

Engineering Procedure

SAEP-21

31 May, 2004

Project Execution Requirements for Saudi Aramco Royalty/Custody Metering Systems

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Saudi Aramco DeskTop Standards

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1 Scope

This procedure provides instructions and establishes the responsibilities of various organizations for the execution of Saudi Aramco capital and BI-1900 projects involving the installation, modification or upgrade of royalty/custody metering facilities and equipment. Organizations for which responsibilities are specified include, but are not limited to:

- Aramco Oversees Company BV (AOC)
- Aramco Services Company (ASC)
- Communication Engineering & Technical Support Department (CE&TSD)
- Consulting Services Department (CSD)
- Facilities Planning Department (FPD)
- Inspection Department (ID)
- Loss Prevention Department (LPD)
- Oil Supply, Planning & Scheduling Department (OSPAS)
- Process & Control Systems Department (P&CSD)
- Proponent Organization(s)
- Saudi Aramco Project Management Team (SAPMT)

This SAEP does not apply to royalty/custody metering projects developed, funded and executed by Customers or Suppliers. SAEP-50 shall apply for these projects.

2 Applicable Documents

Saudi Aramco Engineering Procedures

<i>SAEP-14</i>	<i>Project Proposal</i>
<i>SAEP-50</i>	<i>Project Execution Requirements for Third Party Royalty/Custody Metering Systems</i>
<i>SAEP-121</i>	<i>Operating Instructions for New Facilities</i>
<i>SAEP-122</i>	<i>Project Records</i>
<i>SAEP-302</i>	<i>Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement</i>
<i>SAEP-303</i>	<i>Engineering Reviews of Project Proposal and Detail Design Documentation</i>

SAEP-334	<i>Retrival, Certification and Submittal of Saudi Aramco Engineering Drawings</i>
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SAEP-1150	<i>Inspection Coverage on Projects</i>
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Saudi Aramco Engineering Standards

SAES-Y-101	<i>Custody Metering of Hydrocarbon Gases</i>
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SAES-Y-103	<i>Custody Metering of Hydrocarbon Liquids</i>
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Saudi Aramco General Instructions

GI-0002.710	<i>Mechanical Completion & Performance Acceptance of Facilities</i>
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Saudi Aramco Forms and Data Sheets

Form SA 7213-ENG	<i>Mechanical Completion Certificate (MCC)</i>
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Form SA 7214-ENG	<i>Performance Acceptance Certificate (PAC)</i>
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3 Definitions and Acronyms

3.1 Definitions

Approve: Review and formal acceptance characterized by the signature of the final authorizing individual or organization.

BI-1900 Project: A project to construct new or upgrade of facilities where the estimated total project cost is \$2,000,000 or less.

Capital Project: A project to construct new or upgrade of facilities where the estimated total project cost exceeds \$2,000,000.

Concur: Review and formal acceptance characterized by initials or signature of an individual or organization other than the final authority.

Construction Contractor: A contractor who is responsible for construction of a facility based on a design and using major materials provided by Saudi Aramco.

Custody Transfer Measurement: A specialized form of measurement that provides quantity and quality information used for the physical and fiscal documentation of a change in ownership and/or responsibility of commodities. The following measurements are custody transfer measurements:

- a. Measurement of hydrocarbon liquid or gas movements (deliveries or receipts) between Saudi Aramco and its Customers, suppliers, or transport contractors.
- b. Measurement of hydrocarbon liquid or gas transfers within, or between, Saudi Aramco business entities (e.g., refineries, bulk plants, terminals, VELA, etc.) where the measurement is used for accounting or loss control.

Customer: The party that takes ownership or responsibility of a hydrocarbon commodity from Saudi Aramco.

Design Contractor: An engineering contractor who is responsible for preparing the design for a facility.

General Engineering Services (GES) Contractor: An in-Kingdom engineering contractor who may act as the design contractor for a Saudi Aramco project.

Lump Sum Procure Build (LSPB) Contractor: A contractor who is responsible for procurement of materials and construction for a facility based on a design provided by Saudi Aramco.

Lump Sum Turn Key (LSTK) Contractor: A contractor who is responsible for design, procurement of materials, and construction for a facility.

Major Gas Metering System: A metering system that is designed to measure more than 200 MMSCFD of hydrocarbon gas.

Major Liquid Metering System: A metering system that is designed to measure more than 100 MBPD of hydrocarbon liquid at reference (standard) conditions.

Meter Skid: The field portion of a metering system consisting of the following components, as applicable: meters, strainers, density meter, flow-conditioning sections, block valves, control valves, piping, instruments, electrical equipment and associated structural steel.

Meter Station: A facility that is primarily dedicated to the measurement of the quantity and quality of a liquid or gas hydrocarbon. The facility may include, but not be limited to storage tanks, pipelines, piping, regulators, valves, strainers/filters, flow straightening and conditioning equipment, samplers, measurement elements, provers, Remote Terminal Units (RTU), pumps, communications (data and SA telephone), metering shelter, UPS, area fencing, area paving, area lighting, ESD valve systems and associated instrumentation, alarms, computers with software programs, peripheral equipment and associated control functions.

Metering System: A complete assembly of equipment that is designed to measure the quantity and quality of a liquid or gas hydrocarbon. The metering system may include, but is not limited to, the meter skid, prover skid, samplers, and control system.

Primary Gas Metering System: A metering system that is designed to measure more than 20 MMSCFD, but not more than 200 MMSCFD of hydrocarbon gas.

Primary Liquid Metering System: A metering system that is designed to measure more than 10 MBPD, but not more than 100 MBPD of hydrocarbon liquid at reference (standard) conditions.

Proponent: The Saudi Aramco organization responsible for signing the Saudi Aramco Form 7213-ENG, Mechanical Completion Certificate.

Prover Skid: The field portion of a metering system consisting of the meter prover, outlet block valve, control valve, piping, instruments, electrical equipment, and associated structural steel.

Review: Examination of a document for completeness and correctness. In instances not involving a concurrence or approval, a response from a document or package review grants general acceptance of the item under the condition that any comments are incorporated in the document.

