

TECHNICAL SPECIFICATION

PROCEDURE AND TECHNICAL SPECIFICATION FOR DESIGN VALIDATION TESTING OF INDUSTRIAL VALVES

MESC SPE 77/300

February 2020

MESC SPECIFICATION DOCUMENT



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They are based on the experience acquired during their involvement with the design, construction, operation and maintenance of processing units and facilities, and they are supplemented with the experience of Shell Operating Units. Where appropriate they are based on, or reference is made to, international, regional, national and industry standards.

The objective is to set the recommended standard for good design and engineering practice applied by Shell companies operating an oil refinery, gas handling installation, chemical plant, oil and gas production facility, or any other such facility, and thereby to achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where MESC SPEs may not cover every requirement or diversity of condition at each locality. The system of MESC SPEs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in MESC SPEs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use MESC SPEs they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will expect them to follow those practices, which will achieve the same level of integrity as reflected in the MESC SPEs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal or its technical advisor.

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- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

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All administrative queries should be directed to the MESC SPE Administrator in Shell GSI.

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PART I INTRODUCTION**1.1 SCOPE**

This MESG SPE covers the requirements and methods for evaluating the performance of industrial valves when they are exposed to the limits of their design conditions. The performance requirements establish limits of acceptability of a valve, regardless of size or pressure rating.

This MESG SPE specifies Design Validation Testing requirements and a type acceptance test method for confirming the seat sealing, fugitive emission and operating torque capability of a valve under pressure, during and after mechanical and thermal cycling

NOTE: For the purposes of this MESG SPE, the terms “design validation test” and “prototype test” are synonymous.

This MESG SPE number is cited in MESG SPE 77/300A, which is a mandatory additional requirement in every valve MESG Buying Description and is therefore applicable to all valve purchases using MESG. This MESG SPE is supplemented by the following MESG SPEs that specify all requirements for Design validation testing and TAMAP listing:

1. SPE 77/300B Valve Qualification Range
2. SPE 77/300C parts 1-3 Sample Synoptic Tables
3. SPE 77/300D EVADOCs parts 1 to 7
- 4.

Use of this MESG SPE assumes that the execution of its provisions is entrusted to appropriately qualified and experienced personnel, because it calls for procedures that may be injurious to health if adequate precautions are not taken. This MESG SPE relates only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage of the procedure.

This MESOC SPE specifies requirements for design performance validation tests, test procedures and acceptance criteria for industrial valves made to the following industry standards:

- NOTES: 1. Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.
2. Most of the referenced external standards are available to Shell staff on the SWW (Shell Wide Web) at <http://sww.shell.com/standards>.

ISO 10434 / API Std 600	Bolted Bonnet Steel Gate Valves for the Petroleum, Petrochemical and Allied Industries
ISO 14313 / API SPEC 6D	Petroleum and Natural Gas Industries - Pipeline Transportation Systems - Pipeline Valves
ISO 15761 / API Std 602	Steel Gate, Globe and Check Valves for Sizes DN 100 and Smaller, for the Petroleum and Natural Gas Industries
ISO 17292 / API Std 608	Metal Ball Valves for Petroleum, Petrochemical and Allied Industries
API Std 594	Check Valves: Flanged, Lug, Wafer and Butt-welding
API Std 599	Metal Plug Valves—Flanged, Threaded and Welding Ends
API Std 603	Corrosion-Resistant, Bolted Bonnet Gate Valves—Flanged and Butt-Welding Ends
API Std 609	Butterfly Valves: Double Flanged, Lug- and Wafer-Type
ASME B16.34	Valves—Flanged, Threaded, and Welding End
BS 1868	Steel check valves (flanged and butt-welding ends) for the petroleum, petrochemical and allied industries
BS 1873	Steel Globe and Globe Stop and Check Valves (Flanged and Butt- Welding Ends) for the Petroleum, Petrochemical and Allied Industries
BS 5154 Series A	Specification for copper alloy globe, globe stop and check, check and gate valves. Partially superseded by BS EN 12288
EN 12288	Industrial valves. Copper alloy gate valves
BS EN 593	Industrial valves — Metallic butterfly valves

This MESOC SPE can be applied to the testing of special valves (e.g. sub-sea, anti-surge, non-slam axial check, feather check, rising stem ball valves, lined valves and valves fully constructed from non-metallic materials) and valves made to industry standards other than those listed above. Their evaluation shall be subject to agreement between the Principal and the Manufacturer.

