

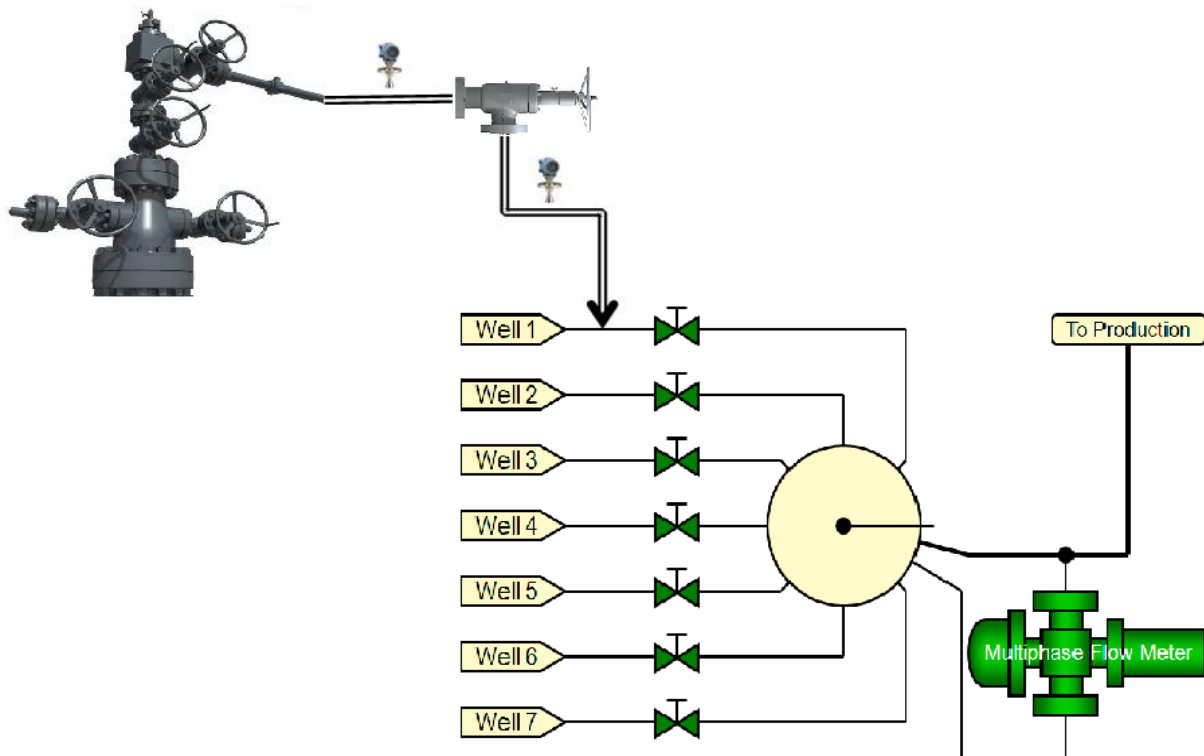
GENERAL DESCRIPTION

Crude oil well test manifold to be provide as Multiport Flow Selector (MPFS) technology. It provides a cost effective method for selecting and diverting well fluids from an individual well to a single test outlet or loop. MPFS should be able to operate in a variety of oil and gas or process applications.

Multiport Flow selector is advanced concept for oil Well test & Production Manifold. This is preferred choice of manifold due to economical and more compact than conventional designs. Multiport valve is a cluster of connecting more than one well and grouping together before the production.

The maximum number of wells inlets to a single MPFS is 8 (Eight), however for engineering excellence operation it is recommended to connect maximum 7 (Seven) nos. of wells. The maximum number of wells that can be connected to a single MPFS in a specific application is determined by the media type and flow rate.

ARRANGEMENT AND WORKING OF MULTIPOINT FLOW SELECTOR VALVE IN PRODUCTION MANIFOLD:



The well lines can easily be diverted to production and Test separator from MPFS. The seven inlets of the multiport flow selector are connected to wells along with isolation valve. The remaining one port is kept free which is home port. During service the home port can be used for seal adjustment.