Royalty Measurement: A specialized form of measurement that is used as the basis for paying royalty to the Saudi Arabian Government.

Secondary Gas Metering System: A metering system designed to handle 20 MMSCFD or less of hydrocarbon gas.

Secondary Liquid Metering System: A metering system designed to handle 10 MBPD or less of hydrocarbon liquid at reference (standard) conditions.

Supplier: The party that relinquishes ownership or responsibility of a hydrocarbon commodity to Saudi Aramco.

Third Party Inspector: An independent inspection agency whose function is to conduct an unbiased inspection of certain systems, equipment, materials, etc., against a set of international standards, guidelines or procedures. For purposes of this SAEP, the Third Party Inspector has particular knowledge of and experience with industry custody measurement standards and procedures.

Third Party Metering Project (TPMP) : A project where a Customer or Supplier enters into a Design Basis Scoping Paper Agreement and Engineering & Construction Agreement with Saudi Aramco to construct or modify a meter

station for receiving or delivering a specific quantity of hydrocarbon from or to Saudi Aramco. The facility may be located in a Customer, Supplier or Saudi Aramco plant. Design and construction of said facility is accomplished in accordance with Saudi Aramco engineering documents and General Instructions.

Vendor: The party that supplies or sells integrated metering systems, metering equipment, or components.

3.2 Abbreviations

AFC	- Approved for Construction
AOC	- Aramco Overseas Company BV
ASC	- Aramco Services Company
BAD	- Business Analysis Department
BI	- Budget Item
BOD	- Saudi Aramco Board of Directors
CE&TSD	- Communication Engineering & Technical Support Department
CMU	- Custody Measurement Unit of Process & Control Systems Department
CSD	- Consulting Services Department
DBSP	- Design Basis Scoping Paper
EDSD	- Engineering Drawing Services Division
EIV	- Emergency Isolation Valve
EPD	- Environmental Protection Department
ES	- Engineering Services
ESD	- Emergency Shutdown
EXCOM	- Executive Management Committee
FAT	- Factory Acceptance Test
FPD	- Facilities Planning Department
FSD	- Functional Specification Document
GES	- General Engineering Services
GI	- General Instruction
GM	- General Manager

ID	- Inspection Department
IS	- Industrial Security
ISS	- Instrument Specification Sheet
IT	- Information Technology
ITPD	- Information Technology Planning Division
LPD	- Loss Prevention Department
LSPB	- Lump Sum Procure Build
LSTK	- Lump Sum Turn Key
MBPD	- Thousands of Barrels per Day
MCC	- Mechanical Completion Certificate
MINPET	- Ministry of Petroleum and Mineral Resources
MMSCFD	- Millions of Standard Cubic Feet per Day
OIM	- Operations Instruction Manual
OSPAS	- Oil Supply Planning & Scheduling
PAC	- Performance Acceptance Certificate
PCG	- Project Coordination Group of the Communications Engineering & Technical Support Department
PDD	- Power Distribution Department
PE&D	- Petroleum Engineering & Development
PFD	- Process Flow Diagram
PF&AD	- Programs, Forecast & Analysis Department
PID	- Projects Inspection Division of Inspection Department
PM	- Project Management
P&CSD	- Process & Control Systems Department
P&ID	- Piping & Instrument Diagram
QA/QC	- Quality Assurance/Quality Control
RTU	- Remote Terminal Unit
SA	- Saudi Aramco
SAEP	- Saudi Aramco Engineering Procedure
SAES	- Saudi Aramco Engineering Standard
SAMSS	- Saudi Aramco Materials System Specification

SAPMT	- Saudi Aramco Project Management Team
SAT	- Site Acceptance Test
VP	- Vice President
VID	- Vendor Inspection Division of Inspection Department

4 Instructions

The Saudi Aramco organizations with metering project responsibilities shall ensure that their personnel become familiar with and execute project activities in accordance with this SAEP.

Commentary Note:

The requirements specified herein have been developed specifically for capital projects. It is intended that the execution of BI-1900 projects generally follow the same requirements except for items related to project funding.

Responsible organizations shall communicate requirements for deviations from this SAEP, including those required for BI-1900 projects, in advance to CMU for resolution. The Technical Director, CMU shall have the authority to approve such deviations provided they are presented with appropriate justification.

Custody metering systems for hydrocarbon gases and liquids shall be designed in accordance with SAES-Y-101 and SAES-Y-103, respectively. Royalty metering systems for crude oil and liquified petroleum gases shall be designed in accordance with SAES-Y-103.

All purchase orders for royalty/custody metering systems, whether issued by Saudi Aramco or an LSPB or LSTK Contractor, shall contain a requirement for the metering system vendor to provide on-site operations and maintenance training.

Factory Acceptances Tests (FAT's) and Site Acceptance Tests (SAT's) shall be conducted for the various types of metering systems as follows:

Test	Liquid Metering Systems All Types	Gas Metering Systems All Types
FAT	X	X
Non-Flowing SAT		X
Flowing SAT	X	

A water injection test shall be conducted for each automatic sampling system in crude oil service.

Meter calibration curves shall be generated for all liquid pipeline and marine loading/unloading meters. When a meter will be used for the transfer of more than one hydrocarbon, a separate curve shall be developed for each fluid.

5 Responsibilities

5.1 Aramco Overseas Company BV (AOC)

Aramco Overseas Company BV (AOC)/Inspection Unit is responsible for performing the functions of VID for metering systems manufactured in Europe.

5.2 Aramco Services Company (ASC)

Aramco Services Company (ASC)/Technical Services Department is responsible for performing the functions of VID, and, when requested by CMU, acting on behalf and at the direction of CMU for metering systems manufactured in the United States.

5.3 Computer Engineering & Technical Support Department (CE&TSD)

For a project involving the installation or use of voice or data communication facilities, the responsibilities of the Communication Engineering & Technical Support Department are summarized below:

- a. For a capital project, concur with the Project Proposal.
- b. Concurs with waivers of Saudi Aramco engineering requirements under CE&TSD jurisdiction in accordance with SAEP-302.
- c. Approve the Communications & Support Equipment Services Request.