This MESOC SPE does not cover the procedure for testing proprietary (special / non-standard) valves such as, wellheads, FCC slide valves, refractory valves, etc. Evaluation of these valve types shall be subject to agreement between the Principal and Manufacturer.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this MESOC SPE is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them.

This MESOC SPE is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this MESOC SPE, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this MESOC SPE which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned, the objective being to obtain agreement to follow this MESOC SPE as closely as possible.

1.3 DEFINITIONS

1.3.1 General definitions

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project, or operation or maintenance of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Design Validation Testing sequence of tests conducted for the purpose of validating that a given product design is capable of performing to established functional requirements

synoptic table summary table of the main parts of the tests to be carried out

fugitive emissions continuous emission on a molecular scale from all potential leak sources of a product under normal operating conditions

critical component component, the properties of which are essential for the safe and reliable long term functionality of a valve (e.g. Body, Bolting, Body sealing, Valve ends, Valve bonnet or cover, Stem, Stem nut or stem bushing, Packing, packing chamber and gland, Packing retention, Obturator, Seats and seating surfaces (including back seats), Hand wheels and levers, Pressure relief, Sealant injection, Anti-static device, Lifting lugs)

critical dimension dimension that is essential for the safe and reliable long term functionality of a valve [e.g. face-to-face dimension, flange dimensions, flange bolt hole orientation, butt-welding end dimensions, centre-to-top dimensions (closed and open position), hand wheel diameter, flange facing finish, type of bolting threads, body and bonnet thicknesses, stem diameter at the extremities and midpoint of the packing contact area, including minimum OD and thread major/minor diameters, surface finish, and straightness, wedge-wear travel, stem projection, number and size of bonnet or cover bolts, stuffing box dimensions and surface finish, and gland follower dimensions, socket-weld ends and threaded ends, gasket dimensions, port opening (bore and seat ring inside diameters), backseat ID and finish, bonnet joint dimensions, stem cylindricity and straightness]

bi-directional valve valve type, which has full differential pressure sealing capability from both sides

uni-directional valve valve type that has full differential pressure sealing capability from one side only

NOTE: For the purpose of this MESG SPE, check valves with dynamically sealed protrusions through the body (e.g. counterweights) are classed as uni-directional valves.

1.4 ABBREVIATIONS

BTC	Break to Close
BTO	Break to Open
DN	Diameter Nominal
DP	Design Pressure
DPE	Double Piston Effect
ETC	End to Close
ETO	End to Open
EVADOC	Technical Evaluation Documents
FE	Fugitive Emission
HP	High-Pressure
HSE	Health, Safety & Environment
LP	Low-Pressure
MESC	Materials and Equipment Standards and Code. NOTE: The MESC codes are contained in the Catalogue Management Tool (CMT) system.
MESC SPE	Mandatory MESC additional requirements
MAWP	Maximum Allowable Working Pressure
NDE	Non-destructive examination
NPS	Nominal Pipe Size
OEM	Original Equipment Manufacturer
PED	Pressure Equipment Directive (2014/68/EU)
PQR	Procedure Qualification Record
QA/QC	Quality Assurance / Quality Control
RF	Raised Face
RT	Running Torque
RTJ	Ring Type Joints
STAR	Supplier Technical Assessment Record
TAMAP	Technically Accepted Manufacturers and Products
UT	Ultrasonic Testing
WPS	Welding Procedure Specification

1.5 CHANGES SINCE PREVIOUS EDITION

The previous edition of this MESC SPE was dated **February 2019. The change is to update the table of contents and make a minor change to Table C.3 Pressure Class qualification groupings, to add anti blowout compliance and welding procedures to EVADOC requirements and to rectify IEC 60548 to IEC 60584 in paragraph C.2.6 in appendix C.**

1.6 COMMENTS ON THIS MESC SPE

Comments on this MESC SPE may be sent to the MESC SPE Administrator at MESC@shell.com.

PART II PROCEDURE AND TECHNICAL SPECIFICATIONS

1 INTRODUCTION

This MESG SPE covers the requirements and method for evaluating the performance of industrial valves when they are exposed to the limits of their design conditions. The performance requirements establish limits of acceptability of a valve, regardless of size or pressure rating.

This MESG SPE specifies Design Validation Testing requirements and a type acceptance test method for confirming the seat sealing, fugitive emission and operating torque capability of a valve under pressure, during and after mechanical and thermal cycling.

Each valve that passes validation testing will qualify a range of similar valves, based on design characteristics, temperature range, size, pressure class, fugitive emission class, and technical qualification class.

