized Inspector of the Weights and Measures Department using manual or automated system for obtaining information, inspection and audit

of telecommunication system(s)/network in order to ensure compliance of all parameters relating to total metering and billing systems as provided in these regulations.

(*f*) The malfunction of any master clock in any telecommunication node should not in any way affect the accuracy of the metering and billing system.

PART II—TELECOM SYSTEM CLOCK

Clock Synchronization.

3.—(*a*) All Telecom Service Providers shall align the frequency of their telecommunication system in accordance with the Primary Reference Clock (PRC) and Synchronization Supply Unit (SSU) for provision of error free data of intelligence transmitted among various network nodes.

(*b*) All Telecom Service Providers with high speed backhaul networks shall have at least two alternate sources of PRCs for maintaining accuracy at any point in time.

(*c*) In case of failure of the system in exceptional circumstances to provide accurate PRC or SSU, the network will be run from a system clock with accuracies of at least 1 part in 10^6 (1×10^{-6}).

PART III—TELECOM SYSTEM DATE AND TIME

Time and Date Synchronization.

4.—(*a*) All Telecom Service Providers shall maintain their telecommunication system(s) containing NTP servers.

(*b*) All Telecom service providers shall provide type approved telecommunication systems that ensures accurate timing for metering and billing system.

(*c*) All Telecom Service Providers shall be required to ensure the following :

(i) Up to 100msec accuracy of date and time clock(s) of telecommunication system used for CDR/IPDR.

(*ii*) Periodically synchronize date and time stamps with a standard internationally recognized NTP or GPS source shall be put in place.

(*iii*) The other Telecom Service Provider's network with whom an Interconnect is established or being established also conforms to these regulations.

(*d*) For the purpose of determining time accuracy, the actual beginning of a call is the time instant, determined on the basis of the time of the official time standard at which the connection has been set up to end.

The actual end of a call is the time instant, determined on the basis of the time of the official time standard, at which the connection is released.

PART IV—BILLING SYSTEM

Billing Tolerance.

5.—(*a*) During billing test, Weights and Measures Inspector shall among others if need be, make a demand of call records from the billing system and cause same to be rerated by the Inspector in accordance with the billing tariff plan. This rerated per call charge will be compared with the per call charge appeared on the bill issued to the customer in line with Section 25 of the WM Act Cap. W3 LFN, 2004.

(*b*) No tolerance will be given to the difference between the rerated per call charge and also the per call charge appeared on the bill issued to the customer. The billing tolerance for each billed call for different type of services shall be as follows :

(*a*) Fixed Wired/Wireless	: +/- 0 Kobo
(*b*) Mobile Service	: +/- 0 Kobo
(*c*) Modem Dial-up Internet Service	: +/- 0 Kobo

Verification of Metering and Billing System.

6. The Inspector is allowed to use automatic call generators to generate Test Calls from switches to test the metering accuracy.

(*i*) *Method One*—The Inspector shall reconcile test log records from call generators with the corresponding records in the Billing System.

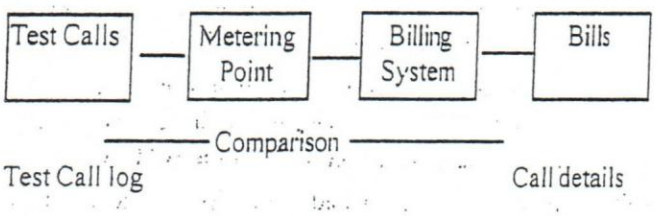
(*ii*) *Method Two*—The Inspector shall reconcile test log records from call generators with the records extracted from a metering point, followed by reconciliation with the metering point and the corresponding records in the Billing System.

(*iii*) *Method Three*—Manual test calls are acceptable if there is no appropriate test equipment for the Inspector.

(*iv*) *Method Four*—Other methods including on-line monitoring shall be in accordance with the Superintendent directives from time to time.

Methodology to Verify Metering System Using Test Calls.

7. The Metering Test is performed on verification by the Inspector as shown below—



The test should involve the following steps—

(*a*) Generation of Test Calls.
(*b*) Collection of Test Call log.
(*c*) Collection of call details from the Billing System.

(*d*) Producing test result by comparing the Test Call log from call generator with the call details from the billing system. Test Calls are accepted or rejected in accordance to the tolerance levels.

Maximum Permissiable Error.

8. Maximum Permissible Error for Total Metering and Billing System (MPE).

S/No.	*Time Stamp*	*Error*
1.	Time Beginning - Time End	± 100 milliseconds
2.	Supplementary Services (Time Beginning - Time End)	± 100 milliseconds

If the duration of the call and the use of the system respectively is determined by the number of clock pulses, the following requirement have to be met —

(*i*) Up to an interval length of 100 seconds, the clock pulse interval bill may deviate from the standard clock pulse interval by a maximum of 1%, if this value is exceeded, the deviation may not be more than 1 second.

(*ii*) The beginning of the interval may deviate from the actual beginning of the call by not more than 100 milliseconds.

(*iii*) The fraction of a clock pulse interval at the end of a call may be counted as a full interval.

Master Clock.

9.—(*i*) The accuracy, i.e. the deviation of the master clock in dependence on the time, may not exceed 10 exp (-7) within every second.

(*ii*) The time of the master clock may deviate from the time of the network reference clock by up to 0.1 second.

(*iii*) The time instances to be stored in the call record for the beginning and the end of the call or use of the system and the associate values of correction are dependent on the master clock.

(*iv*) Appropriate security measures have to be applied in order to prevent the master clock from taking the wrong time by applying the WMD seal.

(*v*) The tariff to be charged for the respective call has to be determined on the basis of the rate approved by NCC applicable to the relevant distance and the tariff time in compliance with Section 25 of the WM Act.

(*vi*) The call duration has to be calculated on the basis of the difference between the beginning and the end of usage with an accuracy of 100 milliseconds.

(*vii*) When call records are transmitted from the data collection part of the system to the data post processing part of the system, losses,

multiplications or modifications may occur with a frequency of not more than 5 exp (-8).

(*viii*) All measures taken in the process of metering and charging by which charges may be influenced, have to be recorded, by the equipment that is affected by a particular measure.

At the same time, the system shall be able, as far as possible, to allocate the time at which a particular measure was taken, to the respective calls.

Billing System Records.

10. All Total Metering and Billing systems recorded shall be kept by the provider of telecommunication services for at least two years in accordance with the Weights and Measures Act Cap. W3 LFN, 2004.

PART V—DATA USAGE

Verification of a Data Usage Meter System.

11.—(*a*) At all reasonable times an Inspector shall measure internet data traffic a subscriber consumes or to measure how much internet data traffic passes through a subscriber's data terminal/communication equipment over a given time period.

(*b*) The measurement shall provide accuracy for all traffic data usage that traversed :

(*i*) Individual/Corporate Internet Connection ;
(*ii*) Commercial outfit Internet Connection ;
(*iii*) Other Internet Users Connection.

(*c*) Inspector's Verification shall include among others an independent accuracy test of all telecom service provider's data traffic usage instrument (Hardware and Software).

Methodology.

12. Apart from other methods available for the Inspector, the Inspector shall perform independent traffic measurement by generating test traffic data, obtain usage meter records from telecom service providers and compare same traffic data with the Inspector's Independent test records as the Superintendent may direct from time to time.

Meter Permissible Error Calculation.

13. *Meter Permissible Error Calculation for Data Traffic Usage*— The calculation for the meter permissible error shall be :

Quantity of data subscribed for in bytes = A
Quantity of data received (uplink and Downlink) = A_r

$$\text{Percentage Error} = \frac{(A-A_r) \times 100\%}{A}$$

Acceptable Error.

14. *Acceptable error range for Data Traffic Usage Meter*—The acceptable error range for date traffic usage meter shall be ±2.0%.

Marking.

15. Marking Data Traffic meter (Instrument) shall be stamped with the appropriate Weights and Measures Inspector's stamp in a legible and prominent position except where the Instrument is too fragile to withstand Inspector's receiption stamp.

Seal.

16. The adjustment mechanism and the software in the total metering and billing system shall be sealed by the Weights and Measures Inspector to prevent an unauthorized adjustment and to ensure the security of the accuracy of the Instrument at all times.

PART VI—SUPPLEMENTARY

Interpretation.

17.—(1) In these Regulations unless the context otherwise requires—

"*Act*" means the Weights and Measures Act, Cap. W3 LFN, 2004.

"*Accuracy of Metering*" means the degree of approximation between the call data stored in the call records and the actual call data.

"*Authority*" means the Weights and Measures Department of the Federal Ministry of Industry, Trade and Investment.

"*Billing Tolerance*" means the maximum deviation allowed in each call charge of billing test.

"*Clock*" means a method to provide timing signals for the purpose of these regulation, usually located in the nodes of a telecommunications network, used for the purpose of establishing the time of data generation and collection.

"*CDR*" means Call Data/Detail Record, is the record of detailed information such as call type, call start time, call duration, calling party, called party, etc are captured by the switches.

"*Call Duration*" means the interval between the call is actually established, that begins when the call is answered and ends when the call is terminated.

"*Downlink*" means part of a network connection on a data terminal/ communication equipment used to receive, or download, data from the remote server.

"*GPS*" means Global Positioning System.

"*Inspector*" means the Inspector of Weights and Measures appointed under the Weights and Measures Act.

"*ITU-T G.811*" means ITU-T Recommendation on Timing Characteristics of Primary Reference Clock.

"*ITU-T G.812*" means ITU-T Recommendation on Timing requirements of slave clocks suitable for use as node clocks in synchronization networks.

"*IPDR*" means Internet Protocol Detail Record that provides information about IP-based service usage, performance, and other activities as Operational Support System (OSS).

"*Master Clock*" means the clock in the nodes of a telecommunications network, used for the purpose of establishing the time of data generation and collection.

"*Metering*" means the process capturing and recording call details such as calling number, time of day, call duration, etc. for billing purpose.

"*Metering and Billing System*" means all technical facilities involved in the process of metering and billing, such as facilities for generating, transmitting, collecting, storing and processing tariff and call data.

"*MPE*" means an extreme value of an error permitted by the specification as stated in this regulation.

"*Network Synchronization*" means way of distributing a common time and/or frequency to all elements in a telecommunication system/network.

"*NTP*" means Network Time Protocol use to maintain time and date accuracy and reliability for all network elements including but not limited to work stations, servers, routers, etc. in any network.

"*Telecom Service Provider*" means the Licensed Provider of telecommunications service.

"*Primary Reference Clock*" (PRC) means an autonomous clock, operating independently of other sources that provide the reference synchronization signal to all other clocks within a network and refers as ITU-T G.811 recommendation, used for the long term accuracy of Primary Reference Clock and is maintained at 1 part in 10^{-11} (1×10^{-11}) with verification to Co-ordinated Universal Time (UTC).

"*Reference Timing Signal*" means a timing signal of specified performance that can be used as timing source for a slave clock.

"*Regulation*" means all or any regulations issued by the Weights and Measures Department including these Regulations.

"*SSU*" means Synchronization Supply Unit and refers as a logical function for frequency referencing, processing and distribution having the frequency characteristics as per ITU-T G.812 Recommendation with an accuracy on 1 part in 10^{10}(1×10^{-10}).

"*Superintendent*" means the Superintendent of Weights and Measures appointed under the Weights and Measures Act.

"*Telecommunication System*" means any electrical, electromagnetic, electronic, optical or optio-electronic system for the emission, conveyance, switching or reception of any intelligence within, into, or from, Nigeria, whether or not that intelligence is subjected to re-arrangement, computation or any other process in the course of operation of the system, and includes a cable transmission system, a cable television transmission system and terminal equipment.

"*Time*" means the time of the day for the purpose of these Regulations.

"*Timing Signal*" means a normal periodic Signal, generated by a clock.

"*Time Scale*" means a system of unambiguous ordering of events.

"*Time Stamp*" means the time recorded in a CDR used for calculating the charge amount for the services provided or consumed.

"*Type Approval*" means the metrological and technical evaluation of measuring/metering instrument to determine its fitness for trade use.

"*Uplink*" means the part of the network connection used to send data from the data terminal/communication equipment back to the remote server.

"*UTC*" means Co-ordinated Universal Time, the time scale maintained by the Bureau International des Poids Mesures (BIPM) which forms the basis of a co-ordinate dissemination of standard frequencies and time signal.

"*Verification of a Data Usage Meter System*" means the procedure (other than type approval) that includes the examination and marking and/or issuing of a verification certificate that ascertains and confirms that the measuring instrument complies with the statutory requirements.

(2) Words and expressions used herein but not defined shall have the same meaning assigned to them in the Act and Regulations.

Short Title.

18. These Regulations may be cited as the Weights and Measures Telecommunication Legal Custody Transfer Regulations, 2014 and shall apply throughout the Federal Republic of Nigeria.

MADE at Abuja this 4th day of November, 2014.

Signed
OLUSEGUN AGANGA
Minister of Industry, Trade and Investment

EXPLANATORY NOTE

(*This Explanatory Note does not form part of these Regulations but is intended to explain their purport*)

These Regulations prescribe the Verification/Test for the Telecommunication Sector by the Inspectors of the Weights and Measures Department of the Federal Ministry of Industry, Trade and Investment.

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WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004)

OIL AND GAS CUSTODY TRANSFER GUIDELINES
Under Section 8 (1) (b), (d), (f) and 47 (2) (b)

ARRANGEMENT OF GUIDELINES

Guideline :

SECTION IV—CUSTODY-TRANSFER STANDARD GASEOUS PETROLEUM MEASUREMENT

SECTION V—SEPARATOR MEASUREMENT

SECTION VI—WET GAS PETROLEUM MEASUREMENT

S. I. No. 55 of 2014

WEIGHTS AND MEASURES ACT
(CAP W3 LFN, 2004)

OIL AND GAS CUSTODY TRANSFER GUIDELINES

Under Section 8 (1) (*h*), (*d*), (*f*) *and* 47 (2) (*b*)

[*4th Day of November*, 2014] Commencement.

PART I—INTRODUCTION

Purpose of Guidelines

1.—(1) A. The Niger Delta Province (NDP) is a geologic province in the Niger Delta of West Africa also known as the Niger Delta Basin. The province contains one petroleum system, the "Tertiary Niger Delta (Akata-Agbada) Petroleum System" (classified as number 701901), the majority of which lies within the borders of Nigeria, with suspected or proven access to Cameroon, Equatorial Guinea and Sao Tome and Principe. Rationale.

Oil fields in Niger Delta are not large but are plentiful, with 574 fields discovered (481 oil and 93 natural gas fields). The largest field contains just over 159 million m^3 (1 billion barrels). There are many small reservoirs which remain to be explored. Success rate to hit oil in the past of this area is as high as 45%.

Today, the Niger Delta is a mixture of mature onshore and shallow water fields, and newer deepwater fields, and this diversity is recognised throughout these Guidelines. A balance needs to be struck between their application to proposals for new systems featuring single-phase measurement of relatively high flow rates, and the development of more marginal fields whose economics do not support single-phase measurement. In addition, many major NDP developments have now passed their production plateaux, but continue to use measurement stations designed to perform optimally at peak plateaux flow rates. Both the latter scenarios present considerable measurement challenges.

One of the principal aims of the Federal Ministry of Industry, Trade and Investment (FMITI) Licensing and Consents Unit is to maximise the economic benefit to the Federal Republic of Nigeria of its oil and gas resources.

The FMITI has therefore developed these Guidelines in order to help maintain a reasonable standard of measurement on oil and gas, while remaining flexible enough to encourage the development of the remaining hydrocarbons in the Niger Delta.

Application of Guidelines

2. This document contains Guidelines for Licensees and Operators in Nigeria, and the Territorial waters of Nigeria.

The Guidelines are intended for use in the design, construction and operation of metering systems for which the Minister of Industry, Trade and Investment's approval is required under the Weights and Measures Act 2004.

3. These Guidelines should be interpreted as representing general minimum requirements. They should not be viewed as prescriptive, and whatever the 'class' of measurement agreed, alternative techniques to those described in this document will be considered provided that they can be shown to give a similar or greater level of accuracy and reliability.

4. These Guidelines routinely refer to the 'Operator' and the 'Licensee'. While the legal responsibility to meet the terms of the Weights and Measures Act rests with the Licensee, the FMITI expects Operators to similarly adhere to the principles of 'good oilfield practice' and the two terms are used here interchangeably.

5. In order to assist the Licensee in establishing the appropriate method of measurement the FMITI should be contacted at an early (pre-Field Development Plan) stage. Early consideration of measurement requirements will enable the Licensee to complete the screening of options at an earlier stage and so minimise the effort in system evaluation. This procedure is intended to avoid the pitfall of the Licensee proceeding with a system design that is not acceptable to the FMITI.

Contacting the FMITI

6. Contact details for the FMITI can be found on the Ministry's website at : http://www.fmti.gov.ng.

Regulatory Framework.

2.—(1) The principal legislation that applies to the oil and gas production industry, particularly in relation to petroleum measurement, is as follows :

2. *The Weights and Measures* Act 2004.—Petroleum measurement is explicitly required by the Act, but is also implied by obligations elsewhere in the Licence – 3.3 below refers.

3. *FMITI Inspection*—In order to satisfy the Minister that no unauthorised alterations to the approved method of measurement have been made, inspectors from the FMITI may at their discretion inspect metering systems at any stage from construction through commissioning into production.

4. *Method of Measurement*—Where petroleum is delivered via a pipeline that serves as a common transportation route for a number of fields then the "method of measurement" will include :

(*a*) The measurement of petroleum at the terminal serving the relevant pipeline.

(*b*) The allocation procedures used to determine each contributing field's share of the petroleum used at or exported from the terminal.

Purpose for which Measurement is Required.

3.—(1)The first task in determining the suitability of a proposed measurement system or systems is to identify the purposes for which measurement is required. These broadly fall into the following two categories—

(*a*) To account for petroleum won and saved from the licensed area ;

(*b*) For other purposes relevant to the licence.

2. *Measurement of Petroleum Won and Saved* : Among the most usual purposes under 3.1 (*a*) are to—

(*i*) safeguard revenues from oil and gas fields ;

(*ii*) allocate terminal out-turns to contributing fields in shared transportation systems ;

(*iii*) account for petroleum in the form of crude oil, gas or LPG exported from terminals or other export facilities ;

(*iv*) allocate production into shared transportation systems from different fields commingled in shared process equipment ;

(*v*) account for quantities of gas flared ;

(*vi*) account for quantities of gas used for power generation ; and

(*vii*) account for quantities of gas used for gas lift or for reservoir pressure maintenance.

3. *Other Purposes relevant to License* : And under 3.1 (*b*), to—

(*i*) improve understanding of reservoir behaviour to enable effective reservoir management strategies to be implemented ;

(*ii*) account for flare gas measurement, for reporting and consent purposes ;

(*iii*) establish viability of reservoir as production prospect as for example with Extended Well Tests (EWT) ; and

(*iv*) establish clearly whether a reservoir is no longer economically viable prior to initiating abandonment procedures.

4. With the above considerations in mind, the Ministry will seek at all times to implement measurement solutions that are appropriate and economically feasible.

SECTION II—MEASUREMENT APPROACHES

Terms of Reference.

4.—(1) This Section is intended as a high-level overview of typical measurement options. It should be of particular use at the early stages of a field development plan. The decision as to which measurement solution is appropriate for a particular field is arrived at following discussion between the Licensee and the FMITI. A Measurement Approach for the field will be agreed, taking into account the technical and economic features of the proposed field development plan.

2. This Section is not intended to be exhaustive or prescriptive, but rather to—

(*i*) outline the typical scenarios in which each of the Measurement Approaches is appropriate.

(*ii*) describe the typical characteristics of each Measurement Approach and the typical uncertainties that are potentially achievable with each.

Further guidance on the design, installation and reverification for each Approach are given in later dedicated Modules of the Guidelines.

Discussion with FMITI

Selection of Measurement Approach.

5.—(1) For new field developments, Licensees must contact the FMITI so that a meeting may be arranged in order to discuss the appropriate measurement approach.

It is in the Licensee's own best interest that this meeting takes place at as early a stage in the field development as possible.

2. The overall goal is for the measurement technique, uncertainty and operating procedures to be appropriate for the fluid and service in question. The available measurement options may be severely limited by the nature of the fluid measured.

Rather than 'fitting' a measurement approach to a particular field development, it is more appropriate to consider at the design stage the economics of the field and the standard of measurement that will thereby be supported. Essentially this reduces to whether or not the project economics will support separation and dedicated processing of fluids prior to their measurement and export. Once the likely fluid characteristics are clear (e.g. 'single phase', 'wet gas') it will then be clear which of the measurement approaches are realistically achievable.

It may also have to be borne in mind that the fluid characteristics may change throughout the field life. For example, production from a dry gas field may become wet due to falling reservoir pressure, or the water cut of an oil field may increase to the extent that the measurement solution can no longer

be considered a 'single phase' application. Here it may be necessary to establish review dates at which the agreed method of measurement will have to be reconsidered.

The FMITI will normally press Licensees for the best standard of measurement consistent with these economic considerations. The Licensee is then expected to ensure that appropriate design and operating procedures are followed.

3. Once the appropriate Measurement Approach for a particular development has been agreed, this must be regarded as no more than a 'first step'. Whatever the class of measurement system, the target uncertainty will only be met if adequate supporting measures are taken. The fact that a liquid measurement system has been designed, to, for example, Custody Transfer standards does not in itself imply that its measurement will meet its design uncertainty of 0.25%. Rather, that this is the level of uncertainty that such a system may achieve, if operated and maintained correctly.

The appropriate level of maintenance for a measurement system will of course depend on the measurement approach selected. The overall aim of any maintenance programme is to maintain the measurement system within its target design uncertainty. Custody Transfer systems will generally require the highest degree of attention.

Marginal Field Developments

4. The highest standards of measurement are only achievable on single-phase fluids, and the following requirements—

(*i*) 3-phase separation ;

(*ii*) Gas processing and drying (without which the gas is saturated and liable to liquid dropout at the slightest decrease in pressure) ;

(*iii*) Oil processing to 'low pressure' conditions (without which the oil may contain a considerable amount of gas and water vapour in solution).

have the potential to make some 'marginal' field developments uneconomic.

Therefore, when reviewing a Licensee's measurement proposals for a 'marginal' field, the FMITI is fully prepared to agree to the necessary relaxations in measurement uncertainty in the interests of encouraging the development of remaining Niger Delta oil and gas reserves.

For such relaxations to be granted, the FMITI will however require economic justification from the Licensee. This need only be a 'broad-brush' indication, but it should include the following :

(*a*) Details of the relevant field economic parameters (e.g. predicted production profiles and development costs).

(*b*) The measurement options considered (one of which may necessarily

(*c*) The approximate cost to the project that would have been incurred by the installation of a lower-uncertainty (*e.g.* Custody Transfer) measurement system and the economic justification for its rejection.

Economic Exposure

5. At the field development stage, the economic 'exposure', both to the Licensee and the Government (where 'taxable' petroleum is involved) can be calculated from the product of the following projected parameters :

(*i*)Throughout of the metering system (taking into account expected field life) ;

(*ii*) Uncertainty of the measurement system.

This is a useful parameter when determining the appropriate measurement solution. By investing more money in a higher-quality measurement system, it may be possible to reduce the uncertainty and hence the exposure, although to some extent a law of 'diminishing returns' may apply. This calculation will normally form a central part of the preliminary discussions with the FMITI.

"Fiscal" Measurement—Clarification

6. The use of the phrase 'fiscal metering' does not necessarily imply any single expectation of the quality of the instrumentation to be installed. 'Fiscal' refers to the meter's service, not its quality.

High accuracy metering systems installed to determine quantities and quality at points of custody transfer are frequently also fiscal, so the misunderstanding has arisen that only such high accuracy export meters are fiscal.

The following may help clarify the question of what constitutes a fiscal metering system.

"*Fiscal*" literally means concerned with government finance.

A fiscal meter is therefore any system, or element of that system, that is used to determine production rates that will ultimately generate revenue for the Government.