A - SCOPE OF SUPPLY

The basic scope of supply shall be design, sizing, selection, manufacturing, testing, delivery, documentation, of a complete operational multiport Flow selector along with controller, other accessories duly SKID mounted. Multiphase flow meter can be added as a part of skid.

Typical arrangement is shown in the attached P&I Diagram.

The VENDOR's scope for the Multiport Flow Selector shall be as described in this specification and associated documents including but not limited to:

- Multiport Flow Selector controller, i.e. Electrical Actuator
- Sizing calculations
- Data and Documentation as per Material Requisition, including maintenance manuals, export crating and transportation details.
- Inspection & Testing
- Commissioning and Start-up Spares
- Two (2) years operations and maintenance spares list inclusive of sub-vendor.
- Itemized special tools required for installation, start-up and maintenance.
- Field service rates for technical support and onsite pre-commissioning.
- Training.
 - One session of in house training in vendor's facility
 - One session of on the site training.
- Project Management of the complete order and scope of supply.
- Storage, preservation packing and suitable for land, sea or air shipment as per the delivery terms.

B - BATTERY LIMITS

The battery limits for the MPFS in this specification shall be applicable and included in the VENDOR's scope of supply as shown in the P&ID and as listed below:

Sr. No	Description	Battery Limit
1	Well inlets, main production outlet and test outlet, vent and drain connections	MPFS shall be vertical type with all inlets horizontal around the valve body and the main production outlet and test outlet shall be at the bottom. Vent connection is important however location of vent and Drain shall be per VENDOR standard
2	Signals (for remote monitoring and control)	All hardwired signals shall be connected and terminated to EEx'e' certified junction boxes at control modules mounted <u>on the Skid. (If applicable)</u> In case only MPFS is a part of skid, hardwire connection to be terminated directly to MPFS actuator. Junction Boxes if required shall be of SS316L, ATEX certified. Serial Communication: Communication protocol shall be Modbus over RS-485
3	Electrical power supply, (-----to provide)	All electrical equipment within the MPFS shall equipped with power supply boxes with cable glands for further wiring by EPC CONTRACTOR.

		Power supply cable size shall be provided by EPC CONTRACTOR to VENDOR.
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C - TECHNICAL REQUIREMENTS

i) GENERAL TECHNICAL REQUIREMENTS

The MPFS shall be used to divert the flow from up to seven well strings (or as mentioned in datasheets) to a single multiphase flow meter for well testing purposes. An eighth position shall be provided to "park" the selector . The MPFS shall be equipped with remote and local position control facilities.

The following sub-sections shall constitute common technical requirements for the MPFS.

ii) HAZARDOUS AREA CLASSIFICATION AND CERTIFICATION

All electrical / electronic field instrumentation items such as motor, transmitters, switches, controller etc shall be of EEx'd' type suitable for installation in Zone 1, Gas Groups IIB, Temperature Class T3, as a minimum irrespective of the area classification.

All electrical / electronic Instrumentation items shall be certified by an internationally recognised organisation (statutory body) such as BASEEFA, PTB, FM, CSA, UL etc for operation in hazardous area classification.

All electrical / electronic Instrumentation items to be installed in a hazardous area shall conform to CENELEC / IEC as per EU Directive ATEX 94/9/EC and shall also carry the marking as per ATEX directive.

iii) INGRESS PROTECTION

All MPFS components shall have ingress protection of IP-65 in accordance with IEC-60529 as a minimum.

All field instruments installed under / exposed to direct sun light shall be provided with a UV resistant, GRP canopy.

iv) SOUR SERVICE REQUIREMENTS

In sour service application as identified in applicable project pipe material class specification / instrument datasheet all process wetted parts materials including accessories of the corresponding instrument must conform to the requirements of NACE Standards MR-0175/ISO15156.

v) POWER SUPPLY

To Specify

vi) CONNECTIONS

All Threaded end connections shall be NPT (Taper) as per ASME B 1.20.1. Threaded process connection shall be seal welded. All Flanged end connections shall be as per ASME B 16.5. / NORSOK / SPO Compact TYPE.