Successful completion of the type acceptance test according to this MESG SPE shall be documented by a Design Validation Testing report and a "Certificate of Acceptance" (see example in Appendix D). Manufacturers may submit this "Certificate of Acceptance" with their tenders to demonstrate that applicable valves are covered by the range qualified. No renewal of past certificates will be issued for valves that are not fully compliant with MESG SPE requirements.

Valve prototype / type acceptance test results accepted by Shell Global Solutions will also be logged in the TAMAP database.

Tested valves that are not fully compliant with MESG SPE requirements will be issued a letter of acceptance specific to the project upon completion of the Design validation Testing, provided project requirements are met. These valves will be classified as Non-TAMAP and will not be published on the TAMAP.

NOTE: For the purposes of this MESG SPE, the terms "type acceptance test" and "prototype test" are synonymous.

For information: Validation testing by means of Design Validation Testing is a performance requirement in MESG and it is also one of the required steps before manufacturers and products are accepted in TAMAP. As such, Design Validation Testing is procedure shared by MESG and TAMAP.

The TAMAP work is coordinated by Shell Global Solutions at a global level in order to avoid the need for repeating the work on every valve purchase. Its aim is to reduce the number of prototype tests required across projects, stockists and Operating Units. In a similar fashion TAMAP reduces the number of independent design evaluations and qualification audits by projects, stockists and Operating Units.

MESG purchase specifications for valves in general define the following requirements:

1. Valve type, product standard, size and pressure class;
2. Materials of construction;
3. Additional design details;
4. Inspection and certification requirements;
5. Production- and prototype testing requirements.

TAMAP lists technically accepted manufacturers and products. It is maintained by Shell Global Solutions.

Valve qualification and acceptance in TAMAP will be granted only after all the following steps have been successfully completed:

1. Evaluation of the valve design documentation (EVADOC);
2. Quality verification and technical audit;
3. Performance validation;
4. Results of the processes described above have been documented by the Manufacturer and submitted to Shell Global Solutions.

The procedures for prototype testing in MESG and performance validation in TAMAP are identical

The objective of TAMAP is to provide an auditable process trail confirming the valve

Manufacturer's competence to:

- *design safe and reliable valves that are capable of performing to the design limits and suitable for the intended services;*
- *successfully pass design performance validation testing in accordance with the Design Validation Testing requirements specified herein;*
- *demonstrate an effective and operable quality management system ensuring full compliance with this and other MESG SPEs;*
- *manufacture products to a consistent quality level.*

TAMAP lists manufacturers that have the competence and capability to fabricate valve products that meet Shell Global Solutions' requirements. Procuring valve products from manufacturers listed in TAMAP does not discharge the purchaser from his responsibility to execute an appropriate inspection and test plan to assure that quality requirements are met for each order.

Valve prototype test results accepted by Shell Global Solutions before successful completion of all the requirements specified in Section 4 will be listed in the TAMAP database with a "Pending (2-STAR)" rating.

Valve prototype test results accepted by Shell Global Solutions remain valid for a period of 5 years, starting from the approval of the test report, provided there are no significant changes in design or manufacturing procedures or sites. After this period the acceptance shall be renewed by review of Shell's experiences with the particular valve product or by re-testing.

2 GENERAL CONDITIONS

2.1 CONFLICT OR INCONSISTENCY

If the Manufacturer/Supplier identifies any apparent conflict or inconsistency in requirements within this MESG SPE, the Manufacturer/Supplier shall take the following additional actions:

- The Manufacturer/Supplier shall immediately notify the Principal in writing of the apparent conflict.
- The Manufacturer/Supplier shall advise the Principal in writing of any related actions already taken prior to discovery of the apparent conflict.
- The Manufacturer/Supplier may propose a resolution of the apparent conflict.
- The Principal shall advise the Manufacturer/Supplier in writing of the applicable requirement and appropriate further action.

2.2 STATUTORY REQUIREMENTS

The Manufacturer/Supplier shall satisfy all applicable regulations (see PART I clause 1.2).

3 TEST FACILITY

3.1 TEST LOCATION

The valves shall be tested at the Manufacturer's plant utilizing their own test facilities or at a designated outside test facility.

If an outside testing facility is used, the Manufacturer/Supplier shall be responsible for supplying all pre-test documentation.

In order to qualify for listing in TAMAP, designated outside test facilities shall be approved by Shell Global Solutions. Testing performed at the Manufacturers' plant or outside testing facility shall be witnessed by Shell Global Solutions or a representative thereof.

Personnel performing emission testing shall be qualified in accordance with the manufacturer's documented training programme that is based on the Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method.