From the Operator's standpoint, fiscal metering systems can be viewed as central to the collection of their own revenues. Operators therefore have a duty to themselves and other stakeholders to ensure that fiscal metering systems, whatever their 'accuracy', are treated with due importance.

Depending on the particular allocation mechanism for a field, any of the following measurements :

* Separator flow-rates
* Well-test flow rates
* Gas flared

* Fuel and utility gas
* Gas injected
* Produced water discharged

may potentially be fiscal.

Measurement Approaches and Typical Uncertainties

7. The following 5 Measurement Approaches are typical :

Approach	*Typical Uncertainty in Mass Flow Rate Measurement* (%)	
	Liquid	*Gas*
Custody Transfer	0.25	1.0
Allocation	0.5 - 5	2 -5
Well Test	10	
Multipurpose Metering	10 -20	

Of these uncertainty limits, only those of Custody-Transfer are clearly defined by Industry consensus. The remainder are approximations, reflected by the relatively wide ranges quoted here. Indeed, there seems little point in defining limits that cannot be demonstrably adhered to through traceable measurements; in many cases meaningful comparison with a standard is simply not possible.

The characteristics of these approaches are discussed in turn in sections 2.5-2.8. Design, operation and reverification considerations are covered in detail in dedicated Modules of these Guidelines.

Fuel and Utilities Gas

8. Fuel gas measurement systems should normally be designed and operated to meet Allocation uncertainty levels.

Factors Affecting Uncertainty

By Difference Measurement.

6.—(1) The uncertainty of a quantity measured 'By Difference' depends on the following factors :

(*a*) The measurement uncertainty of each of the other elements of the allocation system.

(*b*) The relative proportion of the 'by difference' quantity to total allocation system throughput.

This uncertainty is therefore not a static value, as the second of these, in particular, is subject to change.

New Measurement Systems

2. Operators of fields where measurement 'By Difference' is proposed are expected to provide details of the anticipated uncertainty throughout field life, taking into account the factors listed in 1 above.

Existing Measurement Systems

3. Operators of fields where 'By Difference' measurement is already in place are expected to place the uncertainty of their measurement under continuous review, perhaps by means of 'dynamic modelling' using Monte Carlo simulation methods.

There are many measurement systems in the NDP that would by normal standards be Custody-Transfer quality but where 'By Difference' Measurement could been agreed. The FMITI should be contacted if measurement uncertainty exceeds the levels defined above in 5.7 (i.e. 0.25% for liquid, 1.0% for gas).

Where the Government's financial exposure becomes unacceptably high, the Operator may be asked to consider the retro-fitting of 'direct' measurement techniques.

Use of Statistical Uncertainty Models

4. There is considerable scope for the use of statistical uncertainty models in this area. These are potentially very powerful tools, enabling both Regulator and Operator to determine where maintenance should be targeted in order to gain the maximum return in improved measurement uncertainty.

Selection of Primary Measurement Device.

7.—(1) The selection of an appropriate primary measurement device is a critical step in any measurement approach. BS 7405 provides useful guidance in this area.

Liquid Hydrocarbons

2. The most commonly used primary device for Custody Transfer levels of measurement of liquid hydrocarbons is the turbine meter, normally with a facility for in-situ verification with a pipe or compact prover. The use of master meters for verification purposes may also be suitable for smaller-scale applications.

Coriolis meters are also widely used for liquid hydrocarbon flow measurement, both as primary devices and as 'master meters'. They are particularly suitable for the measurement of LPG or condensate.

The use of positive displacement meters should be considered for flow measurement of highly viscous fluids.

The use of multi-path 'spool-piece'-type ultrasonic meters for Custody Transfer applications is now well established.

3. Where single-phase flow cannot be guaranteed (for example, in separator metering applications) measurement challenges become significantly more pronounced. The correct choice of meter will be influenced by process flow considerations. Gas breakout and high water cut can have significant adverse effects on the operation of turbine meters and ultrasonic meters respectively.

Separator design and maintenance can often be enhanced to minimise the impact of either or both of these factors.

Gaseous Hydrocarbons

4. For dry gas applications the orifice plate is still the most widely-used meter for Custody Transfer measurement of large volumes of high-pressure gas. However, their effective operation is critically dependent on the judicious application of the provisions of International Standard Organisation (ISO) 5166. In particular, the flow should be single phase if an uncertainty of 1.0% or less is required. The Operator must also be able to demonstrate that the orifice plate and meter tubes are in an acceptable condition, and the need for regular inspection of these should always be borne in mind at the design stage.

The use of other differential-pressure devices, such as Venturi or V-cone meters, may also be considered.

Multi-path ultrasonic meters have been in use for a number of years now and have gradually gained acceptance for use in Custody Transfer and Allocation applications. A large amount of data has been collated on these devices and the first standards have now been published.

Further work is presently being carried out and revisions to these standards are expected in the next couple of years.

Coriolis meters are now widely accepted as being capable of performing at Custody Transfer uncertainty levels in gas applications.

Turbine meters have traditionally been used for low pressure and smaller volumes of gas. More recently, with the facility to calibrate at higher pressures, turbine meters have also been used for high pressure and higher volume applications. However, these meters remain particularly susceptible to damage by any liquids present in the gas and they are not therefore regarded as suitable for use in typical offshore applications on the NDP.

Wet Gas and Multiphase Hydrocarbons

5. Orifice plate meters, Venturi meters, V-cone meters and, to a lesser extent, ultrasonic meters, have been widely used in wet gas applications.

When an orifice plate is used in applications where a significant amount of liquid is present (for example, in separator metering applications) the use of a plate with a drain-hole is strongly recommended. The additional uncertainty introduced is likely to be small compared with that which would be introduced by a build-up of liquid upstream of the plate. Recent independent tests have shown that the V-cone meter may be particularly suited to wet gas metering applications. A new generation of 'hybrid' meters is presently under development.

Ultrasonic meters should not be used for the measurement of wet gas if the liquid content is expected to exceed 0.5% by volume.

6. For 3-phase applications where oil, gas and water are to be measured simultaneously, the optimum choice of meter is very much application-dependent. Module 8 of these Guidelines presents more detailed guidance in this area.

New Technology

7. The FMITI encourages Operators to continue to develop and deploy new technology, consistent with the retention of a satisfactory degree of measurement integrity.

Where a Licensee wishes to use new technology or to deploy existing technology in a novel setting, the FMITI may :

* Require that the Licensee establishes an evaluation programme ;
* Wish to be involved in the design, implementation and evaluation of the findings of any such programme.

Custody Transfer Measurement Scenario

Custody Transfer Measurement.

8.—(1) Economic considerations aside, Custody Transfer uncertainty levels for a new field development will be generally be regarded as appropriate.

2. It must also be borne in mind that there may be commercial factors (e.g. pipeline agreements) that dictate the need for Custody Transfer uncertainty levels, irrespective of the FMITI's stance based on the considerations of 8.1.

3. Custody Transfer uncertainty levels will generally only be achieved by the implementation of the highest quality design, installation and operating practices. It is necessarily expensive to achieve, but offers the benefit of reducing financial exposure to potentially prolonged and undetectable systematic mismeasurement.

4. Guidance on the installation, operation and verification of such systems is presented in detail in Modules 3 and 4 of these Guidelines, for liquid and gas systems respectively.

However, there are some high-level features common to both, which are dealt with here.

System Design

5. Custody-Transfer level measurement systems will normally have to employ tried-and-tested measurement techniques designed and installed to recognised industry standards, where these exist.

Where a Licensee wishes to employ 'new' technology in such an application due regard should be given to 7.7 above.

Maintenance and Operation

6. The correct maintenance and operation of a Custody Transfer measurement system plays a critical part in helping the system achieve its potential uncertainty target.

7. In recent years, in an effort to drive down operating costs, there has been a tendency to reduce the presence, on-site, of dedicated measurement personnel. In certain extreme cases, experienced metering personnel only visit the site to perform routine reverification of primary and secondary instrumentation. While the FMITI fully supports Operators in their drive to extend the economic life of fields, this process must be commensurate with the retention of an acceptable level of measurement integrity.

The presence of a complete set of 'as found/as left' routine calibration procedures may give the superficial impression that a metering system is being operated correctly. However, in itself, this is not sufficient. Appropriate day-to-day operation of a measurement station is the critical factor.

The lack of full-time, on-site, presence of dedicated metering personnel is only acceptable for Custody Transfer applications provided the following concerns have been addressed fully:

(*i*) The responsibilities for the day-to-day operation of the measurement station must be clearly defined, and the relevant personnel trained to an acceptable level. The FMITI may require evidence of the training received by these personnel, and details of any independent competence assessment involved. For oil metering systems reliant on meter proving, particular attention should be given to the theory and practice of proving, and the correct practice to be followed with regard to the acceptance of the results of meter proves (Section 18.4 of these Guidelines refers).

(*ii*) Operational Procedures need to be readily available at all times. Particular attention must be paid to alarm-handling; both in terms of responsibilities for checking alarms, and the procedures to be followed in the event that they are found to be active.

(*iii*) Remote metering support may need to be enhanced. Should active alarms or other measurement issues be encountered, there must be available at all times an expert point of contact for the on-site operating personnel.

The acceptability to the FMITI of these strategies may depend on the provision of a remote (e.g. onshore) monitoring capability.

8. In general, maintenance schedules for the reverification of primary and secondary instrumentation should initially be as tight as economically justifiable. If a 'calibration', rather than 'health-checking' regime is proposed, initial recalibration frequencies will typically be monthly for gaseous hydrocarbon systems and 3-monthly for liquid hydrocarbon systems. These may subsequently be relaxed once confidence in the system has been demonstrated.

Allocation Measurement.

9.—(1) Allocation measurement refers to continuous measurement by which a quantity of hydrocarbon, metered to Custody Transfer standard, is attributed to different sources.

For the measurement of a field's hydrocarbons to achieve Allocation levels of uncertainty, dedicated processing facilities for that field will be required.

2. The best levels of Allocation metering may approach Custody Transfer standards. The worst cases may have uncertainty levels only marginally lower than optimal Well-Test systems.

The wide range of uncertainties that may result from this general class of metering is a reflection of the fact that there are no established standards for its deployment, and that there is therefore considerable scope for variation in system design and operation. These areas are discussed in detail elsewhere in these Guidelines—particular attention should be paid to Module 6 (Separator Measurement).

Allocation Measurement Scenario

3. Allocation measurement may be appropriate when the field economics are not sufficient to support Custody Transfer standards of measurement but are nevertheless able to support dedicated separation and process trains with continuous measurement.

4. Practical examples where allocation measurement may be appropriate may include, but are not limited to, the following scenarios :

(*a*) Marginal satellite developments across existing infrastructure where spare separator capacity exists – for example, where all the production from the host field can (due to declining production rates) be routed through one separator, freeing another one for dedicated use with the satellite field.

(*b*) Marginal satellite developments across existing infrastructure where there is insufficient spare separator capacity for the above option; in such cases the host facility's test separator may effectively become a production separator for the satellite field.

(*c*) Development of a marginal gas field where condensate is expected to be present in significant quantities, with the wet gas exported into a shared pipeline for transport onshore–production from this field will [illegible] allocated on the basis of the figures reported by the

Minimising Measurement Uncertainty

5. The measurement uncertainty of an Allocation system will be minimised by the following steps :

(*a*) Appropriate design and operation of the Production Separator (Module 6 refers).

(*b*) A regular programme of routine calibration for all primary and secondary instrumentation. Particular attention should be paid to the condition of primary measurement devices, particularly orifice plates if used.

(*c*) The installation of a water-in-oil meter in the oil take-off line, although attention is required to obtain the best possible results with these devices.

Well Test Measurement.

10.—(1) Well Test measurement refers to intermittent measurement of production rates by test separator metering. Flow rates of each of the three phases are related to well-head parameters (such as choke position or well-head flowing pressure), and the production from each well is integrated over a flowing period to give the total production from each well, and hence the field.

This strategy is fairly widely employed and is often referred to as 'Flow Sampling'.

(2) As with Allocation measurement, there are no established standards for its deployment, and there is therefore considerable scope for in system design and operation. These areas are discussed in depth in elsewhere in these Guidelines—particular attention should be paid to Module 6 (Separator Measurement).

Well Test Measurement Scenario

(3) Well Test measurement will be regarded by the FMITI as appropriate for marginal developments whose economics do not support the provision of dedicated separation and process trains and the facility for continuous measurement.

(4) Typical examples of Fiscal Well Test measurement systems include, but are not restricted to, the following scenarios :

Satellite developments across existing facilities where there is insufficient spare separator capacity (either test or production) to permit separate processing of the new field. The existing well-test programme is then extended to include additional well tests from the satellite field.

Development of a number of satellite fields to a central 'hub' facility; allocation to each field will be by 'flow sampling', with Custody Transfer standard measurement of the commingled fluids at export.

Minimising Measurement Uncertainty

5. The levels of uncertainty achievable in Well Test applications depends on a number of parameters, among the most important of which are the frequency and scheduling of well testing, and the state of repair of the test separator and its associated metering instrumentation.

6. The measurement uncertainty of a Well Test system will be minimised by the following steps :

(*a*) Appropriate design and operation of the Test Separator (Module 6 refers).

(*b*) The implementation of a regular programme of routine calibration of all primary and secondary instrumentation. Particular attention should be paid to the condition of orifice plates if used.

7. Hydrocarbon accounting procedures may have a considerable influence on quantities allocated to fields in well-test measurement regimes. Particular attention should be paid to the 'decay factors' used to interpolate between the results of well tests.

Multiphase Measurement.

11.—(1) Fiscal Multiphase measurement refers to simultaneous measurement of all three phases (oil, gas and water).

2. For a proposal for Fiscal Multiphase measurement to be acceptable to the FMITI, it will normally include plans for the periodic reverification of the multiphase meter, for example by its comparison with a separator. Modules 6 and 8 should be consulted for guidance on Separator and Multiphase measurement respectively.

Multiphase Measurement Scenario

3. Examples of typical scenarios where multiphase measurement are likely to be acceptable to the FMITI include, but are not restricted to, the following:

Satellite developments across existing facilities where field economics do not permit the provision of a dedicated process and separation train for the satellite field.

4. In many cases, a multiphase approach may be preferable to a solution based on well testing.

While it is true that the instantaneous measurement uncertainties on a multiphase meter may be relatively high (compared to those possible on a test separator), the ability to allocate production on the basis of continuous, rather than intermittent, measurement may be a more significant factor.

Subsea/ Downhole Measurement.

12.—(1) The provision of subsea or even downhole measurement is essentially seen by the FMITI as a method of 'last resort', to be used only when there is no other technically or economically feasible means of attributing production to a field. Module 9 of these Guidelines provides some further Guidance in this area.

2. The principal challenges to the acceptability of a measurement proposal based on subsea or downhole measurement are :

(*a*) The feasibility of the proposed method for the reverification of the meter.

(*b*) The presence of an acceptable contingency plan for adoption in the event of meter failure.

Subsea/Downhole Measurement Scenario

3. Examples of typical scenarios where multiphase measurement are likely to be acceptable to the FMITI include, but are not restricted to, the following :

(*a*) Satellite developments tied back to subsea templates prior to processing on a host facility.

(*b*) Single-well satellite developments tied back directly to a host facility where there is no tax or equity differential between commingled fields; in this case measurement is required for reservoir management purposes only.

Section III—Custody Transfer Standard Liquid Petroleum Measurement

Terms of Reference.

13.—(1) These notes are intended to provide the industry with guidance on high-quality flow measurement of petroleum in the liquid phase.

This Module of the FMITI Measurement Guidelines is intended for use with liquid petroleum that is sufficiently above its vapour pressure that there is no significant risk of gas break-out at the meter.

Where this condition is not met, operators are strongly advised to exercise caution in applying the principles and advice provided here.

This module deals with 'Custody-Transfer' standard liquid hydrocarbon flow measurement. By industry consensus, this is defined as dry mass flow measurement with an overall uncertainty of ±0.25% or better. The overall uncertainty is derived from an appropriate statistical combination of the component uncertainties in the measurement system.

The equipment used to achieve this level of performance will vary according to the particular circumstances of each development.

2. A substantial proportion of the metering stations covered by this Module of the Guidelines are based on 'conventional' turbine meter and bi-directional prover loop systems with associated on-line density measurement and automatic sampling. However, an increasing number of Custody Transfer metering systems are making use of alternative technologies, such as ultrasonic meters, for flow measurement. There may be very sound technical reasons for doing so.

Many fields on the NDP have now passed their production plateaux, and as flow rates decline the original method of measurement agreed with the Ministry may no longer be suitable. For example, there may be significant problems associated with the operation of turbine meters and prover loops at flow rates considerably lower than their design maxima.

Alternative means of operation in such circumstances (for example, the use of smaller turbine meters, with a master meter for reverification purposes) are considered in this Module.

Volume or Mass Measurement

Mode of Measurement.

14.—(1) Hydrocarbon measurements may be either in volumetric or mass units. The choice of measurement should be discussed with the FMITI.

2. Volume will normally be used for stand-alone field tanker loading operations and mass for multi-field pipeline or offshore pipeline with an allocation requirement.

3. Where the measurement is in volume units, these should be referred to standard reference conditions of 15°C temperature and 1.01325 bar absolute pressure. The metering system should compute referred volumes by means of individual meter temperature compensation and totalizers.

4. Mass measurement and reporting may be achieved either by :

(*a*) Measurement of volume flow rate (for example, by turbine or ultrasonic meter) and fluid density ;

(*b*) Direct mass measurement by Coriolis meter.

If the method (*a*) is preferred, the density should if necessary be compensated to the volume flow meter inlet conditions. Mass flow rate may then be computed as the product of this density and the measured volume.

Volume Correction Factors

5. Liquid volume correction factors should be calculated as described in the IP Petroleum Measurement Manual, Part VII ('Density').

The original issue of this paper described a computer routine for the calculation of C_{tl} and C_{pl} for crude oil and condensate. This routine has since been incorporated into many commercial agreements and flow computer

software. It used the 'Downer' equation in the calculation of oil and condensate compressibility, and specified requirements for rounding and truncation of input values and constants.

The FMITI has since accepted a modified form of the IP Routine that incorporates the equation and constants described in API 9.2.1M for the calculation of compressibility. It is also accepted that the rounding and truncation provisions of the IP method may not necessarily be appropriate for modern flow computers and may be ignored.

6. It is essential, however, that the values of K_0 and K_1 input into the flow computer for use in the calculations are representative of the type of oil being measured.

Appropriate values of K_0 and K_1 for oil are given in Appendix F of IP Petroleum Measurement Paper 2.

7. Operators are encouraged to consider the use of specific constants derived for the particular application by laboratory analysis of representative samples.

It should be borne in mind that the 'generalised' values of K_0 and K_1 referred to in 14.5 were derived from the analysis of a relatively small sample of stabilised, non-Niger Delta, crude oils. The derivation of application-specific constants is therefore particularly recommended for systems with high crude oil vapour pressures, as it is to these systems that the 'generalised' constants are likely to be least applicable.

General Design and Installation Criteria.

15.—(1) Metering stations should have a common inlet header and, if necessary, a common outlet header to ensure uniform measuring conditions at all metering streams, temperature and pressure transducers and density meters.

However if product of differing physical properties is produced by separate production trains and is not fully commingled before metering then it may be necessary to have separate measurement of the differing fluids.

Meter Runs

2. A sufficient number of parallel meter streams should be provided to ensure that, at the nominal maximum design production rate, at least one standby meter is available.

Isolation Valving

3. Adequate valving should be provided such that individual meters may be safely removed from service without necessitating the shut-down of the entire export system.

4. The Operator should be able to demonstrate the integrity of all vent and drains systems, particularly those downstream of the meter. For example, the use of 'double-block and bleed' valves, or sight-glasses, or 'spades' can be considered.

Recirculation Facilities

5. The FMITI does not normally permit the fitting of recirculation loops to metering systems except in production systems featuring rapid tanker loading. Where recirculation systems are fitted around the metering system, full details of recirculation and any other non-export flows through the meters must be recorded.

Sampling System

6. Fiscal Quality crude oil metering systems should be provided with automatic flow-proportional sampling systems for the determination of average water content, average density and for analysis purposes.

Sampling systems should be broadly in accordance with International Standard Organisation (ISO) 3171. Due attention should be paid to the recommendations of the IP Petroleum Measurement Manual, Part VI ('Sampling').

Analysis of the samples obtained will ultimately be used to apportion production to the field from which the liquid hydrocarbons are being measured. They may also form the basis for any Crude Oil Valuation Procedures.

The sampling system is therefore a critical part of any Fiscal Quality measurement system. Any errors introduced through sampling error will generally have a direct, linear effect on the overall measurement.

7. As with any sampling system, it is important that properly-designed sampling probes are used and positioned in such a way as to ensure representative sampling.

8. Sampling flow rates should be 'isokinetic', as defined by International Standard Organisation (ISO) 3171. Sample lines should be provided with flow indicators to help demonstrate that this condition is being met.

Water-in-Oil Meters

9. Corrections to metered throughput for water and sediment content will normally be based on a retrospective analysis of flow-proportional samples.

However, the FMITI may consider the use of on-line water-in oil meters in certain applications.

There are problems inherent in the comparison of any on-line technology with its 'sampling' equivalent. Disparity in their results may be caused by a systematic inaccuracy in the on-line meter, but it may equally be due to a lack of representivity of the samples.

A lengthy period of intercomparison and investigation of the relative merits of the two methods operating on the same, preferably 'typical' system, would be very beneficial to the industry as a whole, and the FMITI would be very interested in Operators' proposals for any such field trials.

Temperature and Pressure Measurement

10. Temperature and pressure measurement points should be representative of conditions at the meter inlet and situated as close to the meter as possible without infringing the requirements of the API Measurement Manual. In practice, this means approximately 5 diameters downstream of the meter location.

11. Temperature measurements that affect the accuracy of the metering system should have an overall loop accuracy of 0.5°C or better, and the corresponding readout should have a resolution of 0.2°C or better - this is equivalent to an uncertainty of approximately 0.05% in C_{TL}.

Thermowells should be provided adjacent to the temperature transmitters to allow temperature checks by means of certified thermometers.

12. Pressure measurements that affect the accuracy of the metering system should have an overall loop accuracy of 0.5 bar or better and the corresponding readout should have a resolution of 0.1 bar or better.

Densitometer Installation

13. Due attention should be paid to the recommendations of the Part VII of IP Petroleum Measurement Manual ('Density').

14. Dual densitometers should normally be used and should feature a density discrepancy alarm system (typically 1.0 kg/m³). Where single-densitometer systems are used, high and low set point alarms should be used.

15. Provision should be made for solvent flushing on systems where wax deposition may be a problem.

16. Densitometers should be installed to the manufacturer's specification and as close to the volume meters as possible. They should be provided with thermowells and pressure indicators so that it may be demonstrated that there is no significant difference from the volume meters' inlet conditions. If this is not the case, temperature and pressure compensation must be applied.

Specific Designated Installation Criteria for Turbine Meter/ Prover loop Systems.

Pulse Counting

16.—(1) The metering signals should be generated by a dual meter head pick-up system in accordance with either Level A or Level B of the IP 252/76 Code of Practice. This is to indicate if signals are "good" or to warn of incipient failure of meter or pulse transmission.

2. A pulse comparator should be installed which signals an alarm when a pre-set number of error pulses occurs on either of the transmission lines in accordance with the above code. The pre-set alarm level should be adjustable, and when an alarm occurs it should be recorded on a non-resettable comparator register. Where the pulse error alarm is determined by an error rate, the error threshold should be less than 1 count in 10^5. Pulse discrepancies that occur during the low flow rates experienced during meter starting and stopping should be inhibited. This is to avoid the initiation of alarms for routine process situations thereby tending to induce a casual attitude to alarms in general.

Prover Loop Design

3. Prover loops should preferably be of the bi-directional type to eliminate possible directional bias. The prover loop swept volume should have a suitable internal lining. The flanged joints within the calibrated volume should have metal-to-metal contact and there should be continuity within the bore.