Similarly, for a project involving the installation or use of voice or data communication facilities, Computer Engineering & Technical Support Department/Project Coordination Group (PCG) acts as the primary contact for design, construction and coordination for communication issues. The responsibilities of the Project Coordinaton Group are summarized below:

- a. When a Communications & Support Equipment Services Request is received by CE&TSD, confirm the availability and condition of existing communication system pairs and/or circuits. Assigns cable pairs and/or circuits if available.
 - b. Review Detail Design Package(s) in accordance with SAEP-303.
 - c. Approve “key” communications design drawings.
 - d. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.
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- e. Approve the satisfactory completion of any remaining PCG start-up items ("yes items) on the Mechanical Completion Punch List.
- f. Approve the Partial Mechanical Completion Certificate, Form SA 7213-ENG, for the communications portion of project.
- g. Review the documentation for the communications portion of the project.
- h. Submit a list of exception items for the Performance Acceptance Punch List to SAPMT.
- i. Approve the satisfactory completion of the PCG exception items from the Performance Acceptance Punch List.
- j. If required, approve Performance Acceptance Certificate (PAC), Form SA 7214-ENG, on behalf of CE&TSD.

5.4 Consulting Services Department (CSD)

The responsibilities of CSD are summarized below:

- a. For a capital project, review the DBSP.
- b. For a capital project, approve the Project Proposal.
- c. Approve waivers of Saudi Aramco engineering requirements under CSD jurisdiction in accordance with SAEP-302.
- d. Review Detailed Design Package(s) in accordance with SAEP-303.

The responsibilities of the CSD Waiver Coordinator are specified in SAEP-302 and are summarized below:

- a. Route all waivers to ID and CE&TSD, if applicable, for concurrence and to CSD, Chief Engineer, LPD, P&CSD, as applicable, for approval.
- b. Distribute approved waivers to Saudi Aramco organizations in accordance with SAEP-302.

5.5 Facilities Planning Department (FPD)

For each capital or BI-1900 project, the responsibilities of Facilities Planning Department (FPD) are summarized below:

- With the Proponent(s) and CMU, participate in a study to establish the objective, scope and justification for the metering project.

For a capital project, the responsibilities of Facilities Planning Department are summarized below:

- a. Prepare the DBSP. Submit the DBSP to various Saudi Aramco organizations for review. Revise the DBSP in accordance with any comments received. Obtain concurrence from the Proponent(s) and SAPMT, and approval from EPD, Vice President(s), Proponent organization(s) and Vice President, Project Management. Approve the DBSP for Engineering Services.
- b. Distribute approved DBSP to various Saudi Aramco organizations.
- c. Approve the Project Proposal.
- d. Obtain concurrence for the project from Business Analysis, Corporate Planning, Finance, and Management Committee, and approval for funding from the Executive Committee and the Board of Directors, as applicable.

5.6 Inspection Department (ID)

The Inspection Department is responsible for providing inspection coverage in accordance with SAEP-1150. Specific responsibilities of the Inspection Department are summarized below:

- a. For a capital project, review the DBSP.
- b. Concur with all waivers of Saudi Aramco engineering requirements in accordance with SAEP-302.

The responsibilities of Inspection Department/Vendor Inspection Division (VID) or its representative(s) are summarized below:

- a. If the metering system is purchased by an LSPB or LSTK Contractor, review the contractor's QA/QC Plan.
- b. If the metering system is purchased by Saudi Aramco, approve the Vendor's QA/QC Plan.
- c. If the metering system is purchased by Saudi Aramco, inspect and approve the fabrication and assembly of the metering system at agreed upon hold points.
- d. For a liquid metering system, witness the calibration of the prover at the Vendor's manufacturing facility.
- e. Provide a list of exception items for the metering system in conjunction with the Factory Acceptance Test (FAT).
- f. Approve the completion of exception items from the FAT.
- g. Clear the metering system for shipment.

The responsibilities of Inspection Department/Projects Inspection Division (PID) are summarized below:

- a. Review Detailed Design Package(s) in accordance with SAEP-303.
- b. Approve the Construction, LSPB or LSTK Contractor's Construction Quality Assurance/Quality Control (QA/QC) Plan.
- c. Inspect and approve the construction of the metering facility.
- d. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.
- e. If applicable, approve the satisfactory completion of any PID start-up items ("yes items) on the Mechanical Completion Punch List.
- f. If required, concur with the Partial Mechanical Completion Certificate (MCC), Form SA-7213-ENG for the communication facilities.
- g. Approve the satisfactory completion of pre-commissioning.
- h. Concur with the Mechanical Completion Certificate (MCC), Form SA-7213-ENG.
- i. Approve the satisfactory completion of any remaining PID items on the Mechanical Completion Punch List.

5.7 Loss Prevention Department (LPD)

The responsibilities of the Loss Prevention Department are summarized below:

- a. For a capital project, review the DBSP.
 - b. For a capital project, approve the Project Proposal.
 - c. Approve waivers of Saudi Aramco engineering requirements under LPD jurisdiction in accordance with SAEP-302.
 - d. Review Detailed Design Package(s) in accordance with SAEP-303.
 - e. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.
 - f. Approve the satisfactory completion of all start-up items ("yes items) on the Mechanical Completion Punch List.
 - g. If applicable, concur with the Partial Mechanical Completion Certificate (MCC), Form SA-7213-ENG for the communication facilities.
 - h. Participate in and approve the satisfactory completion of pre-commissioning.
 - i. Concur with the Mechanical Completion Certificate (MCC), Form SA 7213-ENG.
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5.8 Oil Supply, Planning and Scheduling Department (OSPAS)

The responsibilities of OSPAS are summarized below:

- a. For a capital project, review the DBSP.
- b. For a capital project, approve the Project Proposal.
- c. Review the metering system Functional Specification Document (FSD), and associated Process Flow Diagrams (PFD's), Piping & Instrument Diagrams (P&ID's), and Instrumentation Specification Sheets (ISS's).
- d. Review Detailed Design Package(s) in accordance with SAEP-303. On projects that will transmit data to/from OSPAS, agree on inputs, outputs and associated information. Assign OSPAS valve numbers.
- e. For projects that transmit data to/from OSPAS, install the equipment supplied by the project and build/configure the necessary software to monitor and control the facility.
- f. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.
- g. If applicable, approve the satisfactory completion of any OSPAS start-up items ("yes" items) on the Mechanical Completion Punch List.
- h. Participate in, and approve the satisfactory completion of, pre-commissioning. Include loop checks of the communications to OSPAS and functional tests for all equipment controlled by OSPAS (e.g., remotely-operated emergency isolation valves (ZV's) and/or flow control valves (FCV's)).
- i. Following receipt of the approved Mechanical Completion Certificate and upon receipt of a request from the Proponent(s), issue an Operating Order (via dispatcher) authorizing start-up of the system.
- j. If applicable, approve the results from the Flowing Site Acceptance Test (SAT).
- k. If applicable, approve the satisfactory completion of any remaining OSPAS items on the Mechanical Completion Punch List.