3.2 HSE PRECAUTIONS

Testing of valves is potentially hazardous and it is essential that the safety of personnel be given prime consideration. Given the nature of this test and the possibility of weaknesses in the design of the test equipment, hazardous release of pressurized fluid could occur. Adequate shields or barriers in the area of the test enclosure and other appropriate means for the protection of personnel shall be provided.

The test facilities shall be designed to ensure that all the test conditions are conducted in a safe and protected environment e.g. test bunkers, test cells, and/or monitoring systems to allow safe distance of test personnel. It is the responsibility of the Manufacturer to analyse the hazards resulting from the pressure and temperatures and take proper safety precautions. All applicable safety regulations shall be complied with.

All equipment shall have appropriate certification that verifies its suitability to withstand the minimum and maximum pressures and temperatures in the testing environment.

Special attention: Hoses or pipes used for inlet and outlet supply of test medium shall be suitable for maximum pressures and temperatures. Where hoses are used, appropriately designed clamps and/or chains shall restrain the hoses to prevent detachment from the test rig in the event that a blow-out occurs.

Photographs of the test facilities shall be submitted to the party witnessing the test at least one week prior to commencing the test.

3.3 TEST DURATION

The test duration will depend on valve type, size, test sequence, test pressure / temperature and testing facilities. For testing of a bi-directional on/off valve, the table below provides a starting point for planning purposes (assumes a straight-through test without problems).

Where testing facilities support, Design Validation Testing of multiple valves can be carried out in parallel to optimise overall test duration.

Date	Time	Small bore valve	Large bore valve
Day 1	8:00	100 % DP run-in Ambient Test Heating	100 % DP run-in Ambient test
	17:00	Elevated Temp Test ⁽²⁾	
Day 2	8:00	Cooling ⁽¹⁾ Low Temp. Test	Heating ⁽¹⁾ Elevated Temp. Test ⁽²⁾
	16:00	Warming up	
Day 3	8:00	Final Ambient Test Strip down & inspection	Cooling ⁽¹⁾ Low Temp. Test
	16:00		
Day 4	8:00	Contingency	Final Ambient Test Strip down & inspection
	16:00		
Day 5	8:00		Contingency
	16:00		

Notes:

- 1: To make efficient use of time, thermal cycling can be carried out at times that will have least impact on the duration of the test, i.e. for larger size valves, heating and/or cooling should be done at night.
2. Tabulated duration assumes no intermediate elevated temperature test.

4 VALVE QUALIFICATION AND ACCEPTANCE

The Design Validation Testing is considered to have passed, when the individual tests as prescribed in Appendix C of this MESG SPE are successfully executed. This appendix also details examination procedures and acceptance criteria.

During the tests, all observations, results and findings shall be recorded by the Manufacturer (if the testing is performed in his own facility), or by the designated outside test facility/laboratory, in the respective Synoptic table. Synoptic tables are provided in MESG SPE 77/300C parts 1-3. The representative witnessing the test shall take notes of the observed values during the test for comparison with the recorded values.

Where acceptance of the manufacturer and product in TAMAP is the objective, this will be granted when the following steps have been successfully executed:

1. The design evaluation as specified in Appendix A
2. The quality verification and technical audit as specified in Appendix B
3. The prototype test as specified in Appendix C
4. Submission of the "Final Technical Data book" to Shell Global Solutions, content according index for valve Design Validation Testing data book as specified in Appendix E

5 CERTIFICATION

Successful completion of the Design Validation Test according to this MESG SPE shall be documented by a test certificate generally as shown in Appendix D. Manufacturers may submit this certificate with their tenders to demonstrate that applicable valves are covered by the range qualified.

No renewal of past certificates will be issued for valves that are not fully compliant with MESG SPE requirements.

Tested valves that are not fully compliant with MESG SPE requirements will be issued a letter of acceptance specific to the project upon completion of the Design validation Testing, provided the project requirements are met.

These valves will be classified as Non-TAMAP and will not be published on the TAMAP.

This procedure only qualifies the manufacturing location or plant where the valves were made. Therefore, even if a Manufacturer produces identical valves at other locations or plants, these other locations or plants will require independent qualification in accordance with this MESG SPE.

Valve prototype test results accepted by Shell Global Solutions will also be logged in the TAMAP database.

Valve prototype test results accepted by Shell Global Solutions remain valid for a period of 5 years, starting from the approval of the test report, provided there are no significant changes in design or manufacturing procedures or sites. After this period the acceptance shall be renewed by review of Shell's experiences with the particular valve product or by re-testing. Technically accepted manufacturers and products are listed in TAMAP, which is maintained by Shell Global Solutions.