4. Connections should be provided on the prover loop to facilitate recalibration with suitable calibration equipment which may be a dedicated water draw tank, portable calibration prover loop and transfer meter, or small-volume-type prover.

5. Provers should be constructed according to the following criteria :

(*i*) Unless 'pulse-interpolation' techniques are to be used, the number of meter pulses generated over the swept volume should be at least 20,000 pulses. (This is equivalent to 10,000 pulses between detectors on bi-directional provers).

(*ii*) The resolution of the detector/displacer system should be compatible with the above requirement.

(*iii*) The displacer velocity should not normally exceed 3 m/s to avoid slippage past the displacer but higher velocities may be acceptable with piston-type provers if seal integrity can be demonstrated.

6. Because the resolution of the detector/displacer system can only be gauged by the actual performance of the prover, the FMTI expects the manufacturer to demonstrate an acceptable repeatability during calibration of the prover, such that on 5 consecutive round trips the range of volumes does not exceed ±0.01% of the mean volume. Alternatively, a statistically equivalent repeatability criterion for small volume provers or meter pulse gating systems

17.—(1) For Custody Transfer applications, only transit time multi-path ultrasonic meters should be used.

Meter Diagnostics

2. Multi-path ultrasonic flow meters incorporate a variety of functions that can either individually or collectively be employed for 'health care' monitoring. Provision for data acquisition should be made at the design phase, so that this information may be used for 'footprinting' and monitoring meter performance.

Meter Re-Verification

3. The need to periodically re-verify the meter must be considered at the design stage.

The use of meter diagnostics alone is not presently regarded as sufficient in this respect. An additional means of meter reverification is necessary. Essentially there is the choice between :

(*a*) The use of a master meter ;

(*b*) Removal of the meter for calibration at a recognised test facility ;

(*c*) Comparison of the meter with a pipe prover.

These topics are covered in greater depth in Section 17.10 of these Guidelines.

Use of Master Meter in By-Pass Line

4. Should option (*a*) in 17.3 be preferred, the master meter should be placed in a by-pass line, with the facility to flow simultaneously through the 'duty' and 'master' meters for comparison purposes.

The master meter should preferably be a meter operating on a different physical principle (e.g. a helical-bladed turbine meter). However, there may be practical advantages (e.g. the provision of a meter that could potentially be used as a spare) in the use of a second ultrasonic meter. Periodic comparison of the 'duty' and 'master' meters would immediately reveal the presence of contamination, since the 'master' meter will not have been exposed to the same degree of contamination.

5. Provision of suitable pressure and temperature measurement points is required at both the 'duty' and 'standby' stations in order that the appropriate correction volume factors may be applied when comparing the two meters.

Upstream and Downstream Pipework

6. The straight pipe sections located immediately upstream and downstream of the meter should be selected, fabricated and installed to ensure minimum impact on the performance of the metering station or the specified

Meter manufacturers should be consulted regarding the minimum number of straight lengths required upstream and downstream of the meter.

Flow Conditioners

7. The use of flow conditioners removes one of the principal operational advantages offered by ultrasonic meters, i.e. the absence in the flow line of any flow restriction. However, their use may be necessary in order to address what may be quite serious concerns over possible installation effects.

8. If flow conditioners are proposed as part of the system design then the type and location of these devices should be discussed with the meter manufacturer prior to installation.

Specific Design and Installation Criteria for Coriolis Meter Systems.

18.—(1) This section of the Guidelines highlights the principal points that must be borne in mind when designing and installing Coriolis metering systems. ISO 10790 should be consulted for more detailed guidance in this area.

Flow Profile

2. Coriolis meter performance is not affected to any significant extent by the presence of a 'non-ideal' flow profile at the meter. Coriolis meters are also relatively unaffected by changes in flow profile.

These features of the Coriolis meter have the following implications :

(*a*) The configuration of the upstream and downstream pipework is of relatively minor importance.

(*b*) There is no need to consider the use of flow conditioners.

(*c*) If the meter is to be removed for recalibration, it is not necessary to ensure that the flow profile at the test facility is representative of that experienced by the meter 'in service'.

Pressure Drop Across Meter

3. The pressure drop across Coriolis meters is relatively high. To minimise the potential for 'flashing' of lighter hydrocarbons (with consequent degradation of meter performance) any flow control valves in series with the meter should be placed downstream of it.

Plant Vibration

4. Mechanical vibration has the potential to degrade Coriolis meter performance. If the meter is to be installed in an area with high levels of plan vibration, it may therefore be necessary to clamp or mount the meter in order to minimise this effect.

Temperature Effects

5. Large differentials between the ambient temperature and the temperature of the oscillating tubes of the Coriolis meter may lead to increased error in the temperature compensation routine used to correct the results of the meter's flow calibration to its 'in service' conditions. Where the operating temperature is expected to differ significantly from ambient, the meter should therefore be lagged in order to minimise this effect.

Meter Orientation

6. U-tube devices should be installed with the 'U' vertical to prevent the build-up of gas within the meter body.

Turbine Meter K-Factor

Operating and Re-Verification Procedures—Turbine Meter/ Prover Loop Systems.

19.—(1) The correct operation of these systems is critically dependent on the determination of representative k-factors for the turbine meter. The k-factor used by the stream flow computer (normally that determined at the most recent meter prove) should at all times be within a predefined value, d, of the 'true' k-factor being generated by the turbine meter in its current operating conditions.

The value of d is defined by the Operator at the system design stage. Its value is constrained by the need to retain the overall dry mass uncertainty within ±0.25%, and is typically 0.1%.

Turbine Meter Linearity

(2) For new or modified meters that are to be operated over a wide flow range covering flow rates below 50% of maximum, a characteristic 'Performance Curve' of meter factor versus flow rate should be determined for each meter. This allows the Operator to determine the variation in flow rate that would cause a shift in k-factor of greater than the value of d referred to in 18.1—essentially this is one of the 're-prove alarm limits'.

These curves should cover a range from 10% to 100% of maximum flow rate, subject to any system restriction on flow rate. It is recommended that a number of proves (typically 5) are completed at each of these nominal flow rate points, between which intervals of 10% are suggested.

3. Turbine meters used for 'fiscal-quality' measurement of oil are expected to demonstrate a good degree of linearity in their performance curves. The FMTI typically expects the linearity of meters to be within ±0.15% across the expected operating range of flow rates.

If the variation in K-factor of a turbine meter under normal operating conditions is significantly greater than the value of *d* referred to in 19.1 there will be an increase in the requirement to re-prove the meter due to excursions outwith the re-prove alarm limits. The resultant increased wear on the prover will inevitably have an adverse effect on the duration of its life in service.

Operators are therefore strongly encouraged to use turbine meters with a high degree of linearity. Any extra expense incurred in their purchase is likely to be more than offset by a reduced requirement to reprove the meters during the lifetime of the field.

Proving Regime

4. The requirements governing the intervals between turbine meter proving in a continuous production system (as distinct from tanker loading or batch export systems) are :

For a newly commissioned metering station, for a new meter, or for a meter which is being returned to service after repair, meters should be proved three times per week, at approximately equal intervals between proving, for the first month of operation.

Provided the meter factor performance for this month is acceptable to the FMTI, this frequency may be reduced to twice per week for the second month of operation.

If meter factor performance for this second month is still acceptable, proving frequency may be reduced to once per week at the end.

5. After the initial 'settling in' period described in 18.4, the appropriate proving frequency is determined by the proportion of k-factor shifts in excess of the value d referred to in 19.1 (typically 0.1%).

The maximum interval between successive proves should be no more than (7) days for a stream in continuous operation. Subject to this condition, the proving frequency should be adjusted so that no more than 5% of proves indicate a k-factor shift in excess of d.

6. A meter should also be reproved :

(*a*) When the flow rate through the meter changes by an amount sufficient to cause a change in meter factor greater than 0.1%. This amount will be dependent on the turbine meter's linearity. If the change in flow rate is a scheduled long-term change then the meter should be reproved at the first opportunity. If the flow rate change is unscheduled then the meter should be reproved if the estimated duration of the changed flow rate is 6 hours or more.

(*b*) When any significant change in a process variable such as temperature, pressure or density of the liquid hydrocarbon occurs for extended periods as for flow in (*a*) above that is likely to cause a change in meter factor of 0.1% or more. These values can be determined by a 'regression analysis' of the turbine meters' response to changes in each of these parameters.

In typical Niger Delta production systems practical values of these limits are of the order of 5°C temperature, 10 bar pressure and 2% density.

7. For tanker loading or batch export systems, the frequency of proving will depend on the duration of export and may require several meter factors covering 'ramp up', 'load' and 'ramp down' export rates as well as shifts in fluid temperature.

The frequency of proving will therefore be subject to the approval of the FMITI on a case-by-case basis.

Determination of K-factors

8. For normal operating conditions :

Meter factors should normally be based on the average of at least five proof runs.

The meter factor calculated for each of the consecutive five proof runs must lie within ±0.05% of the mean value of all five.

9. If it proves problematic to satisfy the above condition, for example due to the continual process instability common on some older installations, then an equivalent statistical method may be agreed with the FMITI.

The FMITI has seen many examples in practice where the search for 5 consecutive k-factors within ±0.05% of the mean of all five has not been successful until a great many (as many as 50 in some instances) runs have been completed. The great majority of these runs are then rejected in favour of the last 5. From a purely statistically standpoint, such a practice is highly dubious.

Similarly, the FMITI has seen cases where 'non-typical' operating conditions have been invoked to allow k-factors to be determined more readily. For example, separators have been placed on manual control to stabilise the flow through the meter – with the result that the meter may not be proved at a representative flow rate.

It must always be borne in mind that goal is not simply to satisfy the requirement in 18.8, but rather to obtain a representative k-factor for use until the next meter prove is carried out.

Operators are encouraged to be flexible rather than adhere slavishly to the 'traditional' approach.

10. The following points should be considered when devising a strategy for statistical proving :

(*i*) If it is not possible to achieve the repeatability criteria given in 18.8 within 10 runs, then it may be the case that attempts to obtain a representative k-actor will be unsuccessful even if many more runs are completed.

(*ii*) Under these circumstances it is recommended that a simple arithmetic average of a large number of runs is calculated. The number of runs required will depend on the specific circumstances.

(*iii*) The poor repeatability may be caused by process instability. If this instability is in some way 'cyclical' then the number of runs should be sufficient to cover a complete 'cycle', even if this number is relatively large. Alternatively, if the instability is not regular, a smaller number of runs would probably be sufficient.

(*iv*) A large number of runs may be impractical in certain circumstances, especially those where, due to the large size of the prover or the low prevailing flow rates, the time taken to complete all the proves would be unacceptably high.

(*v*) Where the number of averaged prove runs is less than 20, a statistical analysis should be performed on them in order that 'outliers' can be rejected. This can also be performed when the number of runs exceeds 20, although there the larger total provides some insurance against the undue influence of individual 'rogue' proves.

Data to be Recorded

11. Full details of the proof runs should be entered in the record of meter proves, together with the following information :

Date and Time of prove.

—Fluid temperature.
—Fluid pressure.
—Fluid density.
—Fluid water cut.
—K-factor shift from previous meter prove.

This information may be extremely useful as supporting data should it become necessary to predict k-factors, for example in the event of the failure of a critical element of the meter prover.

K-factor Acceptance Criteria

Any unexplained shift in k-factor in excess of 0.1% should be reverified by a repeat run prior to its acceptance.

12. The performance of a turbine meter should be monitored throughout its service in order to detect any short or long-term change in its characteristics. This is normally achieved by the use of a 'Control Chart', which is essentially a graph of the turbine meter's k-factor history.

Statistical methods may then be employed to assist the operator in deciding whether the result of a meter prove should be accepted. The IP Petroleum Measurement Manual, Part X ('Meter Proving') should be consulted for guidance in this area.

Good proving practice is fundamental to the correct operation of any turbine meter/prover loop system, and as such Operators' strategies will be subject to continuous review by the FMITI.

Prover Failure

13. In the event of the failure of any critical element of the prover the FMITI must be contacted so that an appropriate strategy for the reverification of the turbine meters may be agreed.

14. In the absence of an effective operational prover, it may be necessary to calculate meter factors.

This may be possible using a combination of flow rate (or meter pulse output frequency), meter temperature, meter pressure, water cut, and meter density, using constants which have been generated on the basis of the historical data for that particular turbine meter by use of standard mathematical 'curve-fitting' or 'regression' techniques.

The use of 'calculated' k-factors requires prior authorisation from the FMITI. For such a method to be acceptable to the FMITI, it is important to ensure that :

(*i*) No part of the meter has been modified or replaced since the historical data were gathered.

(*ii*) Although the range of operating conditions whose data are used should be as broad as possible, non-typical data ('outliers'), identified according to standard statistical techniques, have not been included in the regression calculation.

(*iii*) Current operating parameters can be shown to fall within the spread of the historical data to be used.

(*iv*) The set of historical data, the regression calculations used, and the coefficients calculated for each meter are all recorded for possible scrutiny or verification by the FMITI.

(*v*) Sufficient computer facilities and manpower are available to process the large number of calculations involved in a timely manner.

15. Operators should be aware that where turbine meter performance has been affected by contamination of the meters (e.g. by scale formation on the meter blades), regression analysis may not be appropriate.

Spare Prover Sphere

16. A spare prover sphere of the appropriate size and material type should always be available.

This sphere should be stored such that it does not deform under its own weight. Practical solutions to this problem typically involve the storage of the sphere on a bed of polystyrene beads, or the hanging of the sphere in a sack, (but not a net, as the sphere may extrude and deform).

Use of Equipment Outwith its Design Capacity

17. The FMITI strongly encourages Operators to keep the suitability of their measurement systems under continuous review, and to replace unsuitable equipment as required. Nevertheless it is recognised that the turbine meters and provers installed on some older installations may now be over-sized with respect to current production rates.

Given the characteristic operating curve of a turbine meter, with a particularly steep slope and 'hump' at the lower part of the flow range, this may lead to inaccurate measurement unless the proving frequency is increased in accordance with 18.5.

Quite apart from the increased wear on the prover that this would entail, it may in practice be extremely problematic. If significant flow instability is present, it may become difficult or impossible to prove at all. Alternatively, flow energy may be insufficient to drive the sphere through the prover smoothly or reliably. In such low or unstable flow conditions, temperature, pressure, density, and water content may also fluctuate. As viscosity, which may be affected by each of these parameters, is also a dominant influence in turbine meter operation, meter proving may be especially unreliable.

In such circumstances the Operator is encouraged to consider either the alternative proving methods discussed in 18.9 and 18.14, or the use of a 'master meter' (this is covered in 13.9).

Prover Calibration.

20.—(1) The calibration of the prover is probably the most significant single event in the operation of any measurement station that relies on proving for the reverification of its flow meters. Any error introduced at this stage will persist until the prover is recalibrated – this may be a year or more later—and all flow meter calibrations in the interim will be subject to this error.

Inadequate preparation on the part of the Operator has the potential to lead to delays in the completion of the calibration process. It is in the Operators own interest that the calibration is completed without any unnecessary delays (consistent with the correct calibration procedures being followed). The cost of the calibration, direct and indirect, will thereby be minimised, as the Calibrating Authority is normally paid on a daily rate, and any deferment of production caused by the calibration procedure will be minimised.

Appendix 23.2 contains some important guidance for Operators to help ensure that the prover calibration proceeds as smoothly as possible.

2. Prover loops should be calibrated at the manufacturer's works by methods described in IP or ISO standards as part of their systems checks, and again after installation on site. One copy of the calibration certificate for each of these and all subsequent calibrations should be sent to the FMITI.

These certificates should contain the following information:

(*i*) The reference numbers of the sphere detectors and detector seals used in the calibration.

(*ii*) Prover internal diameter and wall thickness.

(*iii*) Prover steel expansion coefficients.

(*iv*) The value of Young's modulus for the prover steel.

(*v*) Details of the traceability to national standards of the calibration equipment.

The values of these constants should not change from year-to-year without the prior approval of the FMITI.

3. The FMITI must be given at least 14 days notice of all prover loop calibrations so that arrangements for possible witnessing can be made.

4. Any maintenance work on the prover that could affect the swept volume (for example, changes of sphere detectors and switches) should not be undertaken without prior notification of the FMITI. The FMITI will advise if a recalibration is required.

5. Inspection of all critical valves and instrumentation along with the sphere, checking of sphere size, sphericity, etc. should take place prior to calibration. After calibration the sphere detectors and all vents and drains should be sealed.

Recalibration Frequency

6. While a metering station is in service, prover loops should normally be calibrated at a frequency of not less than once per year. There are certain circumstances under which the FMITI may permit the interval between successive prover calibrations to be extended to 2 years, on the basis of historic stability and low production rates. Further details of these conditions are given in *Appendix* 3.1.

Where the agreed interval between successive calibrations has to be extended for operational or weather reasons, a two-month 'period of grace' will be allowed. Operation beyond this period requires dispensation from the FMITI. Any agreed delay should not be carried forward to the next calibration. For example, if an annual calibration is delayed by 2 months, the next calibration will be due in 10 months' time.

Acceptance of Results of Prover Calibration

7. For a prover base volume calibration to be acceptable, it should be based on 5 consecutive round trips where the range of volumes is within ±0.01% of the mean of these 5 volumes.

8. The FMITI expects the values of base volumes obtained to agree to within ±0.02% from year to year.

There is a degree of flexibility in the interpretation of this limit, depending on the ease with which the initial repeatability criterion (defined in 19.7) is met—*i.e.* it may be interpreted as meaning ±0.02% rather than ±0.020%.

For example, a result with a shift of 0.024% from the previous year's value would not be acceptable as a first attempt, but would perhaps be acceptable if it was obtained after several days of previously unsuccessful attempts to obtain 5 runs which agree to within ±0.01% of the mean.

Any shift of >0.025% should certainly be verified by a repeat calibration at a different flow rate.

The difference in flow rate should be at least 25%, if operating conditions permit.

The Operator must seek approval from the FMITI before any shift in excess of 0.02% is accepted.

Calibration using Water as the Process Medium

9. The FMITI prefers that calibrations are carried out at line conditions, using the process fluid as the flowing medium. However, under certain circumstances the use of water, rather than the process fluid, may be justified.

If the levels of stability referred to in Section 6 cannot realistically be achieved then the use of water, rather than the process fluid, should be seriously considered by the Operator.

There are number of reasons why calibration on water may be desirable. For example :

(*i*) Calibration of the prover on product may result in the deferment of production.

(*ii*) There may be concerns that the required level of process stability may not be realistically achievable.

(*iii*) The calibration may be completed more rapidly using water, given the better levels of temperature stability achievable, and this may result in a cost saving for the Operator.

(*iv*) There may be environmental or safety concerns over the use of hydrocarbon as the flowing medium.

Where the Operator is considering the use of water then prior consultation with the FMITI is required.

At the moment there is no evidence to suggest that the use of water introduces significant additional uncertainty to the calibration procedure. However, should such evidence come to light then the FMITI may wish to review its non-objection to the use of water as the calibration medium.

The use of Master Meters for In-Situ Re-Verification of Turbine Meters.

21.—(1) Where the problems with proving described in 18.19 are encountered, or where it can be shown that flow rates on the installation concerned have declined to the extent that the existing prover is now over-sized, the FMITI may be prepared to consider meter proving by use of a suitable master meter.

2. The proposed master meter should be appropriate for the nature of the fluids concerned.

Common-Mode Error

3. One of the arguments against the use of a master meter is the possibility of 'common-mode' errors. These may be caused by :

(*i*) A change in the fluid's characteristics that affects equally the response of the 'duty' and the 'master' meter.

(*ii*) A long-term 'drift' in the response of both the 'duty' and 'master' meter caused by their continued use.

4. In order to guard against the first of these, it has until recently been thought to be a necessary condition that the master meter should be based on a different operating principle from that of the meters being proved.

While this is perhaps still advisable, recent experience with helical-bladed turbine meters suggests that they may be sufficiently insensitive to changes in the process fluid to make the first of these sources of common-mode error unlikely.

5. In order to guard against the second source of common-mode error, the 'master' meter should be by-passed and isolated when not in use so that any long-term drift would be detectable when the 'duty' meter is compared with the 'master' meter.

Installation Considerations

6. A master meter installation should include :

(*a*) Sufficient upstream filtering of the fluid to protect the master meter from damage.

(*b*) Sufficient uninterrupted straight lengths of pipe upstream of the master meter to ensure unbiased flow at the meter.

(*c*) Sufficient valving to allow the master meter to be removed for inspection and calibration without disturbing normal flow.

(*d*) A dedicated master meter flow computer capable of determining master meter flow, temperature, pressure, and density to a level of accuracy equal to that of the flow computer used with the meter being proved. Such a master meter flow computer should ideally be programmed to control proving sequences and to calculate meter factors.

Recalibration of Master Meter

7. The master meter should normally be recalibrated at intervals not exceeding six months, or whenever its operation is thought to be suspect. The meter should be calibrated as a complete working unit—combined spool and internals, along with any dedicated interface electronics as required.

8. The master meter should be calibrated on the in-service fluid, where possible, across at least the range of flow rates commonly met in operation. Use of any other calibration fluid should be discussed with the FMITI well in advance. Alternative calibration fluids should, if possible, be of the same viscosity range as the service fluids likely to be encountered during the master meter's service.

9. A spare calibrated master meter should be held at the metering station, ready to be placed in service during periods when the other master meter is being calibrated or inspected.

10. The FMITI may require to witness calibrations of master meters, and should be given at least 14 days' notice of such calibrations.

Initial Calibration

Operating and Re-Verification Procedures—Ultrasonic Meters.

22.—(1) Meters should under all circumstances be flow calibrated at a recognised laboratory prior to their use in service. This applies equally to master meters, where their use is proposed.

The meter should be calibrated over as much of the full anticipated flow range as possible, with particular attention paid to the expected operating flow rate. The meter should normally be calibrated at least six 'nominal' flow rates evenly-spaced within the range, with interpolation of the calibration offset for flow rates not directly covered. To maintain traceability, the calibration data and interpolation calculations should be stored within the flow computer rather than the meter electronics.

2. While it is recognised that meters may have built-in viscosity correction features, the dependence on these factors should be minimised by calibrating the meter on a fluid that resembles, as closely as possible, the in-service process fluid.

It is recognised that this may be a potential barrier to the use of ultrasonic meters for fields with high export flow rates, as suitable calibration facilities may not exist. There may be scope to use onshore terminal facilities as

calibration sites. Metering stations equipped with turbine meter and prover loop designed for 'batch' export may be particularly suitable for this purpose.

3. In addition, the flow profile at the calibration must be representative of that predicted at the 'in-service' meter conditions. If this condition cannot be met then the use of flow conditioners may be necessary (*see* also 17.7).

In-Service Reverification

4. It is recognised that the inherent diagnostic features of ultrasonic meters are a potentially very powerful tool. These potentially offer the user the ability to extend the 'health care monitoring' strategy to the extent that either meter removal and recalibration, or an alternative in-situ reverification (such as meter proving) become unnecessary.

However, it has not been demonstrated to the Ministry's satisfaction that there is sufficient quantitative information contained within the diagnostics for such a scenario to be acceptable. The information offered by the diagnostics is qualitative rather than quantitative, and as such cannot be relied upon to demonstrate that meter performance has changed by a pre-determined amount that would necessitate meter removal and recalibration.

Therefore, as indicated in Section 22.3, there are essentially 3 methods for reverification of ultrasonic meters. These are :

* The use of a master meter.
* Removal of the meter for calibration at a recognised test facility.
* Comparison of the meter with a pipe prover.

Master Meters

5. The 'duty' meter should be compared with the 'master' meter at a frequency agreed with the FMITI.

This will typically be weekly at first, with the possibility to extend the interval between successive calibrations subject to satisfactory meter performance.