5.9 Process & Control Systems Department (P&CSD)

The responsibilities of Process and Control Systems Department (P&CSD) are summarized below:

- a. For a capital project, review the DBSP.
 - b. Approve any waivers of Saudi Aramco engineering requirements under P&CSD jurisdiction in accordance with SAEP-302.
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The Process & Control Systems Department/Custody Measurement Unit (CMU) is Saudi Aramco's central authority in matters of royalty and custody measurement. In this capacity, the Custody Measurement Unit provides technical assistance to the Proponent(s), FPD, SAPMT and other organizations. Specific responsibilities of the Custody Measurement Unit are summarized below:

- a. With the Proponent(s) and FPD, participate in a study to establish the objective, scope and justification for the metering project.
 - b. For a capital project, review the DBSP.
 - c. If the project involves a royalty metering system, notify MINPET of the impending project.
 - d. For a capital project, concur with the Project Proposal.
 - e. Maintain a list of technically acceptable metering system vendors. Provide the list to SAPMT upon request.
 - f. If applicable, review the proposed Schedule H for the LSPB or LSTK Contract.
 - g. Review the metering system Functional Specification Document (FSD), and associated Process Flow Diagrams (PFD's), Piping & Instrument Diagrams (P&ID's), and Instrumentation Specification Sheets (ISS's). For a royalty metering system, ensure that the FSD meets the requirements of the Ministry of Petroleum and Mineral Resources (MINPET). Approve the final FSD.
 - h. If the metering system will be purchased by Saudi Aramco, participate in the technical review of the bids. Regardless of the procurement strategy, approve the results of the metering system technical bid review.
 - i. Concur with the Vendor's preliminary design drawings (NMR 601 Submittal).
 - j. Review Detail Design Package(s) in accordance with SAEP-303.
 - k. Review Vendor's draft Factory Acceptance Test (FAT) Procedure and accompanying documentation. For a royalty metering system, submit the draft FAT Procedure to MINPET for review.
 - l. For a royalty metering system, transmit the final FAT Procedure to MINPET.
 - m. For a royalty metering system, notify MINPET of the FAT schedule.
 - n. For a liquid metering system or a Major Gas Metering System, attend the FAT. If Saudi Aramco participation in a FAT for a Primary Gas Metering System is deemed prudent, notify Proponent(s) and SAPMT, and attend
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- the FAT. Approve the results and all exception items from any metering system FAT attended.
- o. For a royalty metering system, transmit the signed FAT report to MINPET.
 - p. Review Vendor's draft Site Acceptance Test (SAT) Procedure.
 - q. For a liquid metering system, witness the official prover calibration and approve the field data. Approve the prover calibration certificate and calculations. For a royalty metering system, obtain MINPET approval of the prover calibration certificate and calculations.
 - r. Transmit approved prover calibration certificate and calculations to SAPMT for distribution to Third Party Inspector, LSPB Contractor or LSTK Contractor, as applicable, and the Proponent(s).
 - s. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.
 - t. If applicable, approve the satisfactory completion of any CMU start-up items ("yes" items) on the Mechanical Completion Punch List.
 - u. For a gas metering system, participate in and approve the results from the non-flowing SAT.
 - v. Approve the satisfactory completion of pre-commissioning.
 - w. Confirm that the metering system is ready for commissioning and start-up.
 - x. Assist the Proponent(s) with the commissioning and start-up of the metering system.
 - y. For a liquid metering system, participate in and approve the results from the flowing SAT.
 - z. If a crude oil sampling system is provided, witness the water injection test and approve the results. If the sampling system will be used for royalty measurement, obtain MINPET approval of the test results. Notify the Proponent(s) of final approval of the water injection test results.
 - aa. For a liquid pipeline or marine loading/unloading metering system, approve the meter calibration curves for the various meters. For a royalty metering system, obtain MINPET approval of the meter calibration curves. Notify the Proponent(s) of final approval of the meter calibration curves.
 - bb. Approve the satisfactory completion of any remaining CMU exception items on the Mechanical Completion Punch List and from the SAT.
 - cc. Review the project documentation.
 - dd. Approve the Operating Instruction Manual(s) (OIM(s)). Transmit the approved OIM(s) to the Proponent(s).
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5.10 Proponent Organization(s)

When the Proponent(s) intend to assume responsibility for project management (e.g., BI-1900 projects), the Proponent(s) shall be responsible for the requirements specified for SAPMT beginning with Section 5.11, Item d.

The responsibilities of the Proponent(s) are summarized below:

- a. With the CMU and FPD, participate in a study to establish the objective, scope and justification for the metering project.
- b. For a capital project, concur with the DBSP.
- c. For a capital project, concur with the Project Proposal.
- d. Concur with any waivers of Saudi Aramco engineering requirements in accordance with SAEP-302.
- e. Review the metering system Functional Specification Document (FSD), and associated Process Flow Diagrams (PFD's), Piping & Instrument Diagrams (P&ID's), and Instrumentation Specification Sheets (ISS's). Approve the final FSD.
- f. If the metering system will be purchased by Saudi Aramco, participate in the technical review of the bids. Regardless of the procurement strategy, approve the results of the metering system technical bid review.
- g. Concur with the Vendor's preliminary design drawings (NMR 601 Submittal).
- h. Review Detailed Design Package(s) in accordance with SAEP-303.
- i. Approve "key" design drawings.
- j. Review Vendor's draft Factory Acceptance Test (FAT) Procedure and accompanying documentation.
- k. For a liquid metering system or a Major Gas Metering System, attend the FAT. When deemed prudent by CMU, attend the FAT for a Primary Gas Metering System. Approve the results and all exception items from any metering system FAT attended.
- l. Review Vendor's draft Site Acceptance Test (SAT) Procedure.
- m. Approve the Start-Up and Operating Instructions.
- n. For a liquid metering system, witness the official prover calibration and concur with the field data.
- o. Participate in the walk-through and submit a list of exception items for the Mechanical Completion Punch List.