Changes to any item will not void the qualification of valves in TAMAP for which this Design Validation Testing procedure was intended to qualify, provided that the Manufacturer notifies Shell Global Solutions and complies with any additional requirements Shell Global Solutions may specify.

Changes to the suppliers and/or location of supply of pressure containing forgings and castings will not void the qualification in TAMAP provided that the Manufacturer notifies Shell Global Solutions and complies with any additional requirements Shell Global Solutions may specify.

Shell Global Solutions has the right to request a re-test if the qualification of valves in TAMAP has been voided. The re-test shall be subject to the same requirements as specified in this MESG SPE. Unless agreed otherwise, the re-test shall take place at the same testing facility where the previous test was carried out.

APPENDIX A EVALUATION OF THE VALVE DESIGN AND DESIGN DOCUMENTATION (EVADOC)**A.1 INTRODUCTION**

The objective of valve design evaluation is to assess compliance of manufacturer products with applicable Shell MESG specifications, SPE additional requirements and International/industry standards and to agree specific exceptions to selections and requirements made for the purpose of standardisation and variety control, without affecting functional performance requirements or integrity of the valves.

This work is coordinated by Shell Global Solutions at a global level in order to avoid the need for repeating the work on every valve purchase. Its aim is to reduce bid preparation and evaluation effort (Technical and Commercial), as well as to reduce internal and external engineering effort, (Principal, Contractor and Vendor)

Accepted valve designs have been pre-engineered and are considered fit-for-purpose for supply to projects against the MESG specification as detailed on the data requisition sheets and require no further engineering or approval by the Contractor or Principal, other than review and acceptance of the proposal.

The design evaluation step is one of the requirements before acceptance in TAMAP will be granted.

The documentation requirements specified in A.2 below cover the requirements listed in section 6.1 of API RP 591:2008, which is endorsed as amended and supplemented in Appendix B of this MESG SPE

A.2 DOCUMENTATION REQUIREMENTS

This Appendix specifies Shell Global Solutions' requirements for evaluation of the valve design and documentation for the purpose of valve qualification and acceptance in TAMAP.

Before performing the quality and performance validation processes described in Appendices B and C, the Manufacturer shall submit the following documentation to Shell Global Solutions for evaluation:

- a) Relevant design drawings, calculations, etc., for the valves intended for qualification;
- b) Written and signed answer for the EVADOC sheets 1-7 (design package) against MESG SPE requirements for the valves intended for qualification;
- c) For the covered valve range, manufacturer to provide written statement of identical design, which includes MESG numbers, model numbers, drawing/figure numbers with revisions, to ensure that the tested valve is of identical design and that designs of extended range exist, this information to be provided as a spreadsheet.

The manufacturer shall obtain all the necessary documents, MESG specifications and SPE additional requirements in order to compile the Design Package for examination.

All drawings and documents applicable to the technical design evaluation shall be kept in the manufacturer's files and shall be accessible to Shell Global Solutions upon request.

All documents and drawings shall be in English, or shall be accompanied by a certified English translation.

All documents submitted to Shell are considered and treated as confidential information.

A.3 DESIGN PACKAGE (DESIGN EVALUATION)

The design package shall be provided by the manufacturer and shall consist the following instructions:

EVADOC-1 - Comments list on CMT/MESG 77 specifications

Listing of the manufacturers deviations and/or comments with respect to the applicable design standard and additional design requirements of the CMT/MESG.

EVADOC-2 - Cross reference list CMT/MESG numbers / manufacturers drawings

Cross reference lists showing CMT/MESG code numbers versus manufacturer's unique valve identifications, model or figure numbers, nominal sizes, pressure class ratings, applicable as-built General Arrangement drawings numbers with revision status, material lists and deviations to the CMT/MESG buying descriptions, for the complete coverage range.

If a single drawing covers a range of sizes and pressure classes, indicate the same drawing in the spreadsheet, against the relevant MESG number.

General arrangement drawings, offered for examination, shall:

- Be of the latest issue and approved by an authorised person of the quality department.
- Show all information regarding the design i.e., materials of construction (showing full industry standard and grade/type i.e., ASTM grade, BS type, AISI alone is not acceptable), temperature range min./max, indication of revision status. (the engineering standard used to obtain the temperature values shall be noted on the dwg.), **stem anti-blowout compliance** and hardness ranges min./max. of critical materials and dimensions.