Flow rate should be integrated over an interval agreed with the FMITI so that the 'flowed' volumes calculated by the two meters may be compared, taking account of the necessary volume correction factors. The extent of the calibration interval will depend on the flow rates concerned, but will typically be in the order of 1 hour.

6. To guard against the possible 'drift' of both 'master' and 'duty' meters, the master meter must be periodically removed and calibrated at a recognised onshore facility.

The interval between successive recalibrations of the master meter should take place at intervals agreed with the FMITI.

Meter Removal/Recalibration

7. The comments in 3.11, 1-3.11.3, on the initial flow calibration, above apply equally to subsequent re-calibrations of the meter.

8. The interval between successive recalibrations will be determined on a case-by-case basis following discussions between the Operator and the FMITI.

Proving

9. The use of pipe provers to calibrate ultrasonic meters has been tried in practice, but with limited success. Ultrasonic meters do not have the inherent inertia of turbine meters, with the result that instantaneous fluctuations in flow rate, which are to some extent 'damped' by turbine meters, are generally detected by their ultrasonic equivalents. As a result, repeatability may not be sufficient for meaningful comparisons to be made. This problem is even more pronounced with small volume provers.

There is considerable scope, however, for the use of statistical methods in interpreting the results from pipe provers (see, for example, Folkestad) although these have yet to be adopted in practice in the NDP.

Meter Calibration

Operating and Re-Verification Procedures—Coriolis Meters.

23.—(1) The Coriolis meter should be flow calibrated prior to installation.

2. Since the Coriolis meter is a direct mass meter, calibration against a similar mass flow rate standard is preferred. Where the Coriolis meter is calibrated against a volume flow rate standard, the uncertainty in the density of the test fluid (at meter conditions) must be considered when interpreting the calibration results.

3. The calibration conditions should generally be as similar as practically possible to the anticipated 'in service' conditions.

This requirement does not extend to the upstream pipe configuration, since Coriolis meters are relatively insensitive to flow profile effects (17.2 refers).

Zero Flow Check

4. The following parameters :

* Stresses on the meter from the surrounding pipework.
* Fluid and ambient temperature.
* Fluid pressure.
* Fluid density.

may differ substantially from 'calibration' to 'installation'. The effect of each of these differences will be a shift in the meter's output at zero flow.

Therefore, once the meter is installed, the net impact of these installation effects can be quantified by performing a zero-flow check.

5. To check or adjust the zero-flow output, the meter should be 'full' and all flow stopped.

6. Zero adjustment, if necessary, should only be made under process conditions of fluid temperature, pressure and density.

Meter Reverification

7. The meter may be reverified by :

* Periodic comparison with a prover.
* Removal and recalibration at a recognised test facility.

The FMITI may consider the case for extending to 2 years the interval between successive recalibrations of a prover provided that the following conditions are met :

(*a*) The nominal production rate through the meters routinely calibrated by the prover must not exceed 50,000 barrels/day.

Considering the 5 most recent prover calibrations, for each prover volume to be used :

(*b*) The calibrated volume has remained within a range of ±0.02% of its mean.

(*c*) The shift between the 1st and the 5th prover calibrations is no greater than ±0.02%.

Operators wishing to pursue the possibility of 2-yearly prover calibration, and whose systems meet the above criteria, should contact the FMITI in order that the matter may be discussed more fully.

APPENDIX 3.1

PROVER RECALIBRATION—A GUIDE FOR OPERATORS

To ensure that the process of prover recalibration proceeds as smoothly as possible, Operators must take account of the following guidance.

The calibration of the prover will normally be carried out by an independent third party, referred to here as the 'Calibrating Authority'.

Prior to the Prover Calibration

Prior to arrival of the calibration rig :

(1) The Operator should appoint a member of site personnel to liaise with the Calibrating Authority's calibration engineer.

(2) Site management responsible for production should when possible plan the prover calibration work so that it fits into a period of stable process conditions. (This does not apply when the calibration takes place using fluids other than the process fluids as the calibration medium (*see* 18.9).

(3) A 'lay-down' area for the prover calibration rig should be prepared prior to its arrival.

(4) All necessary Permits-to-Work and/or Isolations should be in place in order to enable the calibration to proceed as soon as possible after the Calibrating Authority's personnel arrive on site.

(5) Unless an 'As Found' calibration is required, the site prover should be drained, with the prover sphere removed and ready for immediate inspection by the Calibrating Authority.

(6) The installation Management should ensure that all relevant site staff have been briefed in advance of their roles and responsibilities so that disruption during the proving process is minimised.

(7) Immediately in advance of the arrival of the calibration rig, the Operator should ensure that :

* The prover's 4-way valve is not leaking.
* All relevant isolation valves are leak free, and a means of testing or proving their integrity established.
* All relevant thermowells have been cleaned out and filled with thermally-conducting oil.

(8) As a minimum, the following spares should be held :

* 4-way valve slips.
* Prover door seals.
* One complete set of prover detector switches; these should have been checked for correct operation and for correct insertion depth.
* Prover sphere valves.

(9) The Operator should check that a spare prover sphere of the correct size, material, and condition is available, as well as all necessary sphere tools and a sphere pump. A readily available supply of glycol should also be provided.

(10) The Operator should contact the Calibration Authority to determine which specific site services are necessary, and then ensure that that these are provided. For example, the provision of the following may need to be considered :

* Power supplies (440Vac, 240Vac or 110Vac) with suitable connections.
* Potable water for flushing the master prover at the end of the calibration.
* Dry white spot nitrogen at 1000 psi.

(11) The Operator should have available a suitable pump for hydro-testing or leak-testing the hook-up of the site prover to the calibration rig.

During the Prover Calibration

(12) During prover calibration, the Operator should strive to maintain, as far as possible, steady flow through the metering station, and remain attentive to the requirements of the calibration, as determined by the Calibration authority's engineers.

(13) The decision as to whether or not the calibration has been completed satisfactorily ultimately rests with the FMTI. However, the Calibrating Authority should normally be competent to decide whether or not the relevant criteria have been met.

After the Prover Calibration

(14) After the prover calibration has been completed, the Operator's personnel should endeavour to isolate and depressurise the prover pipework as quickly as possible without compromising safety.

(15) Once the master prover has been put back in its container, the Operator must make every effort to ensure that the master prover container is removed from site as soon as possible, in order not to create any 'knock-on' delays at the site of the next prover calibration.

APPENDIX 3.2

REFERENCES/TECHNICAL PAPERS

FOLKESTAD, T.—Testing a 12" Krohne 5-path Altosonic V Ultrasonic Liquid Flowmeter on Oseberg Crude Oil and on Heavy Crude Oil. North Sea Flow Measurement Workshop, Kristiansand, Norway 2001.

COUSINS.T, AUGENSTEIN. D—Proving of Multipath Liquid Ultrasonic Flow Meters. North Sea Flow Measurement Workshop, St Andrews, Scotland 2002.

SECTION IV— CUSTODY-TRANSFER STANDARD GASEOUS PETROLEUM MEASUREMENT

Terms of Reference.

24.—(1) These notes are intended to provide the industry with guidance on high-quality flow measurement of petroleum in the gaseous phase.

This Module of the FMITI Measurement Guidelines is intended for use exclusively with single-phase gas. Where liquids or other contaminants are thought to be present, operators are strongly advised to exercise caution in applying the principles and advice provided here.

A separate module of the Guidelines (Module 7) deals with Wet Gas metering.

2. This module deals with Custody-Transfer standard gas flow measurement. By industry consensus, this is defined as mass flow measurement with an overall uncertainty of ±1.0% or better. The overall uncertainty is derived from an appropriate statistical combination of the component uncertainties in the measurement system.

Primary Measurement Device

3. The equipment used to achieve this level of performance will vary according to the particular circumstances of each development. Almost all of the gas metering stations covered by this Module of the Guidelines make use of either orifice plate or ultrasonic meters. These notes deal principally with these two types of system.

Coriolis meters are beginning to be accepted for Custody Transfer gas applications, but there is relatively little experience in this area. The FMITI is of course open to proposals for their use.

Whichever method of measurement is adopted, there are certain common principles that must be adhered to; these are covered in section 4.3 of these Guidelines.

Volume or Mass Units

Mode of Measurement.

25.—(1) All measurement should be made on single-phase gas streams.

2. Hydrocarbon measurements may be in either volumetric or mass units. The choice of measurement should however be agreed with the FMITI.

Where volume is the agreed measurement unit, it should be referred to the standard reference conditions of 15°C temperature and 1.01325 bar absolute pressure (dry).

Sampling

3. Suitable facilities should be provided for the purpose of obtaining representative samples. The type of instrumentation incorporated within the measuring system may influence this specific requirement.

Gas Density

4. Gas density at the meter may be determined either by :

(*a*) continuous direct measurement, by on-line densitometer ;

(*b*) calculation, using a recognised equation of state together with measurements of the gas temperature, pressure and composition.

The continuous measurement of gas density is preferred. However, both methods may be used simultaneously, and the comparison of their respective results may provide additional confidence in the accuracy of each method.

This method is discussed in more detail in 28.9 below.

5. Where measurement is reported in volume, the continuous determination of gas relative density and hence density at standard reference conditions is preferred. However, the standard reference density of the gas being metered may, under certain circumstances, be calculated using a recognised equation of state together with measurements of the gas temperature, pressure and composition.

Calorific Value Determination

6. Provision for the determination of the Calorific Value (CV) of custody transfer gas should be made.

Avoidance of Liquid Carry-Over

General Design and Installation Criteria for Gas Metering Stations.

26.—(1) Metering stations should be designed to minimise the probability of liquid carry-over into the metering section, and from any condensation or separation that would have a significant effect on measurement uncertainties.

Secondary Instrumentation

2. Secondary instrumentation shall generally be required for the measurement and recording of the following parameters :

* Line pressure.
* Differential pressure (where applicable).
* Line temperature.
* Flowing density.
* Density at base or standard reference conditions.
* Gas composition (where applicable).

The position of the instrumentation within the system should be such that, as far as possible, representative measurement is ensured.

3. Consideration should be given during the design of a measurement system for the provision of back-up instrumentation to cover the failure of normal instrumentation, and also for the provision of suitable facilities for the on-site verification of secondary metering equipment.

4. Gas density is normally measured in a 'by-pass' line to avoid introducing flow profile disturbances.

Useful guidance on correct design is provided by the IP Petroleum Measurement Manual, Part VII ('Density').

It is important that the gas entering the densitometer is representative of the gas in the line, in respect of composition, temperature, and pressure. This becomes critically important if, as is generally the case, the pressure and temperature are not measured directly at the densitometer.

In the FMITI's experience, failure to take account of this factor in the design of densitometer installations is one of the principal causes of significant mismeasurement in 'real' Niger Delta applications.

Operators may therefore consider the use of densitometers fitted with temperature elements, although the reverification of these temperature elements may itself be problematic. No standard facility presently exists to measure temperature directly at the densitometer.

Therefore, unless the temperature is measured directly at the densitometer, installations must be designed to so that:

* The effect of ambient conditions (normally a cooling one) on the temperature of the gas sample is minimised. This may mean keeping the densitometer inlet line in close thermal contact with the meter tube; ideally it should be placed under any lagging. In extreme cases it may be necessary to heat-trace the line; in this case care must be taken not to over-heat the sample.

* There is no pressure drop between the densitometer and the point in the system where pressure is normally measured. Therefore all isolation valves between the densitometer and the pressure measurement point must be of the full-bore type.

In systems where gas density is also 'calculated' (as described in 25.4 (*b*) above), the comparison of the 'measured' and 'calculated' values can provide a valuable means of demonstrating confidence in the measured value. This is covered in greater detail in 28.9 below.

Densitometer installations should be designed so that, as well as meeting the above criteria, they also offer the facility for easy and efficient removal of densitometers and, preferably, the facility to readily view their Serial Numbers for auditing purposes.

Gas Chromatographs

5. Where it is planned to use gas chromatographs, these should be installed at 'high-points' in the system whenever possible, in order to reduce the probability of liquid contamination.

The distance of the chromatograph from sample take-off points (from both the meter streams and the calibration cylinders) should be minimised. Sample lines should be lagged and heat traced to maintain the temperature of the gas above its dew-point.

A low temperature shut-off valve should be installed on the sample inlet to the press ure let-down system to prevent any liquid drop-out being transmitted to the gas chromatograph.

6. Calibration gas cylinders should be prepared by recognised laboratories following procedures accredited by International Standard Organisation (ISO) or equivalent overseas accreditation bodies.

These cylinders should be maintained at a temperature above the 'minimum storage temperature' stated on their calibration certificates. Either the cylinders should be stored in a heated enclosure, or the mixtures should be certified to -10°C or lower.

When a cylinder has been stored at temperatures below this minimum temperature (for example, during transportation offshore) it should be 'rolled' prior to its use in order to homogenise, as far as possible, the cylinder contents. If this is not done, or if the cylinder is used while stored below its minimum temperature, it is likely that the lighter components may be preferentially sampled during chromatograph calibration. This effectively invalidates the calibration gas cylinder's certification.

7. Pressure let-down systems for use with gas chromatographs should, under normal circumstances, be designed so that the ratio of absolute pressures across each pressure reduction stage is constant.

With the possible exception of the final stage let-down valve, pressure let-down valves should be heated to prevent any liquid drop-out caused by Joule-Thompson cooling of the gas as it expands.

In practice this normally means that valves should be 'hot to the touch'.

8. Flow computers and/or databases should be set with alarm limits on each of the components downloaded from the gas chromatograph in order to prevent the acceptance of a spurious composition in the event of system failure.

Choice of Primary Measurement Device

9. Where metering systems other than orifice plate or ultrasonic metering are to be deployed, these systems together with their flow compensating devices (if applicable) should be of the types agreed by the FMITI.

10. If it is proposed to use new technology then details of the proposed equipment, layout and verification procedures should be discussed with the FMITI at the earliest opportunity.

Consistency within Systems

11. In a gas gathering system, the pipeline Operator should ensure that the basic metering data, flow formulae and computational techniques are compatible throughout all the fields or stations connected to the gathering system. Independent validation of the calculations should be performed.

Requirement for Notification of FMITI

12. The FMITI will require adequate notice (normally at least 14 days) of the factory inspection and calibration of primary and secondary equipment, including flow computers, in order that the Petroleum Measurement Inspectors may witness these tests at their discretion.

Application of ISO 5167

Specific Design and Installation Criteria for Orifice-Metering System.

27.—(1) For new measurement systems the design, installation and operation will normally be expected to comply with the principles of International Standard Organisation (ISO) 5166. Any proposed departure from the most recent revision of this International Standard Organisation (ISO) standard should be discussed with the FMITI prior to implementation.

For existing metering systems, proposals to implement new or modified requirements contained within the current revision of International Standard Organisation (ISO) 5167, either partially or in full, should be discussed with the FMITI prior to implementation.

In this regard the comments in 27.2 must be considered carefully.

Discharge Coefficient Equation

2. In 1998 the Reader-Harris/Gallagher equation replaced the Stoltz equation for the determination of orifice plate discharge coefficient in International Standard Organisation (ISO) 5166. The effect of this change, for typical Niger Delta applications, is that the reported mass flow is decreased by a systematic factor in the region of 0.1-0.2%.

It is of course desirable in principle that the latest version of the discharge coefficient equation should be used wherever possible. However, the following points must be considered :

(*a*) Where there is more than one entrant to a pipeline allocation system using exclusively orifice plate measurement systems, uniformity in the use of discharge co-efficient equation at pipeline entry points is paramount, in order to avoid the introduction of a systematic bias. This consideration over-rides the desire to use the latest version of the discharge co-efficient equation.

(*b*) Terminal measurement systems should wherever possible use the latest version of the discharge co-efficient equation, as no systematic bias is introduced as a result.

For allocation systems involving ultrasonic meters as well as orifice plates, the use of the Reader-Harris/Gallagher equation is preferred for all new developments, as these are more likely to be consistent with the ultrasonic meter measurements. Every opportunity should be made to upgrade older orifice plate systems from the Stoltz equation to the Reader-Harris/Gallagher equation.

Design Considerations

3. The orifice plate metering assembly should, be designed and constructed such that the minimum uncertainties specified in International Standard Organisation (ISO) 5167 are achieved and adherence is maintained to the limiting factors detailed in the standard together with the additional specifications detailed below:

(*a*) Maximum Reynolds number should not exceed 3.3×10^7.

(*b*) The total deformation including static and elastic deformation of the orifice plate at maximum differential pressure should be less than 1%.

(*c*) The uncertainty in flow measurement caused by the total deformation of the orifice plate should be less than 0.1%.

(*d*) The location of the differential pressure tappings with respect to the orifice plate should remain within the tolerances given in International Standard Organisation (ISO) 5167 over the full operating ranges of the differential pressure transmitters. Where plate carriers utilise resilient seals, care should be taken to ensure that the load on the plate caused by the maximum differential pressure does not move the plate out of the pressure tapping tolerance.

(*e*) If the maximum differential pressure across the orifice exceeds 500mbar, it should be demonstrated that the conditions of (*b*), (*c*) and (*d*) are met.

4. The latest version of International Standard Organisation (ISO) 5167 provides increased scope for the use of B-ratios higher than 0.5.

Higher B-ratios may be used, provided the overall uncertainty remains below 1.0%.

Meter Runs

5. Sufficient meter runs should be provided to ensure that, at the maximum design production rate of the field, at least one stand-by meter is available.

The operator will normally be expected to provide an adequate level of isolation valving so that individual orifice plates may be removed from service without the need to shut down the entire metering or process system. Such requirements may, under certain circumstances, be waived if suitable alternative fallback options can be formulated and agreed in advance with the FMITI.

Flow Pulsations

6. The orifice metering station should be located such that pulsations in the flowing gas are avoided.

Where these are unavoidable, the uncertainty in flow due to any such effects should be kept below 0.1%.

Useful guidance in such situations may be found in International Standard Organisation (ISO) Technical Report 3313.

Upstream and Downstream Pipework

7. The metering station should be positioned within a process facility such that the effects of fittings and pipework, both upstream and downstream of the orifice meters, do not impact on the minimum straight length requirements given in International Standard Organisation (ISO) 5166.

8. If flow conditioners are proposed as part of the design, the type and location of these devices should be discussed with FMITI. In addition, provision should be made to periodically inspect these devices, ideally in situ.

Specific Design and Installation Criteria for Ultrasonic Metering Systems.

28.—(1) For Custody Transfer standard applications, only transit time multi-path ultrasonic meters should be used.

Application of Standards

2. Where ultrasonic meters are proposed or used as part of a metering system, the design, installation and operation should comply primarily with general guidance given in ISO 12765, BS 7965 and also in AGA 9 plus specific recommendations from the meter Manufacturer.

Meter Redundancy

3. Multi-path ultrasonic meters clearly have an inherent redundancy capability. However, reliance on 'back-up' chords may not be sufficient, since an ultrasonic meter's accuracy will be adversely affected in the event of chord failure, potentially increasing the overall uncertainty of the metering system outwith the agreed limits.

It is recommended that the degree of redundancy of an ultrasonic meter is clearly established at its initial flow calibration, i.e. chords should be intentionally 'failed' by removing the relevant transducers and the performance of the meter can then be evaluated in each case. This will help establish at what point it becomes necessary to remove the meter altogether in the event of the failure of one or more chords.

Alternatively, sufficient meter runs may be provided so that a standby stream, fitted with a calibrated ultrasonic meter, is available at all times.

Isolation Valving

4. The operator will normally be expected to provide an adequate level of isolation valving so that the ultrasonic meter may be removed from service without the need to shut down the entire metering or process system.

Removal of the meter may be necessitated by the failure of one or more of its components. The need for periodic removal of the meter for recalibration at an onshore laboratory must also be considered.

Meter Diagnostics

5. Multi-path ultrasonic flow meters incorporate a variety of diagnostic tools that can either individually or collectively be employed for 'health care' monitoring. The use of data acquisition features that permit this information to be logged (and perhaps accessed remotely in real time) is strongly recommended, as it may eventually be possible to use this information to justify an extension to the interval between meter recalibrations. Section 29 provides further Guidance in this area.

Presence of CO_2

6. The presence in high levels of some components, such as CO_2, in the gas can influence and possibly even inhibit the operation of the meter. The Manufacturer should be consulted on this issue if CO_2 levels are expected to approach 8% or if the meter is operating near the critical gas density.

Upstream and Downstream Pipework

7. When assessing the potential impact of pipe geometry on the performance of the meter, the manufacturer should be consulted and the following factors considered :

* The general configuration of the pipework and fittings upstream and downstream of the metering system.
* The presence of any self-compensating features associated with the ultrasonic meter.

(8) The metering station should not be installed where vibration or noise levels can interfere with the performance of the meter. In particular, ultrasonic

noise from the so-called 'quiet' control valves can interfere with the operation of ultrasonic meters, as can the close proximity of pressure reduction devices.

9. The straight pipe sections located immediately upstream and downstream of the meter should be selected, fabricated and installed to ensure minimum impact on the performance of the metering station or the specified measurement uncertainty.

The step between the ultrasonic meter and the upstream spool should meet the requirements of 28.2, both 'in-service' and at the calibration facility.

10. If flow conditioners are proposed as part of the system design then the type and location of these devices should be discussed with the meter manufacturer prior to installation. In particular, care should be taken to ensure that these devices do not generate ultrasonic noise or interact with self-compensating features built into some types of meter. If flow conditioners are installed then provision should be made to periodically inspect these devices, ideally in situ.

Density Measurement

11. Due to their linear, rather than square-root, relationship with density, flow rates determined using ultrasonic meters are more sensitive to density error than those based on orifice plate meters.

Special care should therefore be taken to ensure the location of secondary instrumentation is both representative and accurate. This is particularly important when density is calculated, as described in 25.4 (*b*).

Isolation of Secondary Instrumentation

29.—(1) Secondary instrumentation, which may be susceptible to damage or malfunction if exposed to foreign matter, should be isolated from the process for the first 24 to 48 hours after start-up.

General Operating and Re-Certification Procedures for Custody Transfer Gas Metering Stations.

Instruments most likely to be affected are densitometers, relative density analysers and gas chromatographs. During this period the flow computers should preferably use a default gas composition to calculate the gas density at operating and reference conditions or where appropriate, 'keypad' values may be manually entered. The computer should be returned to 'live input' density (line and standard reference) as soon as the process clean-up is complete.

Recalibration of Secondary Instrumentation

2. Detailed procedures for the verification of secondary instrumentation, such as that used to monitor and record differential pressure, pressure, temperature, gas composition, density and relative density should be prepared for review by the FMITI.

3. The re-calibration frequency for each component in the measurement system (primary and secondary instrumentation) should be included within the recertification procedure document.

Initially, the re-certification frequency for most components should be monthly. As a history of equipment stability is built up it may be appropriate to increase the intervals between recalibrations. Prior permission to relax these calibration frequencies must be sought from the FMITI.

In order to support such an application it will be necessary to show that the instruments remain within tolerance on a number of successive re-calibrations and are returned to service in the 'as found' condition.

(4) Test equipment used for the calibration of secondary instrumentation should be calibrated following procedures accredited by International Standard Organisation (ISO) (or an equivalent overseas body) whenever possible.

This test equipment should be dedicated to the metering systems and should be stored securely.

(5) The tolerances used when re-calibrating secondary instrumentation should be set at a level which, while not being so tight as to make their achievement under field conditions extremely difficult, should not be so lax as to risk compromising the overall target uncertainty of the measurement system.

(6) The FMITI may consider a re-calibration schedule based on 'health checking' procedures in circumstances where signal data analysis systems are in place to monitor the condition of the instrumentation and indicate when an instrument is moving out of its specification. A full justification should be supplied if an Operator wishes to adopt such procedures. This should include an analysis of the impact such procedures would have on the overall uncertainty of the metering system.

(7) Where other methods of measurement are employed such as turbine meters or PD meters, either singly or in combination, the appropriate operating procedure and also procedures for periodic verification should be discussed at the design stage with the FMITI.