- p. Approve the satisfactory completion of all start-up items ("yes items) on the Mechanical Completion Punch List.
- q. For a gas metering system, participate in and approve the results from the non-flowing SAT.
- r. Review Vendor's proposal for on-site training program. Participate in training at site.
- s. Review the proposed list of spare parts for start-up and the first Testing and Inspection (T&I).
- t. When notified by SAPMT, verify all spare parts have been received.
- u. Participate in and approve the satisfactory completion of, pre-commissioning.
- v. Review the as-built "red-line" mark-ups of the Approved-for-Construction (AFC) Drawings, specifications and other engineering documents.
- w. Approve the Mechanical Completion Certificate (MCC), Form SA 7213-ENG.
- x. Prepare system for commissioning and start-up.
- y. Request issuance of the operating order from OSPAS.
- z. After receipt of the operating order from OSPAS, commission and start-up the system with CMU.

Commentary Note:

Each facility must comply fully with SA standards and field test requirements before they can be officially commissioned.

- aa. For a liquid metering system, participate in and approve the results from the flowing SAT.
 - bb. If a crude oil sampling system is provided, concur with the results from the water injection test.
 - cc. For a liquid pipeline or marine loading/unloading metering system, perform provings to determine each meter's calibration curve. Submit the meter calibration data to CMU for approval and approval be MINPET if required. Enter the approved calibration data in the applicable flow computers.
 - dd. Approve the satisfactory completion of the remaining exceptions items from the Mechanical Completion Punch List and the SAT.
 - ee. Review the project documentation.
 - ff. Submit a list of exception items for the Performance Acceptance Punch List to SAPMT.
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- gg. Approve the satisfactory completion of the Proponent(s) exception items from the Performance Acceptance Punch List.
- hh. If required, approve Performance Acceptance Certificate (PAC), Form SA 7214-ENG.
- ii. Prepare the Operating Instruction Manual(s) (OIM(s)). Submit the OIM(s) to CMU for approval.

5.11 Saudi Aramco Project Management Team (SAPMT)

The responsibilities of SAPMT are summarized below:

- a. For a capital project, concur with the DBSP.
- b. For a capital project, prepare the Project Proposal in accordance with SAEP-14. Submit the draft Project Proposal to Saudi Aramco organizations for review. Revise Project Proposal in accordance with any comments received. Obtain concurrence from Proponent(s), CMU, and CE&TSD, if applicable. Obtain approval from the appropriate Saudi Aramco Department Managers, General Managers and Vice Presidents.
- c. For a capital project, distribute the approved Project Proposal to various Saudi Aramco organizations.
- d. Prepare waivers of Saudi Aramco engineering requirements in accordance with SAEP-302. Submit waiver requests to Proponent(s) for concurrence. Transmit waiver requests to the CSD Waiver Coordinator for final processing.
- e. Obtain a list of technically acceptable metering system vendors from CMU.
- f. If applicable, prepare the contract for the LSPB or LSTK Contractor. Modify Schedule H to include an obligation to purchase the metering system from Saudi Aramco approved vendors and to incorporate project execution requirements from this procedure. Submit the proposed Schedule H to CMU for review. Revise Schedule H in accordance with any comments received.
- g. Submit the Functional Specification Document (FSD) and associated Process Flow Diagrams (PFD's), Piping & Instrument Diagrams (P&ID's), and Instrumentation Specification Sheets (ISS's) to Proponent(s), CMU, and OSPAS for review. Forward any comments received to the Design Contractor or LSTK Contractor, as applicable, for inclusion in the FSD. Concur with the final FSD. Transmit final FSD to Proponent(s) and CMU for approval.