Flange Rating, Facing and finish shall be as specified in data sheet.

Electrical field cable connection shall be of Metric Thread (Eg: M20, M25 etc) and sizes shall be as specified in datasheet. Separate entries shall be provided for input, output and power supply, as specified in datasheet.

vii) DESIGN LIFE

MPFS and its actuator assembly, control circuit and associated accessories within the VENDOR scope of supply shall be designed for a life expectancy of thirty (30) years, as a minimum.

VENDOR shall warrant the availability of spares and services for all parts for a minimum of 10 years.

viii) LOW POWER CONSUMPTION

All electrical / electronic items shall be of low power consumption type. Vendor must provide power consumption of individual component along with the bid.

ix) SPECIFIC TECHNICAL REQUIREMENTS

The following sub-sections shall constitute specific technical requirements for the MPFS.

D - GENERAL

The MPFS shall be designed and constructed in accordance with the requirements of this specification, data sheets and other specifications referred in the requisition with the requirements of the referenced codes and standards.

The MPFS shall be supplied as fully assembled and tested units, complete with all necessary accessories.

The MPFS shall be vertical type with all inlets horizontal around the valve body and the main production outlet and test outlet shall be at the bottom. The valve ports shall be sized as per the process conditions mentioned in the data sheets. MPFS shall have 8 inlets, as a minimum; one of which shall be in parking position.

The MPFS shall be with the flanged connections for the Process inlet and outlet flanges. The design shall be constructed such that maintenance, cleaning and testing can be performed easily.

MPFS should be provided with vent connections.

MPFS plug sealing design should allow performing temporary maintenance in-situ condition. Plug seal should be field adjustable type. VENDOR to provide suitable plug-seal assembly adjustable tool.

The MPFS shall be provided with a motorised actuator and position indications. Position feedback mechanism to be specified by the supplier. The Electronic controller shall be integral part of electrical actuator. EC shall have the following functionalities as a minimum:

- Control of the MPFS selector position
- Remote well switching and testing as a part of well test programme. i.e., allow the operator to remotely communicate from the DCS / ICSS through the respective station via RTU system.
- Local selector switches and display unit for the field operator to take control of the MPFS.
- Serial link to select and confirm valve position and any system diagnostics to the MPFS.
- Local interface through the selector switch for the field operator to take control of the MPFS.
- Actuator shall have inbuilt local control station. It shall be provided with a Three (3) – position selector switch for REMOTE/ JOG / STEP functions.

- REMOTE position shall disable all the local push buttons operations.
- JOG/ STEP position shall allow the local operation by the field Operator.

- JOG enables continued plug rotation whilst push button is depressed. JOG function shall be disabled in normal working condition. It should be password protected and shall be accessed only by authorized person.
- STEP rotates plug to next well inlet port
- In REMOTE mode operation, the control command will be issued from the USSC control room to the Multiport Electronic controller, and multiport electronic controller in turn shall position the MPFS port to the well inlet which is to be tested. Only one well at a time will be selected for the test.
- The signals from multiport electronic controller unit to the control room shall include:
 - ✓ Indication of well under the test
 - ✓ Indication of Local / Remote mode position
 - ✓ System status common alarm

E.- MPFS BODY CONSTRUCTION

The MPFS shall be manufactured in accordance with ASME B 16.34 & ASME Sec VIII. When selecting MPFS ports, factors taken into consideration shall include, process properties, capacity requirements, normal and shutoff pressure, etc.

The MPFS shall offer a compact manifold design combining production and test manifold in one single unit. The MPFS shall consist of 8 inlets, one test outlet, one main production outlet and a selector (moving part). In a MPFS, maximum 7 inlets shall be connected to the flow lines and the 8th inlet shall be left with blind flange which shall be used as an inspection port called as inspection and parking port. It shall be possible to divert the flow from any of the 7 inlets to the test outlet by operating the selector. All other flows shall combine and exit via the common production outlet port.

The MPFS main production outlet shall be sized to cater total flow from 7 different wells whose flow profile has been given in the Process Data Sheet (PDS). Also, inlet size shall be sized suitability to handle the flow profile given in the PDS.