Use of 'Calculated' Gas Density

(8) When density is calculated, as described in 25.4 (*b*), the accuracy of the ancillary instrumentation has an additional significance. Typical sensitivities of calculated density to process variables are :

Variable	Change	% Change in Density
pressure	1%	1.0
temperature	1°C	0.7
Molecular weight	1%	1.6

Measured/Calculated Gas Density Discrepancy

9. In view of the absence of any possible 'common-mode' error, where both 'measured' and 'calculated' density is in place, the discrepancy between these parameters should be monitored continuously as a means of demonstrating the reliability of each measurement.

The system should incorporate an 'alarm limit' to highlight the occurrence of a higher-than-normal discrepancy. This alarm limit should not normally exceed 2% of the value of the density being measured.

In the FMITI's experience, gas density discrepancy is more often caused by error in the 'measured' quantity (26.4 refers). Provided that the reliability of the 'calculated' density has been demonstrated, the system should be set up so that the 'calculated' mode becomes the primary measurement whenever this alarm limit is exceeded.

Gas Chromatographs

10. Gas chromatographs used in high-quality gas measurement applications normally feature a 'self-calibration' facility.

Calibration reports should feature a value for the 'un-normalised' component total. This value should be monitored, as it demonstrates the reliability of the chromatograph's 'response factors'.

Under normal circumstances, it should lie within the range 100 ±2%. For onshore 'sales gas' measurement stations this tolerance will normally be tighter—typically 100±1%.

Pre-Commissioning

Operating and Re-Verification Procedures—Orifice Metering Systems.

30.—(1) The Operator should prepare a schedule of pre-commissioning tests to demonstrate the operability of salient aspects of the flow measurement metrology as detailed within International Standard Organisation (ISO) 5166. In particular, the interior of the meter tubes and of the orifice bores should be examined to ensure they conform to the relevant provisions of the Standard.

Start-up Plates

2. If there is a risk that debris including dust, mill scale or other foreign matter may be present in the process upstream of the meters then consideration must be given to the use of 'start-up' orifice plates to avoid damage to the primary elements intended for long-term metering service.

Inspection of Orifice Plates and Meter Tubes

3. The interval between successive orifice plate inspections should initially be one month.

Once it has been established that plate contamination is not likely, this interval may be extended after consultation with the FMITI. A typical inspection

sequence, assuming that the condition of the plates is satisfactory on each occasion, might be :

* 6 plate inspections at 1-month intervals.
* plate inspections at 3-month intervals.
* 2 plate inspections at 6-monthly intervals.
* Annual plate inspection.

On plate contamination or damage being encountered, the inspection frequency should automatically revert to the previous stage in the above sequence.

4. When carrying out an examination of an orifice plate in the field it is not necessary to conduct a full gauging examination to the provisions of ISO 5166. The main points of focus for an orifice plate field inspection are :

* Freedom from damage to the plate surfaces, particularly damage or rounding to the upstream edge within the orifice bore.
* Correct orientation within the carrier.
* Plate flatness.
* Plate cleanliness.

5. International Standard Organisation (ISO) 5167 allows an edge roughness of up to 0.0004d (where d is the orifice diameter).

However, International Standard Organisation (ISO) TR 15377 indicates that there is a more or less linear relationship between edge roughness and overestimation of discharge coefficient, C_d. On the tolerance limit (0.0004d), systematic overestimation of C_d by 0.1% can be expected.

The cost involved in re-machining the straight edge is likely to be insignificant compared with the costs involved in systematic mismeasurement of mass flow rate by up to -0.1%. Therefore if any damage to the upstream straight edge has occurred, it should always be re-machined prior to re-use.

6. It may be necessary from time to time to examine the condition of the meter tubes, to ensure that corrosion, erosion or contamination has not occurred to an extent likely to affect the accuracy of the meter. These examinations may be necessary if periodic plate inspections show persistent contamination. Particular attention should be paid to the bore of the pipe section extending 2 pipe-diameters upstream of the orifice plate and also to the condition of the upstream and downstream pressure tappings at their respective points of breakthrough into the meter tube wall. If flow conditioners are used, these should also be examined for contamination and any obvious surface damage at the same frequency as the orifice plates are themselves inspected.

It is recommended that boroscopes are used for inspection purposes, and video recording facility should be utilised where possible in order to provide a traceable record of the inspection.

7. For onshore metering stations, differential pressure transmitters should be calibrated at high static pressure representative of the normal operating pressure for the instrument.

An exception can be made where measurement is for 'allocation' rather than 'sales' purposes, where the use of 'footprinted' transmitters may be permissible.

8. For offshore metering stations, high static calibrations should be performed at a suitable calibration facility and subsequently 'footprinted' at atmospheric pressure for use in periodic verifications offshore. The high-static pressure should be representative of that likely to be encountered offshore under normal operating conditions.

Recent years have seen significant advances in differential pressure measurement and calibration techniques. Consequently, in the event of a differential pressure cell failing its 'footprint' check, once liquid contamination, adverse pressure shocks etc. have been ruled out as possible reasons for the failure, adjustment offshore at zero static pressure may now be considered. The following conditions apply:

(*a*) The static shift exhibited by the differential pressure cell at its onshore calibration is less than 0.05% per 100 bar.

(*b*) The differential pressure transmitter has a proven history of static shift stability, i.e. at least two successive 'footprints' demonstrating compliance with the criteria.

(*c*) The differential pressure transmitter damping factor is less than ~1s (this gives a ~5s response time to a step-change in differential pressure).

(*d*) The uncertainty of the calibration standard is an order of magnitude lower than the operating tolerance of the transmitter under calibration.

(*e*) The facilities provided for the calibration are conducive to good calibration practice – for example, a stable environment for the mounting and operation of the calibration standard will normally be required.

If an operator wishes to pursue this strategy, supporting data should be made available to the FMITI, who may then agree to the atmospheric calibration of differential pressure transmitters on an instrument-by-instrument basis.

In order to guard against long-term drift of the differential pressure transmitter, it should be returned onshore for calibration after 12 months in service, irrespective of its performance in periodic reverification offshore.

9. Differential pressure transmitters used in offshore applications should be introduced into service no more than 12 months after the date of their onshore calibration. Their period in service should then not exceed 12 months.

Densitometer Recalibration

10. Gas densitometers used in offshore applications should be introduced into service no more than 12 months after the date of their onshore calibration. Their period in service should then not normally exceed 12 months.

Recalibration Strategy

Operating and Re-Verification Procedures—Ultrasonic Metering Systems.

31.—(1) It is now approximately 20 years since multi-path ultrasonic meters first became generally accepted as being suitable for use in Custody-Transfer applications in the upstream sector. Throughout this period it has been the policy of both the FMITI and commercial pipeline regulators to insist on the periodic removal of the meters for calibration at a recognised test facility. The period between recalibrations varies from application to application, generally depending on calibration history and meter throughput, but as a rule it does not exceed 12 months.

2. As already referred to in 28.5 above, multi-path ultrasonic meters offer a number of inherent diagnostic capabilities that can be used to give at least a qualitative indication that the meter has not shown any drift in its operating characteristic.

Should these self-diagnostic facilities become sufficiently well understood, it may be possible to extend the interval between meter calibrations beyond the current 12 month horizon; it may even ultimately be possible to abandon the strategy of removal and recalibration altogether, in favour of a continuous 'health-checking' regime. This is in fact the ultimate goal of Government, Operators and meter manufacturers.

3. A 'health-checking' regime, as permitted by currently-available technology, offers the following advantages relative to a 'removal and recalibration' strategy :

(*a*) Operating costs may be reduced.

(*b*) Shifts in meter performance could potentially be detected (at least qualitatively) when they occur, rather than at the next meter calibration.

(*c*) Shift in meter characteristic caused by physical shock during removal and transport to and from the calibration facility would be prevented.

(*d*) The introduction of a systematic shift due to faulty procedures at the recalibration facility (for example, failure to install a flow conditioner) would be prevented.

However, it also has the following disadvantages :

(*e*) The diagnostic facilities are presently qualitative, rather than quantitative.

(*f*) The Operator could be exposed to mismeasurement for longer than 12 months, unless the source of measurement was detectable by the meter

4. With reference to 30.3, the FMITI currently believes that the disadvantages listed in 30.3, though fewer in number, are more significant than the advantages.

The meter diagnostics may indicate that a shift in meter characteristic has occurred. However, it has not been demonstrated to the Ministry's satisfaction that the level of shift in meter diagnostics can be related quantitatively to a shift in meter performance. It is therefore currently impossible to determine whether a pre-defined 'trigger level' of meter shift, necessitating meter removal and recalibration, has occurred.

Consequently, the requirement to remove and recalibrate ultrasonic meters remains in place.

The disadvantages referred to in 30.3 can to some extent be mitigated by the adoption of a 'combined' strategy. For example, very significant change in meter diagnostics (an extreme example of which is chord failure) can be taken as an indication that meter removal is necessary ; these may occur in the normal course of the meter's service or they may be evidence that the meter has been 'shocked' in some way between the recalibration facility and the metering station.

Sources of systematic shift from recalibration facilities are now better understood and can be minimised or eliminated altogether by the adoption of the practices referred to in 30.10 below.

Flow Profile

5. The Licensee must ensure that the flow profile during meter calibrations matches, as far as possible, the predicted 'in-service' flow profile.

If the meter is to be installed with a flow conditioner, it must be calibrated with the same design of flow conditioner, in the same orientation and position within the meter run.

Initial Flow Calibration

6. The ultrasonic meter should be flow-calibrated prior to initial installation. This should take place at a recognised test facility, demonstrating either National or International accreditation.

Recalibration of Ultrasonic Meters

7. As discussed in 30.4 above, the Ministry currently requires ultrasonic meters to be periodically removed and recalibrated. The recalibration, in common with the initial flow calibration, should take place at a recognised, accredited, test facility.

8. The Ministry recognises that there have been cases of unexplained systematic offsets between some of the principal international calibration facilities.

In order to minimise the cumulative effect of any such systematic bias, the Ministry therefore advises Licensees to return meters to the same facility throughout the meters' life in service.

9. Intervals between successive calibrations will be agreed with the FMITI on a case-by-case basis. In common with the Ministry's approach in other areas, the economics of the particular field development will be taken into account when assessing the appropriate recalibration period.

When determining the intervals between successive recalibrations, the Ministry may also consider the availability and relevance of 'health-check' procedures that utilise the diagnostic facilities available via the ultrasonic meter electronics (30.4 refers).

10. The meter should preferably be calibrated on a representative fluid, although recent work (Hall) suggests that the results of a meter calibration on, for example, air or nitrogen is transferable to a natural gas application.

11. Recent work (Hall) suggests that there is no significant 'pressure effect' for ultrasonic meters, i.e. the meter may be calibrated at one pressure and operated at another with no significant shift in meter response as a result. However, until this is proved definitively, it does make sense to calibrate meters at conditions as close as possible the anticipated operating conditions.

12. Meters should normally be calibrated in their 'as found' state so that any shift in meter performance from the previous calibration can be quantified.

Experience with ultrasonic meters over the past 20 years has shown that meters are likely to show the greatest shifts in the first 6 months of operation. It appears that the meter bore become 'conditioned' in-service during this period. Cleaning of the meter bore may therefore be counter-productive and is not recommended.

13. At each meter calibration, the following information should be recorded :

(*i*) Serial Numbers of the reference meters used at the test facility.

(*ii*) Full details of the configuration of the pipework between the reference meter and the meter under calibration-type and position of bends, step changes in pipe diameter, etc.

(*iii*) The position and type of any flow conditioners in the test line.

Operators should retain this information for each meter (preferably in a dedicated dossier). The relevant information should be available for inspection at all times.

14. Industry standard practice at present is for at least 3 runs to be performed at least 6 different flow rates, spaced more or less evenly between the minimum and maximum design flow rates for the meter.

Statistical interpretation of any data from ultrasonic meter calibrations should take into account the number of test runs at each flow rate. Following the principle of the '1/'N' Law, the calibration uncertainty reduces with an increasing number of test runs (provided of course, that the test flow rate remains constant).

It is recognised that the practical possibility of increasing the number of test runs at each flow rate may be subject to financial and/or time constraints. Operators may therefore wish to consider whether increased attention should be paid to the expected operational flow rate, if necessary at the expense of other, less 'representative' flow rates. Such an approach has the potential to reduce the meter's operational uncertainty.

15. Replacement of the ultrasonic meter transducers/detectors or electronics will normally necessitate recalibration of the meter, unless the effect of these actions has been quantitatively determined at the meter calibration and found to be insignificant.

Operators may wish to consider this requirement when planning recalibration strategy. Time thus spent at the meter recalibration may prove to have been well spent should any critical components fail in service.

Implementation of Calibration Data

16. Correction routines employed to compensate for process and environmental effects on the performance of the meter should, as far as possible, be undertaken within the flow computer and not the USM electronics. Similarly, routines adopted to generate instantaneous flow rate corrections based on multi-point calibration data should also be performed within the flow computer.

17. The preferred option is point-to-point linear interpolation. A single point flow-weighted average may be applied if all calibration points lie within ±0.1% of their average value.

Inspection of Meter Spool and Associated Pipework

18. It may be necessary from time to time to examine the condition of the meter spool and associated straight pipe sections, to ensure that corrosion, erosion or particulate contamination has not occurred to an extent likely to affect the accuracy of the meter. Particular attention should be paid to the bore of the meter and the transducer/detector ports and, where appropriate, the condition of the pressure tapping at the point of breakthrough into the meter wall. If flow conditioners are used, these should also be examined for contamination and any obvious surface damage.

Reference Standards

19. Adequate verification or, where appropriate, calibration equipment should be provided to enable the performance of meters, transducers, computers, totalisers, etc. to be assessed. Reference or transfer standards should be certified by a laboratory with recognised traceability to National or International Standards.

Minimum Operating Pressure

20. Ultrasonic transducers/detectors require a minimum operating pressure for acoustic coupling. As a field declines, consideration should be given to the periodic review of performance limitations and also the most appropriate calibration range for the meter.

Orifice Metering Stations

The Calculation of Uncertainties in Flow Measurement Systems Employing Orifice Plate Meters in accordance with ISO 5167 and Ultrasonic Meters in accordance with BS 7965.

32.—(1) For an orifice metering station, the uncertainty in the measurement of a mass flow rate should be calculated using the simplified formula presented in ISO 5166. ISO 5168 offers further guidance in this area.

2. In the case of differential pressure transmitters, it is important to use realistic field values as the choice of uncertainty value has an impact on the operational turndown of the system and also on the setting of the change over point(s) for metering systems incorporating both high and low range transmitters.

Ultrasonic Metering Stations

3. For an ultrasonic metering station, the uncertainty in the measurement of a mass flow rate may be calculated using the method presented in *Annex* A of BS 7965.

4. Alternative methods may be employed for the determination of uncertainty budgets for the measurement of mass flow rate ; the choice should however be discussed with the FMITI prior to implementation.

Uncertainties of Secondary Instrumentation

5. When calculating the overall uncertainty budgets for metering installations, Operators should use realistic 'field' values for the uncertainties of the secondary instrumentation rather than the Manufacturers' claimed values. The uncertainties claimed by Manufacturers for their equipment is usually the best that the equipment is able to deliver under ideal conditions.

Monte Carlo Simulation

6. Uncertainty calculations using Monte Carlo Simulation can be used as an alternative. Further Guidance in this area will be published shortly.

APPENDIX 4.1

REFERENCES/TECHNICAL PAPERS

HALL.J *et al.* Calibration of Ultrasonic Flow Meters at Conditions Different Than Their Operation. North Sea Flow Measurement Workshop, St Andrews, Scotland 2002.

Section V—Separator Measurement

Terms of Reference.

33.—(1) Separator Measurement is an important aspect of many fiscal measurement systems.

Measurement from test separators often forms the basis for many well-test programmes and the interpretation of these results is routinely used to assess the performance of reservoirs.

Nevertheless, this area has received relatively little attention in the past from Regulatory Guidelines or Industry Standards.

Separator metering typically occurs in 'fiscal' measurement applications in one of the following ways—

(*i*) as the basis for an Allocation measurement system, where a dedicated separator is used to determine production of oil, gas and water from a particular field ;

(*ii*) as the basis for a Well Test system, where a test separator is used to periodically determine oil, gas and water flow rates from a particular well ;

(*iii*) for verification purposes, where the output from a (typically test) separator is used to verify the performance of a wet gas or multiphase meter.

The incidence of the use of separators in these and other scenarios is increasing as the Niger Delta matures and 'fiscal' measurement points are moved further and further back towards (and sometimes even beyond) the wellhead.

This Module presents some guidance on how separators and separator metering systems can be designed and operated in order to minimise measurement uncertainty. The guidance offered here can however equally be applied to separator measurement for purely reservoir engineering purposes.

2. Claimed separator measurement uncertainties are often over-optimistic, for reasons given below, and they may be difficult or impossible to substantiate. This must always be borne in mind when considering measurement systems that incorporate separator metering.

3. The overall measurement strategy adopted will depend on the agreed Measurement Approach (defined in Module 2 of these Guidelines).

System Design.

34.—(1) The need to use separators for 'fiscal' metering applications often arises after the separators have been designed and installed. Nevertheless, there may still exist opportunities for modifications to be made with the aim of enhancing measurement accuracy.

Use of On-Site Proving Facilities

2. For a measurement system designed at the outset to be based on separator metering, on an installation equipped with a nearby pipe or compact prover, the facility to route the oil flow line from the separator to the prover should be strongly considered. The facility to calibrate the oil meter in situ may significantly enhance the effectiveness of the overall measurement system.

Alternatively, the separator oil line may be provided with fittings to allow connection to a portable compact prover, in order that the oil meter may be readily calibrated – the calibration could take place, for example, immediately before or after the annual calibration of the installation's pipe prover.

3. Where fiscal measurement is involved, and there is no facility for in situ recalibration of the oil meter, proposals for its recalibration should be discussed with the FMITI at the project design stage.

Prevention of Gas Breakout

4. 'Gas breakout' in the oil line will inevitably lead to a degradation of the measurement of oil flow, whichever technology is used. Whenever possible, separators should therefore be designed to minimise the probability of this occurring. For example, use can be made of the fluid head in maintaining the pressure in the oil take-off line.

Flow Rate Range

5. Test separators should be designed to cover the full range of flow rates from the well(s) under test.

They should include a gas, liquid hydrocarbon and water meter, all maintained to provide a level of performance appropriate to the desired class of measurement.

Shrinkage Factors

6. If wells of significantly different physical properties and process conditions are to be allocated using 'Flow Sampling' techniques, referred to in Module 2 (paragraph 59.1) then additional precautions will be necessary to ensure that each well is treated equitably in the allocation process. The pressure and temperature in the main production separators may be significantly different from those in the test separator during different well tests. This will result in the 'test' gas-to-oil ratio differing from the 'production' gas-to-oil ratio.

To compensate for this a process simulation should be run for each well on both the test separator and the main production separator. This will enable a correction or "shrinkage" factor to be determined. The use of such a factor should result in the sum of wellhead production being in closer agreement with the sum of the installation out-turn. Such adjustments have the merit of tending to reduce any systematic differences between wells of significantly different

properties when using flow sampling for allocation purposes. This is particularly important if some of the wells are sub-sea completions tied back through long sub-sea flow lines.

Water-in-Oil Measurement

7. When the oil stream has a significant water content, the use of a water-in-oil meter in the oil take-off line should always be considered, as this may help minimise the error in dry-oil accounting.

Otherwise, the use of a flow-proportional sampler may be an acceptable alternative.

Oil/ Condensate Measurement.

35.—(1) The possibility of gas break-out and the possible presence of liquids other than oil must always be taken into account when considering the most appropriate method of measuring oil flow rate.

2. Turbine meters are 'traditionally' used for the measurement of oil flow rates from separators. However, assessment of the levels of performance achievable by turbine meters in these applications is not straightforward.

Assuming that the oil output from the separator is always a single-phase liquid, whose flow rate, hydrocarbon composition, water content and dispersion, and operating temperature (and therefore, viscosity) is reasonably constant, a level of uncertainty of perhaps ±5% might be expected.

If the validity of such assumptions cannot be assured, the uncertainty of turbine meter measurement in such service could be in the region of ±5-10% or higher.

3. The use of ultrasonic meters has been suggested, as these meters are less likely to cause gas breakout.

However, caution should be exercised. Water cuts in excess of 5% in the oil take-off line are likely to cause the failure of ultrasonic meters and experience has shown that ultrasonic meters used in the measurement of oil are adversely affected by the presence of relatively small amounts of gas.

At high (>5 ms^{-1}) velocity meters have been rendered inoperable by the presence of as little as 0.4% (by volume) gas.

Gas Measurement.

36.—(1) Separator gas measurement should be treated as a wet gas metering application. Module 7 of these Guidelines should be consulted for more detailed guidance in this area.

Test Separator

2. In test separator applications, orifice plates have the advantage that the turndown of the metering system can be enhanced by having available a range of plates with different orifice diameters.

If the separator is fitted with an orifice carrier, plates can be interchanged to effectively measure test separator flows for wells having a wide range of gas flows. Achieving a high degree of turndown can be problematic with other types of meter, unless the total replacement of the meter with another meter of different nominal bore is possible.

In the light of these considerations the use of an orifice plate for test separator measurement can generally be recommended.

3. When the anticipated turndown requirement of the Test Separator is lower, there may be scope for the deployment of alternative technologies, such as Venturis or V-cone meters.

Production Separators

4. With the lower turndown requirements on production separators, there is greater flexibility with regard to the choice of measurement technique.

Orifice plates, Venturi meters or V-cones are all potentially suitable for this application.

Water Measurement.

37.—(1) Water flow measurement is traditionally achieved using either turbine meters or electromagnetic meters. However, there is scope for the deployment of ultrasonic meters in this area.

SECTION VI—WET GAS PETROLEUM MEASUREMENT

Terms of Reference.

38.—(1) As the Niger Delta matures, wet gas flow measurement is becoming increasingly important. With the development of an increasing number of marginal fields whose economics do not support single-phase measurement, there has been an increasing emphasis on designing systems whose fiscal measurement point may be, for example :

(*a*) On the gas offtake line from a 1st stage or test separator.

(*b*) At the top of a production riser prior to 1st stage separation.

(*c*) At the wellhead of a sub-sea tie back to a host installation.

Scenario (*a*) may form part of an 'Allocation' or 'Well Test' Measurement System, as defined in Module 2 of these Guidelines.

Scenarios (*b*) and (*c*) are regularly encountered in gas fields that are developed and processed as wet gas fields.

The measurement challenges presented by these and similar scenarios are described at some length in this Module. As with other Modules of these Guidelines, particular emphasis is placed on Installation, Verification and Recertification procedures.

2. For the purpose of these Guidelines, wet gas is taken to mean a two-phase flowing liquid where the liquid volume fraction is in the region of 0-10%.

Flow Regimes.

39.—(1) In wet gas flows the following three types of flow regime may occur :

* Stratified flow describes the free liquid running along the bottom of the pipe with the gas flowing at the top of the pipe. This is a common regime in horizontal pipes and low gas flow velocities (typically 5 m/s or less).

* Annular flow describes the liquid flowing around the pipe wall with the gas flowing through the centre of the pipe. This regime occurs in medium flow velocities in horizontal pipes (typically 5-15 m/s). In horizontal pipes, the annular flow is not uniform ; due to gravitational effects the liquid is present in higher quantities around the wall at the bottom of the pipe than higher up the pipe wall.

* Mist flow describes liquid in the flow being carried along in small droplet form within the body of gas. This flow regime requires high gas flow velocities (in horizontal pipes) to keep the liquid suspended in the gas (typically 15 m/s or higher).

Other flow regimes can occur intermittently, particularly slug flow regimes if liquid has become trapped in the flow line, for example at the bottom of a vertical pipe. It is also worth noting that even in a horizontal pipe, liquid can be 'held-up' by gas flows of 1 m/s or less and may remain almost stationary rather than flow with the gas.