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- h. Distribute approved FSD and final PFD's, P&ID's and ISS's to various Saudi Aramco organizations.
 - i. If the project involves the installation or use of voice or data communication facilities, submit a Communications & Support Equipment Service Request to PCD for review and CE&TSD for approval.
 - j. If the metering system will be purchased by Saudi Aramco, prepare the purchase order package. Ensure that the purchase order includes a requirement for the vendor to provide on-site operating and maintenance training.
 - k. If the metering system will be purchased by Saudi Aramco, conduct a technical review of the bids with Proponent(s) and CMU and obtain their approval of the results. If the metering system will be purchased by an LSPB Contractor or LSTK Contractor, submit the the contractor's technical bid review to the Proponent(s) and CMU for approval. Transmit the approved technical bid review to the LSPB Contractor or LSTK Contractor, as applicable.
 - l. Notify Proponent(s) and CMU of the selected metering system vendor.
 - m. If the meter system is purchased by Saudi Aramco, conduct a kick-off meeting with the Vendor.
 - n. Submit the Vendor's preliminary design drawings (NMR 601 Submittal) to CMU and the Proponent(s) for concurrence. Following concurrence by CMU and the Proponent(s), approve the Vendor's preliminary design drawings (NMR 601 Submittal). Transmit the approved drawings to the Vendor, LSPB Contractor or LSTK Contractor, as applicable.
 - o. Approve the Vendor's final design drawings (NMR 602 Submittal). Transmit the approved drawings to the Vendor, LSPB Contractor or LSTK Contractor, as applicable.
 - p. Review Detailed Design Package(s). Submit Detailed Design Package(s) to Proponent(s), CMU, CSD, LPD, OSPAS, PDD, PID, Proponent(s) and PCG, if applicable, for review in accordance with SAEP-303. Forward any comments received to the Design Contractor or LSTK Contractor, as applicable, for incorporation into the package(s).
 - q. Concur with "key" drawings. Submit the "key" drawings to the Proponent(s) and PCG, if applicable, for approval. Transmit approved drawings to Design Contractor or LSTK Contractor, as applicable.
 - r. Distribute Approved-for-Construction (AFC) Drawings and specifications. Provide a CD containing all approved-for-Construction (AFC) Drawings and specifications to the Proponent(s).
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- s. Review Vendor's draft Factory Acceptance Test (FAT) Procedure. Submit draft FAT Procedure and accompanying documentation to Proponent(s) and CMU for review, and review by MINPET if required. Forward any comments received to Vendor, LSPB Contractor or LSTK Contractor, as applicable, for incorporation into the procedure.
 - t. Distribute the final FAT procedure to Proponent(s), CMU and VID.
 - u. Notify the Proponent(s), CMU and VID of the FAT schedule.
 - v. If the metering system is purchased by Saudi Aramco, review the results from the metering system pre-FAT.
 - w. For a liquid metering system or a Major Gas Metering System, attend the FAT. When deemed prudent by CMU, attend the FAT for a Primary Gas Metering System. Concur with the results from any metering system FAT attended.
 - x. Transmit signed FAT report to CMU and Proponent(s).
 - y. Review Vendor's draft Site Acceptance Test (SAT) Procedure. Submit draft SAT Procedure to Proponent(s) and CMU for review. Forward any comments to Vendor, LSPB Contractor or LSTK Contractor, as applicable, for incorporation into the procedure.
 - z. Distribute final SAT Procedure to Proponent(s) and CMU.
 - aa. Confirm exception items from FAT have been satisfactorily completed.
 - bb. Monitor construction of metering facility.
 - cc. Review Start-Up and Operating Instructions. Submit Start-Up and Operating Instructions to Proponent(s) for review. Forward any comments received to Vendor, LSPB Contractor, or LSTK Contractor, as applicable, for incorporation into the document. Submit the the final Start-Up and Operating Instructions to Proponent(s).for approval.
 - dd. Transmit approved Start-Up and Operating Instructions to Vendor, LSPB Contractor or LSTK Contractor, as applicable.
 - ee. For a liquid metering system, review the prover calibration certificate and calculations. Submit the prover calibration certificate and calculations to the Proponent(s) for concurrence, and CMU for approval and approval by MINPET if required.
 - ff. For a liquid metering system, transmit the approved prover calibration certificate and calculations to the Third Party Inspector, LSPB Contractor or LSTK Contractor, as applicable.
 - gg. Participate in the walk-through and assemble a list of exception items for the Mechanical Completion Punch List, including items from the CMU,
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LPD, OSPAS, PID, Proponent(s), and PCG, if applicable. Arrange for completion of the exception items from the Mechanical Completion Punch List.

- hh. Approve the satisfactory completion of any SAPMT exception items required for start-up ("yes" items) on the Mechanical Completion Punch List. Obtain approval from the Proponent(s), CMU, OSPAS, PID, LPD, PCD, if applicable, and other originating individuals (organizations) that their respective start-up items have been satisfactorily completed.
- ii. For a gas metering system, participate in and concur with results from the non-flowing SAT. Obtain approval of the results from the Proponent(s) and CMU. Arrange for completion of the exception items from the non-flowing SAT.
- jj. Review Vendor's proposal for on-site training program. Submit proposed training program to Proponent(s) for review. Request Vendor, LSPB Contractor or LSTK Contractor, as applicable, to revise program in accordance with any comments received.
- kk. Transmit as-built Start-Up, Operating and Maintenance Manuals, Test Certificates to Proponent(s) and CMU.
- ll. Review list of spare parts proposed for start-up and first Testing and Inspection (T&I). Submit spare parts list to Proponent(s) for review.
- mm. Arrange for the purchase of all spare parts with Purchasing, LSPB Contractor or LSTK Contractor, as applicable. Advise Proponent(s) when all spare parts have been received.
- nn. If appropriate, prepare a Partial Mechanical Completion Certificate, Form SA 7213-ENG, for the communications portion of project. Submit the Partial MCC to the required Saudi Aramco organizations for concurrence and PCG for approval.
- oo. If applicable, distribute approved Partial Mechanical Completion Certificate for communications portion of project.
- pp. Concur that all pre-commissioning activities have been satisfactorily completed.
- qq. Review the as-built "red-line" mark-ups of the Approved-for-Construction Drawings, specifications and other engineering documents. Submit drawings, specifications and documents to Proponent(s) for review. Forward any comments to Construction Contractor, LSPB Contractor or LSTK Contractor, as applicable, for incorporation into the drawings, specifications and documents.

- rr. Prepare Mechanical Completion Certificate (MCC), Form SA 7213-ENG. Circulate MCC to required Saudi Aramco organizations for concurrence and the Proponent(s) for approval.
 - ss. Distribute approved Mechanical Completion Certificate (MCC) to various Saudi Aramco organizations.
 - tt. Monitor preparations for system commissioning and start-up.
 - uu. Monitor system commissioning and start-up.
 - vv. For a liquid metering system, concur with results from the flowing SAT. Obtain approval of the SAT results from the Proponent(s), OSPAS and CMU. Arrange for completion of the exceptions items from the flowing SAT.
 - ww. If a crude oil sampling system is provided, review the results from the from the water injection test.
 - xx. Approve the satisfactory completion of any remaining SAPMT items from Mechanical Completion Punch List and Site Acceptance Test (SAT). Obtain approval from Proponent(s), CMU, OSPAS, PID, and other originating individuals (organizations) that their respective items have been satisfactorily completed.
 - yy. Ensure as-built CADD drawings prepared by the General Engineering Services Contractor are complete, accurate and conform to the requirements of SAEP-334. Transmit the final drawings to Engineering Drafting Services Division for incorporation into the Saudi Aramco drawing system and advise the Proponent(s) of the submission. Provide a CD containing all as-built CADD to the Proponent(s).
 - zz. Review project documentation for completeness and correctness. Ensure bound Start-Up and Operating Instructions, Maintenance and Equipment Manuals, Calculation Manuals, As-Built Photostat Books and Inspection and Pre-commissioning Data Books comply with SAEP-121 and SAEP-122 and the technical operating and maintenance documents for all computer systems and equipment are included. Submit documentation to Proponent(s), CMU, PDD and PCG, if applicable, for review. Transmit final documentation to Proponent(s).
 - aaa. Obtain a list of exception items for the Performance Acceptance Punch List from the Proponent(s) and PCG, if applicable. Arrange for completion of the exception items from the Performance Acceptance Punch List.
 - bbb. Obtain approval from the Proponent(s) and PCG, if applicable, that the exception items from the Performance Acceptance Punch List have been satisfactorily completed.
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- ccc. If required, prepare Performance Acceptance Certificate (PAC), Form SA 7214-ENG. Circulate the Performance Acceptance Certificate (PAC) for approval by Proponent(s) and PCG, if applicable.
- ddd. If applicable, distribute approved Performance Acceptance Certificate (PAC).
- eee. Close out the project.