EVADOC-3 - List of assembly and/or finished machine part drawings

These drawings shall be of the latest issue, dated and approved by an authorised person of the quality department. Purpose of EVADOC-3 is to identify and freeze on drawings that form part of the valve design accepted.

EVADOC-4 - Valve + size selection (designation of valves)

These documents shall be used for the selection of finished machine part drawings to be reviewed. The selection shall be made prior to or during the pre-evaluation meeting and agreed between Shell Global Solutions and the manufacturer.

EVADOC-5 - List of calculations

The strength and capability of pressure containing parts and other valve components such as closure members, stems, body and bonnet connections, weakest part of the drive train shall be proven and calculations shall be provided together with the results of certified proof tests, carried out by an independent laboratory.

EVADOC-6 - List of miscellaneous documents

For all the valve makes/styles and each valve size and pressure rating subject to this evaluation the list of miscellaneous documents shall include:

- Forces and torque requirements, (min./max. design torques for seating valve)
- Wall thickness,
- Flow characteristics,
- Testing and inspection procedures, material application techniques such as welding, hard facings, repairs and heat treatment.
- Certified test reports, (e.g. production, fire safe, low temperature, fugitive emissions, torque, bellows cycling and cryogenic tests).
- Typical drawings of (e.g. body markings, name plates, brackets for gear boxes / actuators).
- **Welding procedures.**

EVADOC-7 - List of attached information

This list is for (general) information or additional documents, including all certifying body approvals, project reference lists of valves supplied to the petroleum, petrochemical and natural gas industries.

EVADOC forms 1-7 can be found in SPE 77/300D.

A.4 DESIGN EVALUATION

Valve makes, types and styles shall be evaluated to determine their technical conformity with:

- The requirements as defined in International/industry standards for manufacturing of valves
- The additional requirements and restrictions as specified in the applicable MESC SPEs
- Acceptability of deviations to standards where different selections and technical solutions have been made for the purpose of standardisation and variety control, without affecting functional performance requirements or integrity of the valves
- Materials of construction, including material pairing of parts in moving contact to avoid excessive friction, wear and galling
- Testing requirements and testing standards
- Agreement on the manufacturer's procedures for statistical process control
- Identification and acceptance of sub-suppliers
- Documentation supplied with valves
- Documentation held by vendor
- Certification requirements
- Application boundaries (correlation of manufacturer's valve products with MESC ranges)

A.5 EVADOC REVISION CONTROL

The content of each EVADOC agreement shall be reviewed and approved by Shell Global Solutions - PTE/MMI and the footer of each page shows revision number, issue date and approver.

The content of each EVADOC agreement is controlled by Shell Global Solutions - PTE/MMI.

The EVADOC agreement shall contain a revision log, which shall indicate the revision number and issue date and brief revision details for each individual chapter/section of the EVADOC agreement.

Revisions may be suggested, in writing together with reasons for changes, either by Manufacturer, Contractor, Principal, or Shell Global Solutions. All revisions to EVADOC agreements are subject to strict controls. Shell Global Solutions EVADOC co-ordinator and Manufacturer need to agree to the proposed revisions prior to their implementation. The Manufacturer shall then produce a draft of the affected document and forward to the EVADOC co-ordinator in Shell Global Solutions, who shall be responsible for obtaining the necessary review and technical authority approvals. Revisions shall neither be adopted for use nor issued until Shell Global Solutions - PTE/MMI approval to do so has been given in writing.

Enquiries regarding clarification of EVADOC agreements should be addressed to the EVADOC co-ordinator, who holds control copies of all EVADOC agreements.

A.6 VALIDITY

Changes to the design, materials of construction, sealing material and gaskets, quality control procedures and/or sub-suppliers shall void the EVADOC design verification, unless formal approval is obtained from Shell Global Solutions and the manufacturer complies with any additional requirements Shell Global Solutions may specify.

APPENDIX B QUALITY VERIFICATION

This Appendix specifies Shell Global Solutions' requirements for quality verification and technical audit of industrial process valves and manufacturers for the purpose of valve qualification and acceptance in TAMAP.

This Appendix is written as amendments and supplements to API RP 591 Fourth Edition 2008.

The clause numbering of API RP 591 Fourth Edition 2008 has been retained and any amendments are identified as 'Add', 'Modify to read' or 'Delete'. Any clauses of API RP 591 Fourth Edition 2008 that are not amended or supplemented by this Appendix shall apply as written.

- NOTES: 1. Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.
2. Most of the referenced external standards are available to Shell staff on the SWW (Shell Wide Web) at <http://sww.shell.com/standards>.