2. In practice, wet gas flows may be a combination of the flow regimes described in 39.1.

Combinations of line conditions, pipe orientations, gas to liquid ratios, etc., will influence the type of flow regime present.

An appreciation of which, if any, flow regime is likely to prevail may be extremely useful. The application of the same wet gas measurement technique can produce widely different results depending on which flow regime predominates, and knowledge of the likely flow regime can therefore influence on the correct choice of measurement principle to be applied.

Seletion of Primary Measurement Device.

40.—(1) The flow meters that can potentially be used to measure wet gas flows can be divided into two types :

* Differential pressure devices (Venturi, orifice plate, V-cone)

* Ultrasonic flow meters (where the liquid volume fraction is less than 0.5%)

2. Multiphase meters may be able to handle high gas/liquid ratios, but the use of these meters is outwith the scope of this Module of the Guidelines.

Proposals to use multiphase meters for wet gas measurement will be reviewed by the FMTI on a case-by-case bas is. Multiphase meters that make use of differential pressure devices are most likely to be configurable as wet-gas meters.

3. Turbine meters should not be used for wet gas flow measurement. The presence of liquids in even relatively small quantities can lead to meter failure.

Flow Conditioners

Installation Consideration.

41.—(1) The use of 'thick plate' flow conditioners, designed for use with orifice plates and whose purpose is to correct flow profile, is not recommended in wet gas flow applications. Liquids can easily build up in front of the devices producing a skewed flow profile that will result in measurement error.

In certain conditions hydrates can even form in the flow conditioner, restricting the flow and producing highly distorted exit profiles. Practical experience (*e.g.* Stobie) highlights this and other problems associated with the use of flow conditioners.

However, there may be scope for the use of flow conditioners that are specially designed for use in wet-gas applications—their primary aim being to redistribute liquids evenly across the flow.

Insulation

2. In order to promote temperature stability, and to ensure that the measured temperature is representative of that at the flow meter, insulation of the meter run from the upstream straight pipe length to the downstream temperature measurement device is recommended.

The use of trace heating may be necessary to prevent the formation of hydrates in extreme conditions. It may help to minimise liquid presence; this may be particularly important in meter applications where liquid correction methods are not being applied.

Pressure Tappings

3. It is important to recognise that liquid drop-out in pressure impulse lines is likely to occur, as the temperature of the gas will tend towards ambient once it leaves the meter stream. In extreme cases hydrates may even form.

The presence of either liquids or hydrates in impulse lines will introduce errors in the measurement of differential or static pressure.

Pressure impulse lines connecting the flow meter's pressure tappings to a differential or static pressure transmitter should therefore be as short as possible and inclined towards the vertical in order to drain entrained liquids. Liquid or hydrate accumulation can be further countered by the insulation of the impulse lines and the application of trace heating.

To minimise cooling by ambient conditions, Operators should consider placing the pressure transmitters, and even the impulse lines if possible, in a heated, sealed enclosure.

Catchment pots located in the impulse lines may be effective at catching liquids. These should be drained frequently to avoid excessive liquid build-up and therefore they may not be effective in use on un-manned installations that experience significant liquid dropout in impulse lines.

Secondary Instrumentation

4. Secondary instrumentation may include provision for the measurement of the following parameters :

* pressure (static and/or differential).
* temperature.

5. Provision must be made for the routine reverification of this instrumentation. The initial interval between successive recalibrations will be determined by the FMITI, in consultation with the Licensee, on a case-by-case basis, and will largely depend on the Measurement Approach (as defined in Module 2 of these Guidelines).

Where wet-gas meters are to be deployed on un-manned installations the recalibration frequency may be predetermined by the frequency of occurrence of maintenance visits. However, for systems operated at lower uncertainties, the associated need for reverification may necessitate the scheduling of visits with the express aim of re-verifying the wet gas measurement system.

As with other routine maintenance programmes, scope may exist for the relaxation of calibration frequencies, subject to satisfactory operation of the instrumentation.

6. The use of on-line gas chromatographs is obviously problematic in applications where high quantities of liquids are present.

Gas sampling points, if properly designed, should be capable of providing representative gas samples, even where the liquid-to-gas ratio is relatively high.

It is therefore recommended that gas composition in wet gas applications is obtained through the analysis of samples, obtained from an appropriately-designed sample point, in conjunction with an off-line gas chromatograph.

7. Densitometers should not be used in wet gas applications, even when the liquid volume fraction is relatively low. Contamination will occur, requiring manual intervention.

Venturi Meters.

42.—(1) Venturi flow meters are widely used for wet gas applications that involve measurement prior to any form of separation or fluid processing. Among their advantages are the following :

(*i*) they do not 'dam' the flow (unlike orifice plates).

(*ii*) they can be operated at higher differential pressures than can orifice plates without incurring permanent meter damage (differential pressures up to and above 2 bar can be contemplated).

(*iii*) they have a relatively high turndown (typically 10 :1) when used with re-rangeable differential pressure transmitters.

2. The design requirements for Venturi-type flow meters are contained within the international standard ISO 5167-3. It must always be borne in mind that this standard applies only to dry gas applications.

In general, however, the requirements of ISO 5167 should be adhered to as far as possible. This Module essentially specifies certain key areas where departure from this standard is necessary in order to attempt to minimise measurement uncertainty.

Pressure Tappings

3. The meter should be supplied with a single tapping at the standard 'pipe' and 'throat' pressure measurement points as described in ISO 5166. These should preferably be at the '12 o'clock' position but other positions between 2 and 10 o'clock may be satisfactory.

In addition, a third pressure tapping may be located downstream of the Venturi conical expander outlet (the 'diffuser') to facilitate the measurement of the fully recovered pressure. The optimum position for this third pressure tapping has not been definitively established, but a distance of 6D from the downstream flange is regarded as reasonable.

Significant variations in this parameter can help indicate when new testing for the Venturi correction parameters (*e.g.* the liquid/gas mass ratio) is required.

Meter Orientation

4. For a Venturi meter as described in 42.3, the meter should be orientated horizontally such that the two (or three) tappings are located at the 12 o'clock position. In this way the potential for liquid becoming entrained in the tapping or impulse lines is minimised, and the tappings are kept as far as possible from the bulk of the liquid if stratified or annular flow regimes are present.

Meter Construction

5. The Venturi flow meter should generally conform to the construction requirements of ISO 5166. However, special attention should be paid to the following :

(*i*) The finish of the Venturi internal surface, which should be smooth and free from machining defects including burrs and ridges.

(*ii*) The pressure tappings, which at the point of entry into the meter internal bore should have sharp edges and be free from burrs and wire edges.

(*iii*) The edge of the conical inlet, which should be sharp and free from manufacturing defects.

A Venturi meter not conforming to these construction practices may experience significant variation in its discharge coefficient, resulting in increased measurement uncertainty.

Upstream and Downstream Pipework

6. The presence of liquid in the flow line will affect the flow profile as it enters the Venturi meter. This is a source of measurement uncertainty over and above that normally expected for dry gas measurement. In order to minimise this additional uncertainty:

Upstream pipe work should be designed such that bends immediately upstream of the meter encourage any stratified liquid to flow at the bottom of the pipe away, from the pressure tappings.

The installation should be designed with the upstream straight lengths requirements of ISO 5167 in mind.

7. The Venturi flow meter should be installed with suitable 'double block and bleed' isolation valves so that the meter can be removed and inspected as required.

Calibration of Venturi

8. To minimise measurement uncertainty in wet gas applications, the Venturi meter must be calibrated in 'dry' gas prior to use.

(Jamieson *et al*) have shown that the discharge coefficients of Venturi flow meters can vary significantly with flow rate in gas. To ensure that the best possible measurement uncertainty is obtained, a flow calibration should be performed across the full operating flow range, at temperatures and pressures as close to working conditions as possible. The flow calibration should normally be performed over a minimum of 6 flow rates with a minimum of 3 measurements at each flow rate. Measurements at intermediate flow rates may be required if the calibration curve is particularly unpredictable. Further measurements at individual flow rates may be required to ascertain the degree of repeatability.

Algorithms for Venturi Wet Gas Corrections

9. When differential pressure type flow meters are operated in wet gas, they will generally overestimate the dry gas flow rate. A number of algorithms have been derived in order to account for the over-estimation in flow rate (Steven).

De Leeuw Correlation

10. The method most applicable to Venturi flow meters used in wet gas applications is the correlation derived by (de Leeuw), as the data was generated using Venturi meters.

Full details of the correlation are given in *Appendix* 6.1.

It should be noted that the *De Leeuw* correlation is not suitable for wet gas flows where the gas Froude Number, as defined by De Leeuw, is below 0.5.

Chisholm Correlation

11. The (Chisholm) correction algorithm is the direct predecessor of the de Leeuw equation-the *de Leeuw* equation is effectively a modification of the Chisholm correlation. Essentially the only difference (with reference to the *de Leeuw* correlation given in *Appendix* 6.1) is that the parameter C is defined by Chisholm as :

$$C = (\rho_{liquid} / \rho_{gas})^{0.25} + (\rho_{gas} / \rho_{liquid})^{0.25}$$

i.e. the parameter n is a constant in all cases and is not a function of the gas Froude number F_{rg}.

In addition, the value for the expansibility, ^{E} (in equation (2) of Appendix 6.1) is set to 1.

Murdock Correlation

12. The (Murdock) correction is applied as follows :

$$Q_{gas\text{-}corrected} = Q_{gas\text{-}uncorrected} / {}^{v}(1 + MX^{E}C_{g} / C_{l})$$

where

X Lockhart-Martinelli parameter (defined in *Appendix* 6.1, equation (3))

E expansibility of gas in a Venturi meter, as derived from ISO 5167

C_g/C_l ratio of the discharge coefficient of the Venturi in gas to the discharge coefficient of the Venturi in liquid

M Murdock constant

13. The value of the Murdock constant, M, was originally derived as 1.25.

However, following fairly widespread use of the Murdock Correlation, other values of the Murdock constant have been derived, depending on the application. These have been in the range 1.5 to 5.2 (*de Leeuw*), (*Coupal*). Variation of this magnitude clearly implies that there is a significant potential for serious mismeasurement caused by use of an inappropriate value of M.

It is therefore recommended that when using this equation in the field, periodic verification against a test separator is performed, in order to determine an appropriate value for the Murdock constant.

Choice of Correlation

14. Caution should be exercised when using the Chisholm correlation with Venturi meters in wet gas applications. Like the Murdock correlation, the Chisholm correlation was originally derived from data generated with orifice plates. However, unlike the Murdock correlation, it cannot be 'fitted' to individual meters by the method mentioned in 42.13 above.

The FMTI therefore recommends that the de Leeuw or a 'modified' Murdock correlation is used for Venturi meters in wet gas applications.

Derivation of Liquid Flow Rate

15. Previous sections of this Module have described methods used to account for the over-estimation of gas flow rate when using a Venturi flow meter in wet gas applications.

There is normally an additional requirement to determine the liquid flow rate and especially the flow rate of condensate passing through the meter. This can be determined by routing the flow line to a test separator, or by the use of tracer techniques (described in 42.21 to 42.26 below).

Derivation of Gas and Liquid Densities

16. The density of the gas should be determined from the analysis of representative samples. This value is then input directly into the formula for the uncorrected gas mass flow rate equation (equation (2), *Appendix* 6.1 for the *de Leeuw* correlation, or the equation in 37.12 for Murdock).
AAA. Liquid density should be determined similarly. The value obtained is used in the calculation of the Lockhart-Martinelli parameter.

Upstream Temperature Correction and Pressure Recovery Calculation

17. Details of the procedure for referring the measured temperature to upstream conditions, and for calculating the fully recovered pressure (if this is not measured directly by a third pressure tapping, as described in 42.3. above) are presented in *Appendix* 6.2.

Verification of Venturi Meter Performance

18. There are essentially three different methods of verifying a Venturi meter installed for use in a wet gas application. These are :

(*a*) The use of a test separator.

(*b*) Implementation of tracer techniques.

(*c*) Comparison against another meter (*e.g.* subsea *vs.* topsides).

It must of course be borne in mind that for the last of these to be meaningful, the second meter will itself require to be verified using one of the first two methods.

The choice of reverification method may be further reduced if the Venturi meter is being employed as part of a Fiscal Well Test measurement system (as defined in Module 2 of these Guidelines). In this case the Venturi meter in question is itself likely to be on the gas outlet of the Test Separator.

These verification methods will now be considered in turn.

Test Separator Method

19. The test separator should be designed to cover the full range of flow rates from the well(s) under test.

20. The test separator should include a gas, condensate and water meter all maintained to provide a level of performance appropriate to the agreed Measurement Approach (as referred to in Module 2 of these Guidelines).

Further guidance on separator measurement is contained in a dedicated section (Module 6) of these Guidelines.

Tracer Techniques

21. Tracer techniques have been developed in order to verify flow meters in wet gas applications (*van Maanen*). They are especially useful in verifying Venturi flow meters when there is no possible means of routing the flowline to a test separator.

22. If it is decided at the outset that tracer techniques are to be used for the verification of a wet gas Venturi meter, the installation should be designed and constructed with the needs and requirements of these techniques in mind. Specifically :

* To ensure good mixing of tracer fluids with pipe liquids, it is recommended that there be a length of 150 pipe diameters between the tracer injection and sampling points.

* The injection point should be located such that good mixing will occur between the tracer fluid and line fluids before sampling.

* The sampling point should be located at the bottom of a horizontal pipe to ensure that an adequate amount of liquid can be obtained for analysis purposes—it will generally be necessary to collect at least 50cc.

23. The tracer technique is used to determine the volumetric flow rate of a liquid within a pipe using the following equation :

$$Q_{liquid} = Q_{injected} (C_{injected} / C_{sample})$$

where

$Q_{injected}$	injection volumetric flow rate
$C_{injected}$	concentration of tracer particles in injection fluid
C_{sample}	concentration of tracer particles in sampled fluid

In order to determine condensate and water ratios, hydrophobic and hydrophilic tracers are used.

24. In order to obtain a significant amount of liquid, sampling to atmosphere may be required. In this instance there will be a requirement to know the flash-factor of the condensate to make corrections to the condensate-to-liquid ratio.

The presence of methanol in the pipeline can mask the real concentration of tracer particles in the sampled fluid. Methanol injection should therefore be suppressed prior to commencing the tracer injection procedure.

Reasonable effort should be made to avoid slug flow in the flow-line since the tracer injection method assumes a constant liquid flow.

25. Tracer techniques are essentially 'spot checks' and therefore there will be a degree of inherent uncertainty from fluctuations in liquid presence.

26. Tracer techniques can also be used to directly measure the flow rate of the gas fraction. However, at present the most effective techniques for this purpose involves the use of radioactive tracers, which limits their use in many applications.

However, the gas mass fraction can be indirectly estimated using the techniques described above in combination with the algorithm presented in *Appendix* 6.3.

Comparison Method

27. This method can be used to verify meters in remote locations (e.g. sub-sea or on un-manned platforms). Essentially the meter under test is checked against another 'master' meter, which has in turn been verified using either the test separator or tracer-injection methods.

The results of subsea and topsides meters will almost certainly be at variance and therefore flow testing over a considerable time may be necessary in order to clear or cater for liquids and to allow integration over a period of hours (possibly up to 24 hours). It extremely important to clear the sub-sea flow line and to determine the gas-to-liquid ratio over the flowing period. The

gas-to-liquid ratio may be the link to variable flow measurement factors over time (perhaps as much as a few years).

The flow test can also be used to produce a gas sample at the topsides for the subsea meter.

28. The corrections to be applied to the 'test' meter for gas mass fraction and liquid gas fractions can be determined from the information gained from the 'master' meter. The gas mass fraction and liquid gas fractions may however need to be adjusted owing to flash-off/shrinkage between the fluids at the test meter and those at the master meter. The use of a proprietary process engineering package can be used to calculate the phase fractions at the meter.

The accuracy of this method is dependent on the accuracy of the conversion factors used. As these may not be wholly reliable, the 'comparison' method is unlikely to be an appropriate means of verifying a wet gas Venturi used for Fiscal Allocation purposes (as defined in Module 2 of these Guidelines).

Sub-Sea Applications

29. Venturi flow meters have been successfully installed in sub-sea applications in a number of producing fields.

In order to operate effectively, the units and subsidiary equipment must be suitably 'marinised'. Secondary metering equipment should be installed with adequate redundancy with a view to continued operation following a unit failure. Dual or even triple redundancy is recommended, with differential pressure transmitters being multi-ranged to cover the expected flow rates.

30. Since the meters will effectively be treated as 'fit and forget' units, sub-sea Venturi flow meters are unlikely to achieve reasonably low (*i.e.* better than ±10%) uncertainties unless the flow through the meter can be routed to a test separator or compared against another verified meter. Tracer injection methods are not presently viable in sub-sea applications.

In order to minimise measurement uncertainty, gas and liquid sampling points should be provided on the topsides, since corrections may be required for gas flash-off or condensate shrinkage.

Orifice Plate Meters.

43.—(1) Orifice plate flow meters have been historically used for a wide range of applications including wet gas. However, the limitations of orifice meters must always be borne in mind when they are used in 'non-ideal' applications. Wet gas metering is one such application.

Primarily, orifice plate meters are significantly affected by liquid. As with other flow meters based on the measurement of differential pressure, orifice plates generally over-estimate the gas flow rate when significant quantities of liquid are present. Murdock and Chisholm both derived their corrections for liquid with orifice plate flow meters and these corrections

should be applied if the liquid throughput is substantial. However, in separator applications, any liquid carry-over is often intermittent and so correction for liquid can be difficult to perform accurately. Separators should therefore be designed and operated optimally to avoid significant liquid carry-over. In most cases orifice plates are operated to measure the dry gas flow rate only.

Application of Standards

2. The design requirements for orifice plate type flow meters in terms of their construction and installation are contained within the international standard ISO 5166.

In general, the requirements of ISO 5167 should be adhered to as far as possible. This Module will however specify certain areas where departure from this standard is necessary in order to minimise measurement uncertainty.

Use of Orifice Plates Fitted with Drain Holes

3. Where orifice plates are to be used to measure wet gas flows the Operator is strongly advised to install orifice plates fitted with drain holes.

The use of orifice plates fitted with drain holes is covered by the standard ISO TR 15376. Any additional uncertainty incurred as a result of the use of drain holes is likely to be insignificant compared to that which would result from the continued presence of a liquid build-up on the upstream side of the plate.

The Operator should ensure that the drain hole is located at the bottom of the orifice plate (corresponding to the 6 O'clock position).

Orifice Fittings

4. To minimise measurement uncertainty the orifice plate should be housed within a standard orifice fitting, as used in 'Fiscal-Quality' measurement systems.

Pressure Tappings

5. The meter should be supplied with two tappings at the standard 'flange' pressure measurement points as described in ISO 5166.

Meter Orientation

6. The orifice fitting should be orientated in such a manner that the two tappings are located at the 12 O'clock position. In this way the potential for liquid becoming entrained in the tapping or impulse lines is minimised, and the tappings are kept as far as possible from the bulk of the liquid if stratified or annular flow regimes are present.

Upstream and Downstream Pipework

7. The presence of liquid in the flow line will affect the velocity flow profile as it impinges on the orifice plate meter. This is a source of measurement uncertainty over and above that normally expected for dry gas measurement.

For this reason it is not recommended that the reduced straight lengths outlined in ISO 5167 are used. Where possible, the 'standard' lengths should be used in order to minimise measurement uncertainty.

It has already been stated (43.1, above) that the use of flow conditioners in wet gas applications is not recommended.

8. The orifice assembly should be installed with suitable 'double block and bleed' isolation valves so that the plate can be removed and inspected as required.

Algorithms for Wet Gas Corrections

9. The [Chisholm] and [Murdock] correction factors can be applied. These have been covered in 43.11 and 43.12 above.

Operating Procedures

10. In general, the Operating Procedures should be similar to those described for 'Fiscal-Quality' orifice plate metering stations.

Verification of Meter Performance

11. In any orifice plate metering system, plate inspection forms a critical part of the verification procedure and particular attention should be paid to this area. In general, the required frequency of plate inspection will depend on the Measurement Approach of the system as a whole.

Irrespective of this consideration, a plate found to be damaged on inspection should always be replaced.

Ultrasonic Meters.

44.—(1) Ultrasonic-type flow meters may be used in wet gas applications with a relatively low liquid volume fraction (LVF < 0.5%). They have the significant advantage of being a 'full bore' meter without any restrictions to the flow.

Ultrasonic flow meters, in common with other types of wet gas meter, will over-estimate gas flow rate. However, unlike some other types of wet gas meter (Venturi, Orifice plate) there is as yet no satisfactory correction method to account for this. Ultrasonic meters therefore provide an uncorrected gas flow rate and do not measure liquid flow rate.

2. A number of researchers [Zanker, Stobie, Beecroft] have attempted to use ultrasonic flow meters in wet gas conditions. The installations where this has been most successful have been those where the presence of liquids is relatively low.

Owing to large (uncorrectable) errors obtained from flows with Liquid Volume Fractions greater than approximately 0.5%, ultrasonic flow meters should generally not be installed in flowlines prior to separation other than for testing or comparison purposes.

Application of Standards

3. Ultrasonic flow meter installations in wet gas should generally conform to the requirements of the standard BS 7965. The following guidelines are additional to this Standard.

Meter Installation

4. Ultrasonic flow meters should be installed horizontally, in order that any stratified liquid flow will be at the bottom of the pipe. This will minimise the risk of liquid being trapped in transducer ports for those meters featuring 'horizontal' paths. Meters featuring 'bounce' paths usually feature transducers located near the top of the meter, which will be distant from stratified liquid anyway.

However, care should be taken to ensure that liquid at the bottom of the pipe does not interfere with the ultrasound beams and cause dispersion. The Operator should consider slightly offsetting the bounce paths to avoid any liquid running along the bottom of the pipe.

5. Temperature transmitters should not be located more than 15 pipe diameters downstream of the ultrasonic meter downstream flange.

Meter Location

6. Wet gas ultrasonic flow meters should be located in a position where liquids do not naturally form and in general, the meter should therefore be located at a high point in the flow-line. A small decline in the downstream direction will aid liquid drainage away from the meter. The upstream pipework should be designed so that liquids cannot build-up and produce slugging flow, which can stop the meter from performing altogether unless the transducer ports drain the liquid.

Meter Transducers

7. It is recommended that the transducers are located with their faces close in to the meter spool wall to encourage the removal of liquids by gas turbulence. The transducer ports should be designed to allow the draining of any entrained liquids over a short period of time (2 minutes maximum).

The design of the transducer ports may be modified to feature drainage holes that will encourage the automatic removal of liquids.

8. The transducer capsules are sensitive instruments and can be damaged by a variety of typical operating conditions.

It is recommended that liquid presence in the flowline is minimised, as some transducer types can be adversely affected by liquids, especially condensate, causing the face to become damaged.

Transducers may also have to routinely deal with the presence of additional process liquids (e.g. methanol).

9. Ultrasonic flow meters should be designed to cope with the sudden shutdown conditions that are likely to occur a number of times per year.

However, there have been practical cases where transducers have been damaged by the rapid de-pressurisation of the flow-line. Where possible, flowlines containing Ultrasonic meters should not be depressurised at a rate exceeding 5 bar per minute.

Particular care should be taken during hydro-testing to ensure that the meter is not de-pressurised too quickly and also to ensure that left-over hydro-test water does not affect the meter performance following start-up.

Flow Conditions

10. Ultrasonic flow meters should be operated at as high a flow rate as possible without affecting measurement integrity, since [Wilson] has shown that the measurement error reduces as the flow velocity increases. This is apparently due to the fact that as the flow velocity increases, more and more of the liquid becomes entrained as a mist type flow. As this occurs, the total measurement error tends towards the percentage LVF.

If this effect was predictable, the ultrasonic meter's suitability as a wet gas meter capable of determining both gas and liquid flow rates would improve dramatically. However, [Zanker] has shown that predicting flow regimes in wet gas is not easy and stratified or annular flows, which result in much greater errors, are more commonly acquired.