5.12 Other Organizations

The responsibilities of other service Saudi Aramco organizations (not specifically mentioned herein support of metering projects) are generally consistent with normal project support requirements.

6 Project Activity Matrix

The following matrix summarizes the general sequence of activities and corresponding responsible organizations for a Saudi Aramco metering project. Detailed requirements for each organization are specified in Section 5.

Step	Activity/Work Item	Perform	Review	Concur	Approve
1.	Engineering study & definition of project scope	CMU, FPD, Proponent(s)			
2.	Preparation of DBSP (Note 1)	FPD	CMU, CSD, ID, ITPD (Note 2), LPD, OSPAS, PDD, P&CSD, Various Other Organizations	Proponent(s), SAPMT	EPD, FPD, VP Proponent Organization(s), VP PM
3.	Distribution of approved DBSP (Note 1)	FPD			
4.	Notification to MINPET (Note 3)	CMU			
5.	Preparation of Project Proposal (Note 1)	SAPMT	Various SA Organizations	CMU, CE&TSD (Note 2), Proponent(s)	CSD, FPD, GM IS, LPD, OSPAS, PDD (if applicable), VP ES, VP PM, VP(s) Proponent(s), VP IT (Note 2), VP PE&D (if applicable)
6.	Distribution of Project Proposal (Note 1)	SAPMT			
7.	Expenditure Request Approval (Note 1)	FPD		BAD, PF&AD, Management Committee	EXCOM, BOD

Step	Activity/Work Item	Perform	Review	Concur	Approve
8.	Waiver(s) of SA engineering requirements	SAPMT, CSD Waiver Coordinator		Proponent(s) ID, CE&TSD (Note 2)	CSD, Chief Engineer, LPD, P&CSD, as applicable
9.	Distribution of approved Waiver(s)	CSD Waiver Coordinator			
10.	List of technically acceptable metering system vendors	CMU, SAPMT			
11.	Preparation of LSPB or LSTK Contract (if applicable)	SAPMT	CMU		
12.	Preparation of metering system FSD, and associated PFD's, P&ID's & ISS's	Design Contractor or LSTK Contractor, SAPMT	Proponent(s), CMU, OSPAS	SAPMT	Proponent(s), CMU
13.	Distribution of approved metering system FSD, associated PFD's, P&ID's & ISS's	SAPMT			
14.	Communications & Support Equipment Service Request (Note 2)	SAPMT	PCG		CE&TSD
15.	Preparation of the purchase order package for the metering system (Note 4)	SAPMT, LSPB Contractor, or LSTK Contractor			
16.	Technical Evaluation of Metering System Bids	SAPMT, LSPB Contractor, or LSTK Contractor			Proponent(s), CMU
17.	Purchase of metering system	Purchasing, LSPB Contractor or LSTK Contractor			
18.	Notification of successful bidder	Purchasing, LSPB Contractor or LSTK Contractor; & SAPMT			
19.	LSPB or LSTK Contractor QA/QC Plan (if applicable)	LSPB Contractor or LSTK Contractor			VID
20.	Vendor Kick-Off Meeting	Vendor, & SAPMT, LSPB Contractor or LSTK Contractor			
21.	Vendor QA/QC Plan	Vendor			VID, LSPB Contractor, or LSTK Contractor
22.	Vendor's preliminary design drawings (NMR 601 Submittal)	Vendor	LSPB or LSTK Contractor (if applicable)	CMU, Proponent(s)	SAPMT

Step	Activity/Work Item	Perform	Review	Concur	Approve
23.	Vendor's final design drawings (NMR 602 Submittal)	Vendor	LSPB or LSTK Contractor (if applicable)		SAPMT
24.	Fabrication and assembly of the metering system	Vendor			VID, LSPB Contractor, or LSTK Contractor
25.	Preparation of Detail Design Package(s)	Design Contractor or LSTK Contractor	SAPMT, Proponent(s), CMU, CSD, LPD, OSPAS, PDD, PID, PCG (Note 2)		
26.	Approval of "key" design drawings	Design Contractor or LSTK Contractor		SAPMT	Proponent(s), PCG (Note 2)
27.	Distribution of Approved-for-Construction (AFC) Drawings	SAPMT			
28.	Vendor's FAT Procedure	Vendor	LSPB or LSTK Contractor (if applicable), SAPMT, Proponent(s), CMU, MINPET (Note 3)		
29.	Distribution of final FAT Procedure	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT, CMU (if required for MINPET) (Note 3)			
30.	Notification of FAT schedule	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT, CMU (if required for MINPET) (Note 3)			
31.	Metering system Pre-FAT	Vendor	SAPMT, LSPB Contractor or LSTK Contractor		
32.	Factory prover calibration (Note 5)	Vendor, Third Party Inspector	LSPB or LSTK Contractor (if applicable)		VID
33.	Metering System FAT	Vendor	VID, LSPB or LSTK Contractor (if applicable)	SAPMT (Note 6)	Proponent(s), CMU, MINPET (Notes 3 & 6)
34.	Distribution of approved FAT report	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT, CMU (if required for MINPET) (Note 3)			
35.	Preparation of Vendor's SAT Procedure	Vendor	LSPB or LSTK Contractor (if applicable), SAPMT, Proponent(s), CMU		