2		Normative References
		<i>Add:</i> Valves made to the following International Standards shall also be evaluated for compliance to their respective standards: ISO 10434, ISO 14313, ISO 15761, ISO 17292, BS 1868, BS 1873, BS 5154, EN 12288. Valves shall also be evaluated for compliance to: ISO 5208, EN 12266-1 and EN 12266-2.
6		Valve qualification
	6.2	<i>Modify to read:</i> The manufacturer may engage an independent qualification facility, to perform the inspections, examinations, and tests described in this section. Alternatively, all inspections, examinations, and tests described in this section shall be performed at the manufacturer's facility. The facility(s) used shall be mutually agreeable to the purchaser and the manufacturer. The qualification facility staff responsible for testing shall include a degreed or licensed metallurgical engineer or mechanical engineer. The qualification facility(s) shall be equipped and capable of performing, or supervising the performance of non-destructive examination, physical tests, and chemical analyses on materials. The qualification facility staff shall be familiar with the Shell MESD SPEs and the applicable ISO, EN, ASME, and BS valve standards and with the codes, standards, and specifications referenced in those standards. The facility's proposed program shall cover the following: a) qualifications of the personnel performing the inspections and tests; Personnel performing emission testing shall be qualified in accordance with the manufacturer's documented training programme that is based on the Level 1 requirements specified in ISO 9712 or ASNT SNT-TC-1A for the tracer gas method. b) test details and format used to present the results of the tests; c) number, sizes, pressure classes for each type of valve examined (see Table C.1 and Table C.2 in Appendix C of this MESD SPE); and d) source of the test valves and test valves selection method.
	6.3	Selection of valves
		6.3.1 Add: Upon selection, valves shall be marked by suitable means to prevent tampering with the selected valves (e.g., bar-coded stickers at the

		body-to-bonnet joint, etc.) until the testing laboratory receives the valves.
		6.3.2 Modify to read: It is expected that the manufacturer shall have sufficient stock from which a random sampling of their valve products, and shell materials to be qualified, may be selected. Reduced sample lot may be agreed upon by the purchaser and manufacturer. Selected valves shall be clearly identified. Once testing commences, testing shall be limited to the randomly selected sample lot with no substitutions. Random sampling shall include the selection from Table C.1 and Table C.2 in Appendix C of this MESG SPE
	6.4	Required inspection and testing
		6.4.6 Add: The strength test for the stem shaft-to-closure element maybe waived if the Manufacturer provides sufficient evidence to prove the adequacy of the design to the satisfaction of the purchaser (e.g., design calculations, results of previous destructive testing, etc.)
		6.4.10 Add: The hammer test may be waived if the Manufacturer provides sufficient evidence to prove the adequacy of the design to the satisfaction of the purchaser (e.g., design calculations, results of previous destructive testing, etc.)
		6.4.11 Add: The hand wheel torque test may be waived if the Manufacturer provides sufficient evidence to prove the adequacy of the design to the satisfaction of the purchaser (e.g., design calculations, results of previous destructive testing, etc.)
7		Post qualification
	7.2	<i>c. Add:</i> (Changing type, materials or brand of packing and design of body/bonnet plus body/joint gaskets voids the fugitive emission prototype testing described in Appendix C of this MESG SPE)

APPENDIX C PERFORMANCE VALIDATION

This Appendix specifies requirements, procedure and acceptance criteria for performance validation testing of valves.

C.1 SELECTION OF VALVES AND QUALIFICATION RANGE

Valves selected for performance validation testing should have successfully passed the quality verification testing described in Appendix B to the satisfaction of Shell Global Solutions. However, the required material tests and examinations specified in 6.4.5 to 6.4.12 and Table 1 of API 591:2014 shall be executed after Design Validation Testing. All selected valves shall be clearly identified.

The range of valve sizes and pressure classes to be qualified shall be in accordance with Tables C.1 and C.2 below. Alternative valves may be selected in consultation between Shell Global Solutions and the Manufacturer. The indicated test valve "T" is the most optimum for the qualification range.

As a general rule, when a valve has been successfully tested, for sizes from DN50 (NPS 2) up to DN600 (NPS 24) it will qualify nominal valve sizes 3 sizes smaller and 2 sizes larger. For sizes from DN750 (NPS 30) up to DN2000 (NPS 80) it will qualify nominal valve sizes 1 size smaller and 2 sizes larger. All based on the size of the internal flow bore diameter. For small size valves ranging from DN 15 (NPS ½) up to and including DN 50 (NPS 2), an exception has been made to allow any valve in that range to qualify the full range, e.g. a successful testing of a DN 25 (NPS 1) valve size qualifies DN 15 (NPS ½) through to DN 50 (NPS 2) – refer to Table C.1.