It has also been shown by Zanker that increased line pressure reduces measurement error, as the increased gas density encourages more liquid to become entrained as mist flow.

Flow Profile Correction

11. It has already been stated (41.1. above) that the use of flow conditioners in wet gas applications is not recommended, unless hydrate formation can be avoided.

For Ultrasonic meters there is the additional problem that at high flow velocities (approximately 18ms^{-1} and above), the flow conditioners can be the source of ultrasonic noise which causes the meter to malfunction. BS 7965 states that 10-pipe diameters of straight pipe is satisfactory for Fiscal Quality meters, but flow disturbance caused by valves and bends may cause significant measurement error even with installations complying with this standard. If the

proposed installation is downstream of a number of flow-influencing installations, further pipe diameters should be added to the upstream length (those indicated in ISO-5167 could be used as an indication, for example).

Verification of Meter Performance

12. For increased measurement accuracy, Ultrasonic flow meters intended for use in wet gas conditions should be calibrated in gas at a recognised accredited facility. The procedures to be followed in this case will be the same as those applied to Fiscal Quality gas measurement using Ultrasonic Meters (covered in Module 4 of these Guidelines).

Routine reverification intervals have already been discussed in 41.5 above.

Allocation Wet Gas Metering.

45.—(1) This class of measurement, as defined in Module 2 of these Guidelines, is the best that can realistically be expected of a wet gas metering system.

This section sets out certain general criteria that should be met by a wet gas metering station that is to form part of an Allocation measurement system. The specific cases of Venturi, Orifice plate meters and ultrasonic meters are covered.

Failure to meet any or all of these specifications may mean that the measurement system will necessarily be regarded as being of 'Well Test' rather than 'Allocation' quality.

Venturi Meter

2. Venturi meters must be designed and installed broadly in accordance with ISO 5166.

All reasonable measures should be taken in order to minimise measurement uncertainty. The following specific considerations will apply to Custody Transfer measurement systems (reference is made to other Paragraphs or Appendices of this Module):

(*i*) The meter should have standard pipe and throat pressure tappings at the 12 O'clock position—(42.3, 42.4).

(*ii*) If a third pressure tapping is not used, then the fully recovered pressure should be calculated.

(*iii*) The meter should be installed horizontally—(42.4).

(*iv*) Particular care must be taken in the manufacture of the meter and its associated upstream and downstream pipework—(42.5, 42.6).

(*v*) The meter must be calibrated on dry gas, across the full operating range, prior to use—(42.8).

(*vi*) A liquid correction algorithm should be applied (42.9 to 42.14). Where the Murdock.

(*vii*) correlation is used, it is recommended that a value of M is derived for the specific application by the method referred to in 42.13.

(*viii*) The Venturi meter should be periodically reverified by one of the methods described in 42.18 through 42.27.

(*ix*) There should be an adequate provision of sampling facilities for all correlation and reverification purposes.

(*x*) Where a subsea Venturi meter is used, there should be the means to carry out periodic reverification by comparison with a test separator.

Orifice Plate

3. The orifice plate should be designed and installed broadly in accordance with ISO 5166.

In general, the operational procedures will be similar to those applicable to Fiscal Quality dry gas measurement systems (covered in Module 4). All reasonable measures to minimise measurement uncertainty should be followed. The following specific considerations will apply to Allocation measurement systems (reference is made to other Paragraphs or Appendices of this Module) :

(*a*) Standard orifice fittings, typical of those used in Custody Transfer applications, should be used—(42.4).

(*b*) Particular care should be taken with the manufacture of the upstream and downstream pipework—(42.7, 042.8).

(*c*) The use of orifice plates fitted with drain holes should be seriously considered (42.3) ; otherwise the Chisholm or Murdock correlations should be used to correct for the presence of liquids—(42.11, 42.12).

(*d*) Reverification of the metering system will depend critically on the inspection of the orifice plate; this and calibrations of secondary instrumentation should initially take place at monthly intervals, with subsequent relaxation of the inspection frequency subject to satisfactory results.

Ultrasonic Meter

4. The ultrasonic meter should be designed and installed broadly in accordance with BS 7965.

In general, the operational procedures will be similar to those applicable to Custody Transfer dry gas measurement systems (covered in Module 4). All reasonable measures should be taken in order to minimise measurement uncertainty. The following specific considerations will apply to Allocation measurement systems.

* All reasonable measures should be taken to minimise the presence of liquids in the flow line.

* Particular consideration should be paid to the manufacture and installation of the meter and its associated pipework.

* The meter should be flow calibrated at a recognised onshore facility prior to its installation offshore, recalibration of the meter should then take place at 12-month intervals ; this recalibration frequency may subsequently be relaxed subject to the meter demonstrating a satisfactory degree of stability.

Sampling.

46.—(1) Sampling is a potentially critical part of any wet gas measurement system. This is especially so in situations where a test separator is not provided for verifying wet gas flow meter performance and tracer techniques are used instead.

This section presents some guidance that may help to minimise mismeasurement resulting from poor design and/or operation of sampling systems.

Sampling Points

2. If sampling is to be carried out from the flow line itself, where significant amounts of liquid may be present, two sample points should be installed; one each for gas and liquid.

In this case sampling probes are not advisable in view of the high risk of sample contamination. Instead the sample points should be constructed to allow the removal of gas from the top of the pipe and liquid from the bottom of the pipe. Correct installation of these sample points is vital if tracer flow techniques are to be successful.

Test Separators

3. Test separators should be prov ided with suitable sampling points, with sampling probes installed on the condensate and gas take-off lines.

The provision of a sampling point on the water take-off line should also be considered in order that the salinity, and also the validity of any water density constants.

Gas Sampling

4. For gas sampling the standard IP 345/80 should generally be adhered to. The sample probe should be installed with the 'scoop' facing downstream to reduce the risk of any liquid carry-over entering the sample vessel. The sample vessel should be pre-charged with argon or another suitable gas.

5. Spot sampling is only effective provided the sample is representative of the flowing gas, and the gas composition does not vary unduly.

During comparison of a wet gas meter with a test separator, in order to ensure that the sample is reasonably representative, flowing conditions should be established for as long as it takes to ensure that representative fluids are passing through the test separator and that the flow conditions have settled.

Condensate Sampling

6. For Condensate sampling and analysis due attention should be given to the recommendations of the standard GPA 2165-95.

7. Steps should be taken to minimise the potential for gas break-out in the line. For example :

* The flow line containing the sample point should be located at a lower level than the test separator.
* The sample point should be located upstream of a turbine meter run where flash-off may occur across a filter basket or turbine rotor.
* The number of bends in the flow line should be minimised.

Some pressure drop may result from the use of a static mixer, which should nevertheless be used to ensure a good mix of condensate and water.

Pressurised sampling should be performed to ensure that representative ratios for water and condensate are derived and are not in error from flash-off to atmospheric conditions.

8. The sampling analysis should provide :

* The base density of the condensate.
* The ratio of condensate to water in the liquid (and methanol if applicable).
* Information on the water (or water/methanol mix) so that the validity of any density constants may be determined.

APPENDIX 6.1

De Leeuw Wet Gas Venturi Correlation

The corrected gas volume flow rate can be derived from the following equations: (all equations are based on S.I. units)

$$Q_{gas\text{-}corrected} = Q_{gas\text{-}uncorrected} / \text{“}(1 + CX + X^2)$$

where :

$Q_{gas\text{-}corrected}$ corrected volume flow rate (the best estimate of the 'true' gas flow rate)

$Q_{gas\text{-}uncorrected}$ uncorrected gas volume flow rate, as indicated by the Venturi meter using the following equation :

$$Q_{gas\text{-}uncorrected} = C_{gas} \text{??} d^2 \text{“}(2\text{?}P / \text{?}_{gas}) / 4\text{”}(1 - \text{?}^4)$$

where :

C_{gas} discharge co-efficient of the Venturi flow meter in dry gas as determined through gas calibration

? expansibility of gas in Venturi as defined by ISO 5167

d throat diameter of the Venturi flow meter (corrected for temperature)

?_{gas} gas density at upstream conditions

?P raw differential pressure as measured by the transmitter

ß ratio of d to D, the pipe diameter

and X is the Lockhart-Martinelli parameter, which is derived as follows :

$$X = (Q_{liquid} / Q_{gas}) \text{“}(\text{?}_{liquid} / \text{?}_{gas})$$

where :

Q_{liquid} combined liquid flow rate through the Venturi flow meter

?_{liquid} combined liquid density

C is given by the following equation :

$$C = (\text{?}_{liquid} / \text{?}_{gas})^n + (\text{?}_{gas} / \text{??}_{liquid})^n$$

where :

$n = 0.606(1 - e^{-0.746Frg})$ for $F_{rg} >= 1.5$

$n = 0.41$ for $0.5 <= F_{rg} <= 1.5$

where F_{rg} is the gas Froude number and is given by the following equation :

$$= (V_{gas} / \text{“}(gd)) + \text{“}\text{?}_{gas} / \text{“}(\text{?}_{liquid} - \text{?}_{gas})$$

where :

V_{gas} superficial gas pipe velocity

g local acceleration due to gravity

V_{gas} can be derived by using an iterative method and 'seeding' a velocity based on the uncorrected mass gas flow rate. It can be calculated as follows :

$$V_{gas} = Q_{gas\text{-}uncorrected} / ?_{gas}(?d^2 / 4)$$

For further iterations $Q_{gas\text{-}uncorrected}$ is replaced by consecutive $Q_{gas\text{-}corrected}$ values until the equation converges to a solution.

APPENDIX 6.2

Upstream Temperature Correction and Pressure Recovery

The correction for downstream measured temperature to upstream temperature (in °C) at the inlet can be estimated by the following equation :

$$t = (t_m + 273.15)\,(P_3 / P_1)^{K_3}$$

where

t_m	measured downstream temperature, in °C
P_3	fully recovered downstream pressure
P_1	pressure measured at the upstream tapping
K_3	downstream–to-upstream temperature correction exponent

It is accepted that the value of K_3 is derived from dry gas thermodynamics, and may not therefore be wholly applicable. However, in the absence of any alternative method this is presently regarded as the best means of estimating the upstream temperature.

P_3 can be measured using a third pressure tapping or calculated (in bar) from the following empirical equation (from [Miller]).

$$P_3 = P_1 \,\Delta w / 10^3$$

where

$\Delta w = (A\beta^2 - B\beta + C)\,\Delta P$

and the constants A, B and C, for Venturis with 7° and 15° exit cone angles, are as follows :

7° cone angle	A = 0.38	B = 0.42	C = 0.218
15° cone angle	A = 0.59	B = 0.86	C = 0.436

APPENDIX 6.3

Gas Mass Fraction Estimation Using Tracer Techniques

The gas mass fraction can be estimated as follows :

(1) Perform tracer flow technique to determine condensate and water flow rates and mass ratios.

(2) Analyse condensate to determine base density.

(3) Sample gas to determine gas density.

(4) Record total uncorrected gas flow from Venturi during tracer flow technique.

(5) Determine dry 'first pass' gas mass fraction and liquid-to-gas ratio based on the recorded uncorrected gas flow and tracer flow results (corrections for methanol injection after completion of tracer technique may be required).

(6) '*Seed*' values from the last stage into the wet gas Venturi flow calculation to determine a 'first pass' corrected gas flow rate.

(7) '*Re-seed*' this value into the calculation, correcting gas mass ratio and liquid-to-gas ratio.

(8) Iterate process until corrected gas flow rate converges.

APPENDIX 6.4

REFERENCES/TECHNICAL PAPERS

The following papers are of particular technical interest :

STOBIE, G.—Wet gas flow measurement in the real world. One day Seminar on Practical Developments in Gas Flow Metering. National Engineering Laboratory, East Kilbride, 1997.

READER-HARRIS, M. J., BRUNTON, W. C, GIBSON, J. J., HODGES, D. and NICHOLSON, I. G.—Discharge co-efficients of Venturi tubes with standard and non-standard convergent angles. Flow Measurement and Instrumentation, Vol. 12, pp 135-145, 2001.

JAMIESON, A. W., JOHNSON, P. A., SPEARMAN, E.P. and SATTARY, J. A.—Unpredicted behaviour of Venturi flow meter in gas at high Reynolds numbers. North Sea Flow Measurement Workshop, Peebles, Scotland, 1995.

STEVEN, R.—An overview of the current state of wet gas metering in the natural gas production industry and proposals for future research. 2nd Annual course on practical developments in gas flow metering—Focus on cost reduction, NEL, East Kilbride, Glasgow, 1999.

DE LEEUW, H.—Liquid correction of Venturi meter readings in wet gas flow. North Sea Flow Measurement Workshop. Kristiansand, Norway, Paper 21, 1996.

CHISHOLM, D.—Two phase flow through sharp-edged orifices. Research note, Journal of Mechanical Engineering Science, 1976.

MURDOCK, J. W.—Two phase flow measurement with orifices. Journal of Basic Engineering, December 1962.

COUPUT, J. P.—Wet gas metering in the upstream area : Needs, applications and developments. North Sea Flow Measurement Workshop. Gleneagles, Scotland. Paper 5.1, 2000.

MILLER, R. W.—Flow Measurement Engineering Handbook. McGraw Hill, Table 5.4, 3rd Edition, 1995.

VAN MAANEN, H. R. E.—Cost reduction for wet gas measurement using the tracer-Venturi combination. Practical Developments in Gas Flow Metering. NEL, East Kilbride, 1999 Paper 2.

ZANKER, K. J.—The performance of a multi-path ultrasonic meter with wet gas. North Sea Flow Measurement Workshop, Gleneagles Scotland, Paper 5.2, 2000.

STOBIE, G, J.—Wet Gas Metering in the real world – Part II. Wet Gas Metering Seminar, Paris, 2001.

(*iii*) % gas and liquid flow rate plus absolute uncertainty of water cut in liquid phase.

Method (*i*) is favoured by metrologists and clearly represents performance as stated. This method may not be the most practical for extreme cases of phase fractionation. Methods (*ii*) and (*iii*), while quoting relatively small numbers of the order of 5% to 10% for gas/liquid phase uncertainties and 2% or 3% for percentage water cut may nevertheless exhibit very large individual phase errors of 100% or more depending on the absolute value of the percentage water.

Multiphase Measurement Technologies.

49.—(1) All existing multiphase measurement systems are comprised of a combination of sensors, each of which provide specific information about the flow. On their own these measurements are insufficient to provide a unique determination of the phase flow rates, but when these measurements are considered along with conservation laws such as continuity, it becomes possible to uniquely determine the individual flow rates of the oil, water and gas.

2. Typically sensors within multiphase flow meters seek to measure parameters such as the water content in the liquid and the multiphase density. Technologies used for this purpose vary, but to date there has been a heavy emphasis on the use of radiation techniques to measure density and to quantify the amount of water in the liquid. The measurement of the electrical characteristics of the fluid mixture is also commonly employed to determine the water content within the liquid phase.

Phase Velocity Determination

3. Once the phase fractions have been determined, the individual flow rates can then be determined if the velocity of each phase is known. Commonly, each phase will travel at a different velocity, an effect known as slippage. Presently no practical technology exists that can be used to determine three individual velocities simultaneously, so the problem is often overcome by measuring one velocity and then applying flow models to obtain correction factors. These flow models are often based on knowledge or estimation of the multiphase flow patterns. Methodologies for velocity measurement vary, but two are very common :

* Differential pressure using a Venturi.

* Cross -correlation of flow features over a known axial spacing along the pipe.

Application of Multiphase Meters.

50.—(1) The starting point for any potential multiphase metering application is to clearly identify issues surrounding the location, pressure, temperature, and the likely mode of operation. Sub-sea aspects and HP/HT conditions need very specific advice from multiphase meter manufacturers.

Modes of Operation

2. Possible applications of multiphase meters include, but are not restricted to, the following scenarios :

Scenario	*Measurement Challenge*
Continuous measurement from a single well.	The most straightforward measurement scenario as the measured fluids would be well defined in terms of their physical properties.
Batch testing of a group of wells using a single meter and an appropriate pipework manifold arrangement.	This would require the ability to modify the calibration parameters of the multiphase meter to match each well fluid - a potentially difficult, but not unachievable process.
Continuous measurement of a number of wells after commingling.	A very difficult measurement challenge because the properties of the fluid within the flow meter are unlikely to be well specified at any given time. Measurement error is inevitable because of the critical dependence of multiphase flow meter performance on the physical properties of the flowing fluids. The degree of error will depend on the degree of change in the characteristics of the multiphase fluid, and the degree of sensitivity of the multiphase meter to such changes.

Precision of Measurement of Each Phase

Selection of Appropriate Meter.

51.—(1) If the application under assessment is appropriate for deployment of an in-line multiphase meter, the next issue is to decide which of the phases require the highest degree of measurement precision. It is sensible at this stage to consider the through-life variations that are expected in the production. In some applications it may only be important to measure the gas or oil accurately, but in other situations all three phases may need to have a low measurement uncertainty.

(2) The upper bound of acceptable measurement uncertainty for each phase flow rate should be agreed with the FMITI. While there may be good reasons to compromise on these initial requirements at some future point, it is

a useful starting position. There are numerous methods for specifying uncertainty, but in order to avoid ambiguities it is recommended that each phase flow rate uncertainty is always expressed as a percentage of the actual phase flow rate—method (*i*) in 48.2 above.

3. After consideration of the issues raised above, an assessment of metering technologies appropriate to the measurement scenario should then be undertaken. The aim is to match the multiphase measurement technology to the fluid properties in order to achieve the desired level of measurement uncertainty for each phase.

Relative Phase Fractions

4. In this assessment, it is important to always bear in mind that the achievable uncertainties with current multiphase measurement systems are very closely linked to the relative phase fractions.

For example, attempting to measure oil flow rate accurately when the Gas Volume Fraction (GVF) is very high is an exceptionally challenging measurement task. This is a situation analogous to the measurement of two commingled single-phase flows, the smaller of which is measured by difference. It is well known that in such situations relatively high uncertainty in the measurement of the smaller flow rate will result, irrespective of the accuracy of the measurement of the larger flow rate and of the commingled flow.

Partial separation multiphase metering systems have been developed specifically to deal with very high GVF flows. These meters essentially split the metering challenge to that of a wet gas stream and a low GVF multiphase stream.

Fluid Properties

5. In assessing the suitability of a multiphase meter to a suitable development, knowledge of the properties, as well as the proportions, of each fluid is critical.

For example, for high-water-content wells the use of capacitance measurement to infer water content is unwise as the flow must exhibit non-conducting properties (it is then normally referred to as 'oil-continuous') for this technology to operate successfully.

Similarly, if the produced oil is heavy then its properties in terms of ionising radiation can approach those of water. This creates difficulty in discriminating between the oil and water using dual-energy radiation techniques. Other technologies may therefore be more appropriate.

Meter Sizing

(6) The multiphase meter must be sized to match the total flow rate to factors such as pressure loss and the multiphase flow pattern envelope. Generally, extremely high or extremely low velocities are to be avoided.

Vertical Installation

Meter Installation.

52.—(1) Where multiphase meters are to be installed in a vertical orientation with the flow in an upward direction, care must be taken to consider the nature of the multiphase flow regime. Under certain circumstances, normally at medium-to-high Gas Volume Fractions, it is possible for the flowing fluid to have insufficient energy to continuously sweep all of the liquid through the meter, and a situation of liquid back-flow under gravity can occur. Maintaining a sufficiently high gas velocity will alleviate this potential problem, but no firm guidance can be given in terms of a velocity threshold because of the complex nature of multiphase flow patterns within piping systems. Each application must be considered individually.

Horizontal Installation

2. Multiphase meters operating in a horizontal orientation are likely to have a much less uniform cross-sectional distribution of the oil, water and gas. The gas will have a strong tendency to flow at the top of the pipe, while the water and oil will preferentially occupy the lower part of the pipe.

Segregation within the liquid is also possible, and triple stratified flows have been observed in laboratory tests using crude oil. Distribution effects may impact on the meter performance, but these can normally be reduced by increasing the flow velocity. Again, each application should be considered separately.

Installation in Self-Contained Skid

3. Multiphase meters are often supplied in a self-contained skid that takes care of the physical installation aspects close to the meter. Where this is not the case, multiphase meters should be installed as specified by the manufacturer, as no standards presently exist governing this issue.

Upstream and Downstream Pipework

4. In all cases it is desirable to avoid installation of the metering package immediately downstream of piping configurations or components that will cause significant flow disturbance over and above the transient nature of the majority of multiphase flow patterns.

Achievable Performance.

53.—(1) There is now a considerable amount of performance data on multiphase meters, most of which has been generated in laboratory test programmes. From this data the following general conclusions can be drawn (expressing flow rates as in 48.2 (*i*) above) :

(*i*) There is no currently-available multiphase meter that will give measurement uncertainties on each phase to within ±10% over the full range of Gas Volume Fractions (GVFs) and water contents.

(*ii*) Over certain parts of the envelope of GVF and water content, most multiphase meters will achieve a level of uncertainty of ±10% or less, for all three phases.

(*iii*) The best performance consistently achieved on one of the phases is typically ±5%, but this is normally over a very restricted envelope of GVF and water content.

The above comments are broad generalisations, but they represent a fair assessment of multiphase metering technology in 2001.

Unsteady Local Conditions

Factors affecting Performance.

54.—(1) Probably the single most important cause of uncertainty in multiphase flow measurement is related to the unsteady nature of the majority of flow conditions. The instantaneous flow patterns and the interfaces between liquid and gas phases can be continually varying in a multiphase flow. This is most extreme in slug flow, where the liquid fraction can vary between almost zero in the film region after liquid slugs, to almost 100% liquid in the slug body. However significant fluctuations will also be present in annular and churn flow patterns.

The impact of fluctuating local gas fraction is linearly related to the density ; but for other parameters, particularly differential pressure it exhibits non-linearity. The pressure drop of a liquid slug passing through a Venturi meter can be 5 times higher than the average pressure drop for the flow; the minimum pressure drop in the same flow, corresponding to the 'film' region can be 20% of the average. A Venturi meter would experience pressure drops over a range of 25 : 1 at a nominally steady multiphase production condition. A fundamental principle of single-phase flow measurement—that readings should be taken under steady state conditions- clearly has to be abandoned in such circumstances.

In order to reduce the uncertainty associated with measurement of a parameter that fluctuates over such a wide range, many samples are required over a relatively long measuring period. The measuring period will be unique to each application, so a good knowledge of the flow regime at the multiphase meter is important.

Unsteady Global Conditions

2. In laboratory evaluations, it is usually possible to ensure relatively steady input conditions to the multiphase flow line, so that the average oil, water and gas flow rates are stable over a period longer than that required by the multiphase meter to make its measurement.

However, in 'real' operating systems, steady flow is much less likely over longer time scales. Flow through a multiphase pipeline is influenced by the flow into the line (which may be combined from several wells), the flow patterns developing along the line, the topography of the line (the terrain it passes), the outlet pressure and other fluctuations caused by the downstream processing requirements.

These effects increase the measurement uncertainty of a multiphase meter in the field when compared to the uncertainties of measurement achievable in laboratory tests.

Incorrect Identification of Flow Regime

3. Most multiphase flow meters will use some empirical modelling of the flow in order to derive the individual phase flow rates from the measurements taken. This modelling has its greatest influence on the method of interpreting the pressure drop from a differential pressure device or the velocity obtained from a cross-correlation device.

If the flow conditions differ in practice from those assumed in the empirical models, then there will be an additional uncertainty in the measurements.

There are many ways in which this could occur. For example, the flow pattern may be affected by unexpected changes in the physical properties of the fluids or the operating pressure. In other situations the slug frequency or velocity may be different to that expected—this will have a similar effect to the factors described in 53.1 above.

To illustrate the potential for incorrect flow regime identification, it may be pointed out that it is not uncommon for differences such as those described above to occur in comparisons of the same meter in different laboratory test facilities. Very significant variations can therefore be expected in field conditions.