The MPFS trim shall be completely replaceable through the bonnet.

F.- PIPING REQUIREMENTS

The MPFS shall be provided with flanged connections for the process inlet and outlet flanges. Nozzle (inlets, main production outlet and test outlet) size shall be based on the VENDOR sizing calculation.

The flange dimension, rating, facing and surface finish shall be in accordance with the Piping Material Specification (PMS).

G. -MPFS TRIM AND LEAKAGE CLASS

The MPFS trim consist of the manifold assembly that are in contact with the process medium, which include selector (plug), stem, selector (plug) guide bushing and seat ring.

The seat ring shall be easy / quick replaceable type. It should also allow temporary maintenance in-situ condition. The MPFS seat leakage class shall be as per process requirement and as specified in the data sheets.

All MPFS shall be sized to provide different flow from different wells & sizing calculation as per API 14E shall be submitted for approval.

H. - MATERIALS

The material of the MPFS shall be as per the PMS & as mentioned the data sheet. Seal and gasket materials shall be selected for long term operation under the specified site conditions. VENDOR shall highlight clearly, in case other materials offered which shall be superior to the material indicated in the PMS.

Materials for sour service shall conform to the requirements of NACE Standard MR-0175 / ISO15156. Asbestos or any other locally and/or internationally prohibited materials shall not be used in any forms.

Materials of construction of the actuator shall be electrochemically compatible with the valve body. Materials of construction of the MPFS and actuator shall be suitable for prolonged service in the specified environment.

Castings shall be in the normalized or quenched and tempered condition. Welds or weld repairs shall be subject to a stress relief heat treatment and shall be certified.

Austenitic stainless steel & Inconel 625 material shall be in the annealed condition.

Forgings in CS shall be in the normalized condition.

H.1 - BODY, TRIM:

The MPFS shall be constructed from material as per data sheet.

H.2 - ACTUATOR:

Motor enclosure material shall be in Carbon Steel or Marine grade Aluminum with low copper content.

MPFS shall be electrically actuated by a motor. Motor shall be provided with integral starter with associated microprocessor based controller to position the selector (moving part) to the required position.

The controller shall provide the position feedback, diagnostic data etc to platform PCS system. VENDOR shall provide the power consumption details along with the bid.

Actuator shall be provided with Hand wheel for manual operation. It shall be designed by the VENDOR to suit the offered MPFM

H.3 –MOTOR

Actuator motor shall operate on 24 V DC, $\pm 10\%$ (-ve earthed) Power Supply from solar power system. The minimum class of insulation shall be Class F and temperature rise shall be limited to Class B insulation.

The motor housing shall be certified EEx'd' type suitable for Zone 1, Gas Group IIB, and Temperature ClassT3 hazardous area classification.

I - CONTROL FEATURES

Actuator shall have following control & diagnostic features.

- ✓ Control of the MPFS selector position
- ✓ Modbus over RS-485 or Modbus over TCP/IP serial communication module for remote communication Remote well switching and testing as a part of well test program i.e., allow the operator to remotely communicate
- ✓ Local selector switches and local display unit for the field operator to take control of the MPFS.

J. - SIZING OF THE MULTIPOINT SELECTOR MANIFOLD

- ✓ MPFS shall be sized and selected accordingly based on the process data sheet and Instrument datasheet.
- ✓ VENDOR shall submit the sizing calculation along with the bid. Sizing calculation shall be approved by EPC CONTRACTOR / COMPANY.

K. - TAGGING AND IDENTIFICATION

Each MPFS and its accessories shall be provided with a permanently fastened SS316L nameplate. Name plate shall be permanently fixed to the body of the instrument using SS316L screws. Adhesive labels shall be forbidden. In order to prevent corrosion, name plates in SS316L shall be covered by a transparent protective film.