Step	Activity/Work Item	Perform	Review	Concur	Approve
36.	Distribution of final SAT Procedure	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT			
37.	Completion of FAT exception items	Vendor	LSPB or LSTK Contractor (if applicable), SAPMT		VID
38.	Shipment of metering system	Vendor			VID
39.	Preparation of Construction Quality Assurance/Quality Control (QA/QC) Plan	Construction, LSPB or LSTK Contractor			PID
40.	Construction of metering facility	Construction, LSPB or LSTK Contractor, & OSPAS (if required)	SAPMT		PID
41.	Preparation of Start-up & Operating Instructions	Vendor, LSPB or LSTK Contractor (if applicable)	SAPMT		Proponent(s)
42.	Distribution of approved Start-Up and Operating Instructions	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT			
43.	Official prover calibration (Note 5)	Third Party Inspector, LSPB or LSTK Contractor (if applicable)	SAPMT	Proponent(s)	CMU, MINPET (Note 3)
44.	Distribution of approved prover calibration certificate and calculations	CMU, SAPMT			
45.	Walk-through and preparation of Mechanical Completion Punch List	Proponent(s), SAPMT, CMU, LPD, OSPAS, PID, PCG (Note 2)			
46.	Completion of start-up exceptions items ("yes" items) from the Mechanical Completion Punch List	Construction, LSPB or LSTK Contractor			Proponent(s), SAPMT, CMU, OSPAS, PID, LPD, PCG (Note 2), Other individuals (organizations) that initiated the respective items
47.	Non-flowing SAT (Note 7)	Vendor; & Construction, LSPB or LSTK Contractor		SAPMT	Proponent(s), CMU
48.	Formal training at site	Vendor, LSPB or LSTK Contractor (if applicable)	SAPMT, Proponent(s)		

Step	Activity/Work Item	Perform	Review	Concur	Approve
49.	Distribution of as-built Start-Up, Operating & Maintenance Manuals, Test Certificates (NMR 603 Submittal)	Vendor, LSPB or LSTK Contractor (if applicable), SAPMT			
50.	Preparation of spare parts list for start-up and first T&I	Vendor, LSPB Contractor or LSTK Contractor (if applicable)	SAPMT, Proponent(s)		
51.	Procurement of spare parts	SAPMT, Purchasing, LSPB Contractor or LSTK Contractor	Proponent(s)		
52.	Connection and testing of communications facilities (Note 2)	Communications Operating Organization			
53.	Preparation of Partial MCC for communications facilities (Note 2)	SAPMT		LPD, PID, Other required signatories	PCG
54.	Distribution of Partial MCC (if applicable)	SAPMT			
55.	Pre-commissioning	Vendor; Construction, LSPB or LSTK Contractor, Proponent(s), LPD, OSPAS		SAPMT	Proponent(s), CMU, OSPAS, LPD, PID
56.	As-built "red-line" mark-ups of Approved-for-Construction (AFC) Drawings and specifications	Construction, LSPB or LSTK Contractor	SAPMT, Proponent(s)		
57.	Mechanical Completion Certificate (MCC)	SAPMT		LPD, PID, Other required signatories	Proponent(s)
58.	Distribution of Mechanical Completion Certificate (MCC)	SAPMT			
59.	Preparation of system for commissioning and start-up	Vendor, Proponent(s)	SAPMT, CMU		
60.	Issuance of Operating Order	Proponent(s)			OSPAS
61.	Commission and start-up of metering system	Vendor, LSPB, or LSTK Contractor, Proponent(s), CMU	SAPMT		
62.	Flowing SAT (Note 8)	Vendor, LSPB or LSTK Contractor (if applicable)		SAPMT	Proponent(s), CMU, OSPAS

Step	Activity/Work Item	Perform	Review	Concur	Approve
63.	Sampling System Water Injection Test (Note 9)	Vendor, LSPB or LSTK Contractor (if applicable)	SAPMT	Proponent(s)	CMU, MINPET (Note 3)
64.	Meter Calibration (Note 5)	Vendor, LSPB or LSTK Contractor (if applicable), Proponent(s)			CMU, MINPET (Note 3)
65.	Completion of remaining items from Mechanical Completion Punch List and SAT	Vendor, & Construction, LSPB or Construction Contractor			Proponent(s), CMU, SAPMT, OSPAS, PID, Other individuals (organizations) that initiated the respective items
66.	Preparation of as-built drawings	GES Contractor	SAPMT, EDS		
67.	Preparation of project documentation	Vendor, LSPB or LSTK Contractor (if applicable), GES Contractor	SAPMT, Proponent(s), CMU, PDD, PCG (Note 2)		
68.	Preparation of Performance Acceptance Punch List	Proponent(s), PCG (Note 2)			
69.	Completion of items from Performance Acceptance Punch List	SAPMT			Proponent(s), PCG (Note 2)
70.	Performance Acceptance Certificate (PAC) (if required)	SAPMT			Proponent(s), PCG (Note 2)
71.	Distribution of approved Performance Acceptance Certificate (if applicable)	SAPMT			
72.	Close-out of project	SAPMT			
73.	Operating Instruction Manuals	Proponent(s)			CMU

Notes:

1. Required for capital projects only.
2. Required for projects involving communications facilities only.
3. MINPET involvement is only required for royalty metering systems.
4. The purchase order shall include a requirement for on-site operations and maintenance training by the metering system vendor.
5. Required for liquid pipeline or marine loading/unloading metering systems only.
6. SAPMT, Proponent(s) and CMU participation is required for each liquid metering system and Major Gas Metering System. CMU shall determine when participation is required for a Primary Gas Metering System. Participation by SAPMT, Proponent(s) and CMU is not required for a Secondary Gas Metering System.

- 7. Required for gas metering systems only.
- 8. Required for liquid metering systems only.
- 9. Required for crude oil automatic sampling systems only.

31 May, 2004	Revision Summary Major revision.
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