Uncertainty in Physical Properties of Fluids

4. To obtain the best achievable performance of a multiphase flow meter the initial calibration process must include filling the meter with each of the single phases in turn, and measurements made of relevant parameters such as the dielectric constants or gamma attenuation coefficients.

This end-point information can then be entered into the meter set-up software. Most meters also require that the density of the individual phases are known, at least as a function of temperature, and for gas as a function of pressure as well. A good PVT model is therefore essential.

Under laboratory conditions it is usually a straightforward task to calibrate a multiphase flow meter with respect to the fluid properties, and to be confident that the properties of the fluids are constant over the course of a test. However,

in the field, considerable thought needs to be given as to how this basic calibration is performed.

Typically, physical property calculations are performed by multiphase meters on the basis of the analysis of samples, and clearly there is considerable scope for error in this process.

Methodologies for in-situ determination of the physical properties need careful consideration, and clearly there are many challenges to be overcome, not least of which is guaranteeing clean single phase flow for each end-point calibration. Small amounts of contamination will bias the results significantly and this will feed through in all subsequent multiphase measurements.

In circumstances where fluid properties will change appreciably with time, a methodology is required to allow the new physical property data to be downloaded to the multiphase meter.

Alternatively, some form of back-calculation routine may need to be applied to correct the measured data.

Operation of Meters.

55.—(1) Due to the absence of any 'standard' design of multiphase meters, it is difficult to give general guidance on their operation. Their in-service operation is largely governed by the recommendations of the individual manufacturers. The issues highlighted in the previous sections need to be addressed prior to installation, but once installed there are no standards currently in existence that specify particular operating methodologies.

Flow Rate Data

For example, most commercially-available meters provide local data processing and can provide either rolling average flow rate data, or instantaneous flow rate data. A decision as to the most appropriate data for each application is required. Generally the rolling average technique over a reasonably short time period (15 minutes to 1 hour) is to be preferred as the instantaneous data can fluctuate wildly and make sensible decision making impossible.

Maintenance of Fluid Property Data

2. Maintaining correct fluid property data is by far the greatest issue concerning the on-going operation of a multiphase meter. It would be wise to assume that the technicians responsible for operating the multiphase meter will not be multiphase metering experts, so a heavy emphasis should be placed on developing a detailed procedure concerning the fluid property set-up data. A record of changes to the set-up configuration is absolutely essential, as this not only provides measurement traceability, but would allow the metering data to be reprocessed should the need arise.

Initial Calibration

Re-Verification of Meters.

56.—(1) Before installation a multiphase meter should always be calibrated over a range of Gas Volume Fractions, water contents and flow velocities similar to those likely to be encountered in its 'in-service' application. This process will check the functionality of the meter, and will give an indication of the level of accuracy that may be obtained in the field, albeit with different fluid properties.

Periodic Reverification

2. It is essential to consider the methodology and procedure for periodic re-calibration at the design stage of any new multiphase meter installation.

Once installed, periodic re-calibration of a multiphase meter by 'traditional' methods may be very difficult, if not impossible.

Quite apart from the inherent technical difficulties, the use of multiphase meters for 'fiscal' measurement will generally be a solution of 'last resort' in an extremely marginal application. In such cases, suitable infrastructure for the calibration of the meter (for example, a nearby test separator) may not exist.

3. Where it is practical to remove a multiphase meter, the most appropriate option is to repeat the initial calibration at a suitable test laboratory. In view of the concerns expressed in 53.3, it is recommended that the same calibration facility is used in each case.

4. Where this is not possible, a periodic comparison against a test separator is likely to be the next best option, but careful consideration of the uncertainty associated with test separator measurements should be made. Practical experience over many years has shown that test separators often do not provide the anticipated measurement accuracy. Module 5 of these Guidelines suggests ways in which separator measurement may be enhanced.

This method is at the very least likely to provide a reasonable verification of the meter's repeatability.

5. In Norway, a subsea template and dual flowline system has been developed, allowing production to continue whilst one well is routed to a platform-based test separator. When well-testing is not ongoing, two production lines are available to maximise flow.

6. In situations where removal of the meter or comparison with a test separator is not possible, there are essentially two remaining means of demonstrating that at least some measurement integrity is being maintained.

The first is to rely on static (zero flow) calibration of instruments such as gamma densitometers, and the second is to use some form of in-situ calibration technique. While static calibrations provide a useful check on sensor

performances, it must be remembered that this process will not identify any changes that may have taken place within the meter that are only manifested under dynamic conditions. To avoid this drawback, radioactive tracer technology has been developed recently that allows a verification process in-situ and under dynamic flow conditions.

SECTION VIII—FLOW COMPUTERS

Guidelines for Manufacturers and Operators

Terms of Reference.

57. This Module is intended to provide Manufacturers and Operators with some guidance on points to consider in the design and operation of flow computers for use with high-quality oil and gas measurement systems.

These features are generally common to Oil and Gas systems. Where items are specific to either oil or gas this is indicated.

This is not intended to be an exhaustive list, as this would be beyond the scope of this document.

Redundancy

Design Considerations.

58. Either of the following scenarios are regarded as satisfactorily addressing redundancy concerns in connection with high-quality metering systems :

(*i*) a dedicated flow computer may be provided for each meter run ;

(*ii*) multiple meter runs may be computed by one central flow computer, in which case a standby instrument should be provided so that maintenance or replacement may be carried out without interruption of flow.

Storage of Constants

2. All computer and compensating functions, other than data input conversions, should be made by digital methods. All calculation constants should be securely stored within the computer and should also be easily available for inspection at the appropriate resolution.

3. Computer equipment should be designed such that constants can be adjusted only by authorised personnel. Where it is necessary to use manual data inputs within the computer, for such functions as defaults, establishing fallback values and setting alarm limits, the use of this data should be automatically logged.

4. Flow computers and databases should be designed so that measurement accuracy is not compromised by inadequate resolution on the display of critical constants.

Lack of resolution on the computers' displays can create difficulties in establishing whether the correct values of constants have been entered.

Totalisers

5. Totalisers on individual and station summators should have sufficient digits to prevent rollover more frequently than once every two months. The resolution of the totalisers should be such as to comply with this rollover criterion. Totalisers should provide resolution sufficient to permit totalisation checks to be completed within a reasonably short time frame.

6. Totalisers and summators should be non-resettable and should be provided with battery-driven back-up or non-volatile memories where they are of the non-mechanical type.

7. Where external totalisers or summators are not installed, the resolution of the flow computer totalisers should be such as to comply not only with this rollover criterion, but also allow totalisation tests to be performed to the required tolerance. These totalisers should also be non-resettable. If the resolution of the totalisers cannot meet both the rollover and totalisation test requirements, consideration should be given to the provision of a totalisation test function within the flow or database computer.

8. Flow computer manufacturers should consider the provision of a separate 'maintenance' totalisation register for use during totalisation checks.

Remote Access

9. The facility for remote access to a database and flow computers is becoming common.

This is a potentially extremely useful feature and its use is strongly encouraged.

Correction Algorithms

10. Where multiple meter factors are used in conjunction with approved algorithms to calculate instantaneous flow correction factors, the calculations should be performed by the flow computer and not within the meter electronics unit.

This applies particularly to the use of calibration 'offsets' applied to ultrasonic meters.

Software Changes

11. The FMITI must be informed of any proposed changes to the flow computer or database software.

A software version number or configuration certificate should be accessible to enable changes in software to be identified.

12. A full set of calculations and input tests should be carried out when the software is installed in the flow computer.

Alarms

13. Any alarms used within the flow computer must be accessible to suitably authorised persons and not 'hard-coded' within the operating software. This will allow appropriate alarms to be enabled or disabled for use and suitable values to be set for their initiation.

14. The use of alarms should be carefully controlled. They provide an important means of drawing attention to potential mismeasurements, especially on systems where metering personnel are not present full-time.

SECTION IX—MEASUREMENT STATIONS—SUPPORTING DOCUMENTATION

Terms of Reference.

59.—(1) This Module is intended to provide Operators with guidance as to the documentation that the FMITI expects to be maintained in connection with Fiscal Quality Measurement Stations, both oil and gas, as defined in Module 2 of the Guidelines.

2. The same principles apply to lower-quality measurement systems, though there will be less stringent requirements in these cases.

3. This list is not intended to be exhaustive but rather to provide guidance on the maintenance of a satisfactory degree of traceability in measurement stations. This is to satisfy the interests of Regulators, both Government and Commercial, and the Operators themselves. For example, the ability to calculate the magnitude of a mismeasured quantity, and potentially recover revenue that would otherwise be lost, may depend critically on the ability to identify exactly when a problem arose.

4. These guidelines have been formulated with the need to avoid duplication in recording data in mind. Proposals to further reduce duplication will be viewed sympathetically by the FMITI provided they do not unduly jeopardise traceability.

System Design and Operational Documentation.

60.—(1) The following documentation should be maintained at the measurement station :

(*i*) The latest version of the system's Functional Design Specification ;
(*ii*) A full set of up-to-date Operation and Reverification Procedures.

FMITI Logbooks.

61.—(1) Logbooks must be maintained at the measurement station.

Use of Electronic Logbooks

2. Logbooks have traditionally been of the 'hard copy' type, in a dedicated notebook with numbered pages to demonstrate that no entries have been destroyed. While the FMITI has no objection to the continued use of such logbooks, operators are strongly urged to consider the use of 'electronic' logbooks, provided that these are suitably secure. This offers a number of

advantages—principally, it allows the logbooks to be reviewed onshore. A well-designed electronic logbook would allow a 'filter' to be applied to entries to allow the reviewer to search by category.

Logbook Format

3. Entries should be clear and concise at all times, and should be signed, timed and dated.

4. The operator must maintain a separate logbook for each meter stream.

5. The operator should consider the use of a 'common equipment' logbook in which to maintain records of work done on equipment or instrumentation that is not specific to any one stream—for example, the sampling system.

6. For liquid measurement systems using a prover loop, a prover log must be maintained. This should contain details of all prover calibrations, sphere detector serial numbers and any maintenance work carried out on the prover and its associated instrumentation.

Meter proving records should also be maintained. The important parameters that should be recorded are given in Module 3 (Sections 3,5,10) of these Guidelines.

Significant Events

7. These logbooks should contain details of all significant events in the operation of the measurement station. A well-maintained logbook should permit the precise timing of any mismeasurement to be identified retrospectively. It should allow the observer, e.g. an Independent Auditor, to establish to what extent the measurement station is able to run 'smoothly', without upset.

* Examples of 'significant' events include :

(*i*) Any removal of the flow meter, for whatever reason.

(*ii*) The totaliser readings at the removal from, or introduction of, the stream into service.

(*iii*) Any 'non-routine' events, such as the failure of any items of instrumentation and any remedial action taken.

Note that this list is not intended to be exhaustive—the Operator is expected to be able to decide what constitutes a 'significant' event in the operation of a measurement station.

8. A list of currently-operating dispensations should be readily available for inspection at all times.

9. Operators should notify the FMITI prior to any major maintenance or recalibration work on the metering system. The operator must seek dispensation from the FMITI if they cannot comply with the agreed calibration schedule of a primary element, or in the event of the failure of a flow computer or database.

Reporting to FMITI

Mismeasurement Reports.

62.—(1) The FMITI should be notified, preferably by E-mail, when any abnormal situation or measurement error occurs which could require significant adjustments to the totalised meter throughputs.

2. When corrections to meter totalised figures are required due to known metering errors, a formal report should be prepared. This report should be sent, preferably by *e-mail*, to the FMITI, and should contain the following details of the mismeasurement :

* Its start and finish time.
* Totaliser readings at its start and finish.
* The method used to determine its magnitude.
* The reasons for its occurrence.

Records to be Maintained

3. Records should also be maintained, at intervals of not more than four hours, of the following parameters :

(*i*) All meter totaliser readings ;

(*ii*) Meter flow rates (also relevant meter factors), pressure and temperature, and (if measured continuously) density ;

(*iii*) Any change in meter pulse comparator register readings.

A set of these readings should be recorded at 24:00 hours, or at the agreed time for taking daily closing figures if different.

Other parameters, such as liquid density and %BS and W content, should be recorded at agreed intervals if not already included in the automatic log.

All above records should be available at all reasonable times for inspection by the FMITI. Electronic or hard copies are acceptable. Records for the preceding 12 months should be retained at the metering station.

Flow Computer Configuration Records.

63.—(1) Configuration listings for each stream flow computer must be maintained at the measurement station. These listings may be of critical importance in the retrospective calculation of any mismeasurement. Any manual change of a normally-fixed parameter should be recorded in a Controlled Document, giving details of :

* The date and time of the change.
* The previous value of the parameter.
* The new value of the parameter.
* The reason for the change.

An example of a change in flow computer configuration that would need to be reflected in the configuration listing is the change in calibration constants following the annual recalibration of a densitometer.

Calibration Certificates.

64.—(1) The Operator must have readily available at the metering station calibration certificates for the following—

(*a*) All current test equipment – the FMITI expects test equipment to have been calibrated at a laboratory accredited by SON, or an equivalent overseas authority, whenever possible.

(*b*) Elements of the metering system that have been calibrated remotely (for example, orifice plate/meter tubes, differential pressure cells, densitometers).

2. These certificates can either be maintained in 'hard-copy' or electronic (*i.e.* scanned) form.

Routine Calibration Records.

65.—(1) Routine calibration records must be maintained at a metering station. These records should allow the auditor to readily establish :

(*i*) that planned maintenance routines have been carried out at the agreed frequency ;

(*ii*) the degree of reliability of the secondary test equipment under calibration.

For offshore systems, the Operator is encouraged to make these records available onshore.

Copies for at least the last 2 years should be retained. The procedure of reviewing them can be time-consuming and this activity can be profitably pursued prior to any offshore inspection.

2. Operators are strongly encouraged to use an electronic means of maintaining routine calibration records. This may be in the form of one of several commercially-available packages, or it may be developed 'in-house'. However, it should have the facility to readily summarise the details required by 65.1.

As well as helping to reduce the time spent on these tasks by Auditors, a well-designed system can also be of significant help to the Operator as it significantly facilitates the task of collation of calibration records prior to their submission to the FMITI in application for the extension of agreed calibration intervals.

Section X—New Systems—Design Considerations

Terms of Reference.

66.—(1) This section is intended to provide a 'high-level' overview of important points that must be considered by Licensees when reviewing potential solutions to measurement challenges.

Application of Suitable Technology.

67.—(1) It is the responsibility of the Licensee to ensure that the chosen measurement technology is appropriate to the desired application.

This is not a trivial point. On more than one occasion, meters totally inappropriate to the in-service flow conditions have been commissioned and installed in NDP applications. The costs involved in retro-fitting new meters are likely to be very high—not to mention the potential cost to the Operator of systematic under-measurement resulting from the use of the meter in conditions for which it was not designed.

Discussion with the FMITI is recommended at as early a stage as possible in the field development. Guidance in this area is also available in BS 7405.

Nature of Fluids

2. Careful consideration must always be given to the likely nature of the fluid or fluids being measured. In particular:

* Is the fluid likely to be single phase, two-phase (e.g. wet gas), or multiphase?
* If dealing with gas, is the fluid likely to be at or near its dew-point?
* If dealing with liquid, is gas break out likely to occur?
* Are contaminants such as scale or wax likely to occur?

The answers to these and other questions can have a critical bearing on the appropriate choice of meter for a given application.

Flow rates to be Measured

3. Certain types of meter have higher flow rate capacities than others for the same bore of meter tube. The choice of a meter may therefore impact on the required number of meter runs.

4. Operators should consider the expected flow rates that are likely to occur throughout the life of a field. Some meters have higher turn-down characteristics than others.

Life-of-Field Costs.

68.—(1) While the FMITI recognises the demands on many projects to minimise Cap-ex costs, the life-of-field cost of a measurement station must always be at the forefront of the Operator's mind.

Selection of high-quality primary and secondary instrumentation can have a critical role to play in reducing life-of-field costs.

Reliability of Instrumentation

2. The FMITI has seen many examples of the use of inferior quality, but nevertheless nominally 'fit-for purpose' elements of measurement systems.

The use of high-quality instrumentation is likely to reduce Op-ex costs associated with the failure in service of critical elements of the measurement station.

Maintenance Costs

3. High-quality instrumentation, though more expensive, is likely to be more stable than its lower-cost counterpart. However, this Cap-ex cost is likely to be more than offset through reduced Op-ex maintenance costs. The FMITI is always ready to agree to reductions in the required calibration frequencies of instrumentation, subject to the demonstration of satisfactory performance and stability.

Reverification Procedures

4. The cost of reverification of a system should be considered at the design stage.

5. Any proposal for the reverification of a measurement system that involves shutting in production from a well, or even a field, will potentially be very costly for the Operator.

As a rule, this means of reverification will not be acceptable to the FMITI.

Physical Location of Metering Skid.

69.—(1) Operators are asked to consider the physical location of the overall metering skid. This has the potential to affect the quality of measurement, and can have safety implications.

Process Pipework

2. The piping arrangement before and after the metering skid should be given careful consideration as this can have a considerable impact on the operation of the system components.

The siting of a metering station at the bottom of a 'U' in the process pipework is not conducive to effective measurement in the long term, particularly in wet gas applications.

3. The type and location of control valves also requires careful consideration, particularly where ultrasonic meters are to be used. If in doubt, the meter manufacturers should be consulted for advice.

Effect of Ambient Conditions

4. The FMITI has experience of metering skids being sited in some of the most exposed locations possible on offshore installations. These have occasionally been in open, rather than closed modules.

While the FMITI accepts that there may be safety considerations involved in the use of open, rather than closed, modules, Operators are reminded that extremes in ambient conditions can have a practical effect on measurement integrity, particularly in areas where assumed values of temperature are used, e.g. gas density measurement.

Operators should consider the siting of metering skids, where possible, so that their exposure to ambient conditions is minimised. Lagging and insulation requirements will thereby be minimised.

Safety Considerations

(5) Operators must consider the ease of access to metering skids, particularly to those areas that require routine maintenance and calibration.

Section XI—Standards and Technical Papers

Standards

Operators are encouraged to make use of the Industry Standards listed below when considering the design, construction and operation of measurement systems.

Technical Papers

Technical papers are referred to in the text by the first-named author, e.g. [Smith]. The paper details are presented at the end of each Module.

Energy Institute (formerly Institute of Petroleum)
61 New Cavendish Street,
London W1M 8AR,
United Kingdom.
www.petroleum.co.uk

Petroleum Measurement Manual

Part	*Content*
VI	Sampling.
VII	Density.
X	Meter Proving.
XIII	Fidelity and Security of Measurement Data Systems.
XV	Metering System.
X	Background, Development and Computer Documentation.

IP 200 (API 2540 ; AST D1250) Petroleum Measurement Tables

Publication	Content
Vol. VII Table 54A	Generalised Crude Oil, Correction of Volume to 15°C Against Density at 15°C.
Vol. IX Table 54C	Volume Correction Factors for Individual and Special Applications, Volume correction to 15°C Against Thermal Expansion Coefficients at 15°C.
Petroleum Measurement Paper No. 2	Guidelines for Users of the Petroleum Measurement Tables (API Std 2540 ; (IP200); ANSI/ASTM D 1250).

American Petroleum Institute
1220 L Street, Northwest,
Washington D.C. 20005,
U.S.A.
www.api.org

MANUAL OF PETROLEUM MEASUREMENT STANDARDS

Chapter	*Content*
4	Proving Systems.
5	Liquid Metering.
6	Metering Assemblies.
8	Sampling.
9	Density Determination.
10	Sediment and Water.
9.2.1	Compressibility Factors for Hydrocarbons, 600 to 1074 kgm^{-3}
9.2.1M	Compressibility Factors for Hydrocarbons 350 to 637 kgm^{-3}
12	Calculation of Petroleum Quantities.

Report	*Content*
345/80	Composition of Associated Natural Gas—Determination of oxygen, carbon dioxide and C1-C5 hydrocarbons as a group.

ISO (International Organisation for Standardisation)
Case Postale 56
CH-1211 Genève 20
Switzerland
www.iso.org

ISO	*Content*
1000	SI units and recommendations for the use of their multiples and of certain other units.
10790	Measurement of fluid flow In closed conduits – Guidance to the selection, installation and use of Coriolis meters (mass flow, density and volume flow measurements)
2714	Liquid Hydrocarbons - Volumetric measurement by displacement meter systems other than dispensing pumps.
2715	Liquid Hydrocarbons - Volumetric measurement by turbine meter systems.
3170	Petroleum Liquids - Manual sampling.
3171	Petroleum Liquids - Automatic pipeline sampling.
3675	Crude Petroleum and Liquid Petroleum Products -Laboratory determination of density or relative density Hydrometer method.
3735	Crude Petroleum and Fuel Oils - Determination of sediment extraction method.

4006	Measurement of Fluid Flow in Closed Conduits - Vocabulary and symbols.
4124	Liquid Hydrocarbons - Dynamic measurement; Statistical control of volumetric metering systems.
5167-1	Measurement of Fluid Flow by Means of Pressure Differential Devices; Orifice Plates, Nozzles and Venturi Tubes Inserted in Circular Cross-section Conduits Running Full. (Current Revision)
6551	Petroleum Liquids and Gases - Fidelity and security of dynamic measurement cabled transmission of electric and/or electronic pulsed data.
6976	Natural Gas - Calculation of calorific values, density, relative density and Wobbe index from composition.
7278	Liquid Hydrocarbons - Dynamic measurement; Proving systems for volumetric meters.
9951	Natural Gas -Turbine meters used for the measurement of gas flow in closed circuits.
10723	Natural Gas – Performance evaluation for on-line analytical systems.
12213	Natural Gas - Calculation of compression factor.
13443	Natural Gas - Standard reference conditions.
GUM 1	Guide to the Expression of Uncertainty in Measurement.
TR 12765 : 1998	Measurement of fluid flow in closed conduits – Methods using transit-time ultrasonic flow meters.
TR 15377 : 1998	Measurement of fluid flow by pressure-differential devices – Guidelines to the effect of departure from the specifications and operating conditions given in ISO-5167-1.
TR 3313 : 1998	Measurement of fluid flow in closed conduits – Guidelines on the effect of flow pulsations on flow measurement instruments.

A number of relevant international standards are currently at the Draft International Standard (DIS) stage.

When these documents are adopted as full ISO standards they should be included in any list of standards to which reference would routinely be made in arriving at the design of a metering system.

BRITISH STANDARDS INSTITUTE
389 Chiswick High Road,
London W4 4AL,
United Kingdom
www.bsi-global.com
http://bsonline.techindex.co.uk

Many British Standards are now uniform with international standards and where this is the case are issued by the British Standards Institute as dual-numbered standards. BS 1042 is one such standard. However only part one of the British standard is uniform with the ISO equivalent, ISO 5166. The other parts of the British standard give guidance on the use of orifice plates with drain holes and the effect on discharge coefficients of non-ideal installation. The additional parts of the British standard are a useful source of practical guidance.

BS	Content
1042	Measurement of fluid flow in closed conduits; pressure differential devices.
1904	Industrial Platinum Resistance Elements. (adopted as dual or triple numbered CEN and national standards with identical text).
7405	Guide to the selection and application of flowmeters for measurement of fluid flow in closed conduits.
7965	The selection, installation, operation and calibration of diagonal path transit time ultrasonic flow meters for industrial gas measurement.

AMERICAN GAS ASSOCIATION
400 N. Capitol Street, N.W.
Washington, DC 20001
U.S.A.
www.*aga.org*

Report	Content
No. 8	Compressibility and supercompressibility for natural gas and other hydrocarbon gases.
No. 9	Measurement of Gas by Multipath Ultrasonic Meters.
No.10	Speed of Sound in Natural Gas and Other Related Hydrocarbon Gases.

GAS PROCESSORS ASSOCIATION
6526 E 60th Street
Tulsa, OK 74145
U.S.A.
www.*gasprocessors.com*

Report	Content
GPA 2165, 1995	Standard for analysis of natural gas liquids mixtures by gas chromatography.