The name plate shall indicate the following information as a minimum:

- ✓ Tag number
- ✓ Manufacturer's name and trade mark
- ✓ Serial number and model number
- ✓ Range
- ✓ Material
- ✓ Size and rating
- ✓ Voltage, watts and frequency for electrical instruments
- ✓ IP rating/Hazardous area classification
- ✓ Weight of complete assembly

The VENDOR shall submit a label schedule with nameplate details to the EPCC / CONTRACTOR for approval.

L. - PAINTING AND COATING

The protective coatings for the MPFS unit including the parts in SS316L shall be as per "Painting Manual of the COMPANY. Protective coating shall not obscure equipment tag plate etc. It shall be suitable for offshore environment.

VENDOR's standard painting specification may be acceptable if the same conforms to the above COMPANY Specification or exceeds the specification requirements subject to COMPANY's approval.

M. - INSPECTION AND TESTING

M.1 – GENERAL

The inspection and testing requirement shall be in accordance with Inspection and Test Plan attached with the Material requisition and Purchase Order. The Inspection and Testing shall be witnessed by EPCC CONTRACTOR /COMPANY/ COMPANY's representatives.

It shall cover in-house inspection & testing by the VENDOR, Factory Acceptance Testing (FAT) and Site Acceptance Testing (SAT).

VENDOR shall be responsible for preparing test procedures, co-ordination with third party system vendors and the testing of interface to third party equipment.

It shall be VENDOR's responsibility to modify and/or replace any hardware and modify the software if the specified functions are not completely achieved satisfactorily during testing and factory acceptance.

M.2 - FACTORY ACCEPTANCE TEST (FAT)

A detailed Factory Acceptance Test (FAT) procedure shall be prepared by VENDOR and submitted for EPCC CONTRACTOR / COMPANY approval.

FAT procedure shall provide the following details, as a minimum:

- ✓ Description of each test, purpose of test and expected result.
- ✓ Scheduled start date of each test and its approximate duration.
- ✓ The tests shall be conducted in accordance with approved procedure.
- ✓ VENDOR shall record all test results, issues and shall take action on all issues till the successful completion of the tests.

All records shall be verified and signed by the personnel witnessing the tests. One full set of documentation shall be made available during 'FAT' for reference and use, which shall be used to record 'FAT' changes and observations. All 'FAT' punch lists shall be cleared by VENDOR prior to the shipment.

N. – TRAINING

VENDOR shall provide necessary training to the COMPANY engineers. VENDOR shall indicate the optimum number of attendees per training session and the pre-requisites for attending these courses.

The course and the documentation shall be in English, and tailored for the application and site concerned. VENDOR shall provide training materials for all the participants which shall adequately cover every aspect of the MPFS including site calibration.

Training shall include the theoretical, practical. No. of attendees and required sessions.

VENDOR offer shall cover the following options in terms of location of training:

- ✓ Training to be held in COMPANY's offices
- ✓ Training to be held at VENDOR's office.

O. - SPARE PARTS AND CONSUMABLES

PRE-COMMISSIONING, COMMISSIONING SPARE PARTS:

VENDOR shall provide spares for:

- ✓ Pre-commissioning
- ✓ Commissioning and Start-up

OPERATIONAL SPARE PARTS

VENDOR shall compile a S.P.I.R. list based on 2 years continuous operation of the MPFS. This list should be based on VENDOR's recommendations.

VENDOR shall provide a separate price for all recommended spare parts, repair /replacement policy, including which spares are currently stocked and where.

CONSUMABLES:

VENDOR shall provide all the consumables required during pre-commissioning, commissioning and SAT's (If applicable).

P.- PACKING, MARKING AND SHIPPING

MPFS and its associated accessories shall be packed, marked and shipped as per the EPCC CONTRACTOR purchase document.

All openings of MPFS must be positively sealed for storage and shipping by proper backing plates or other methods to ensure against ingress of dirt and transportation hazard. The use of adhesive tape alone is prohibited.

Easily damageable parts such as machined faces shall be fitted with caps / plates for proper protection. Machined or threaded surfaces exposed to the atmosphere in shipment or storage shall be coated with rust preventive.

After the successful test, all the components especially body cavities are to be thoroughly dried prior to preparation for packing and shipping.