Tables C.1 and C.2 assume valve designs are identical in terms of design standard, construction, geometry, fit, form and function, tolerances, stem packing designs/types, anti-friction, anti-galling measures. Where the valve internal designs are identical; the full bore designs also cover reduced bore based on the through-bore size of the closure member. Also where the valve internal designs are identical but the body joint is different (end entry and split body ball valve designs) both designs can be covered subject to a design review by SGSI. In order to validate the different body joint the joint shall be subjected to a static FE test over the full thermal cycle. The Manufacturer shall submit relevant documentation to demonstrate that the valve designs are identical.

Integral body double closure member block and bleed valves for which the individual closure element design and stem sealing design is already qualified by successfully passing Design Validation Testing of individual single body valves are part of the qualification range.

Table C.1 Qualification range for valve DN 50 (NPS 2) and smaller

Nominal sizes				Pressure Classes						
FLANGES	BORE	Bore		150	300	600	800	900	1500	2500
Inch		Inch	DN							
1/2	FB	1/2	15							
3/4	RB	1/2								
3/4	FB	3/4	20							
1	RB	3/4								
1	FB	1	25			T				T
1.1/2	RB	1								
1.1/2	FB	1.1/2	40							
2	RB	1.1/2								
2	FB	2	50							

Table C.2 Qualification range for valves DN 50 (NPS 2) and larger

Nominal sizes				Pressure Classes					
FLANGES	BORE	Bore		150	300	600	900	1500	2500
Inch		Inch	DN						
2	FB	2	50						
3	RB	2							
3	FB	3	80						
4	RB	3							
4	FB	4	100						
6	RB	4							
6	FB	6	150				T		T
8	RB	6							
8	FB	8	200						
10	RB	8							
10	FB	10	250						
12	RB	10							
12	FB	12	300						
14	RB	12							
14	FB	14	350						
16	RB	14							
16	FB	16	400						
18	RB	16							
18	FB	18	450				T		T
20	RB	18							
20	FB	20	500						
24	RB	20							
24	FB	24	600						
30	RB	24							
30	FB	30	750						
36	RB	30							
36	FB	36	900				T		T
42	RB	36							
42	FB	42	1050						
48	RB	42							
48	FB	48	1200						
56	RB	48							
56	FB	56	1400						
64	RB	56							
64	FB	64	1600				T		T
72	RB	64							
72	FB	72	1800						
80	RB	72							
80	FB	80	2000						

Table C.3 Pressure class qualification groupings shall be as defined below:

Size DN50 (NPS 2) and smaller according Table C.1	
Group 1:	Class 600 qualifies classes 150, 300, 600 and 800 *)
Group 2:	Class 2500 qualifies classes 900, 1500 and 2500 *)
Size DN50 (NPS 2) and larger according Table C.2	
Group 1:	Class 900 qualifies classes 150, 300, 600 and 900 *)
Group 2:	Class 2500 qualifies classes 1500 and 2500 *)
Group 3: Pressure seal valves	Class 900 qualifies classes 600, 900 and 1500 *)
*) Provided that the designs, geometry and functionality are identical. If by design, a triple offset butterfly valve of class 900 pressure rating is uni-directional and is selected for testing then the qualification extension is not automatically provided on lower pressure classes as bi-directional. The selection of the valve for testing shall take this aspect in to account. Certain valve types and production ranges may not be produced in the above class qualification groupings. In such cases the following rules apply: Size DN50 (NPS 2) and smaller: - Group 1: If class 600 is not produced then class 300 qualifies classes 150 and 300. - Group 2: If class 2500 is not produced then class 900/1500 qualifies only class 900/1500. Size DN50 (NPS 2) and larger: - Group 1: If class 900 is not produced then class 600 qualifies classes 150, 300 and 600 and class 300 qualifies classes 150 and 300. - Group 2: If class 2500 is not produced then class 1500 qualifies only class 1500. - Group 3: If class 900 is not produced then class 600 qualifies only class 600 and class 1500 qualifies only class 1500. Class 2500 qualifies only class 2500.	

C.2 TEST ARRANGEMENT**C.2.1 Test rig**

In designing the test rig arrangement, the Manufacturer shall ensure that all test sequences are carried out in a safe, secure and efficient manner. Therefore, due care and attention shall be paid to the following:

Personnel / personal protection, unobstructed escape routes,

Appropriate environmental air quality measurement or detection devices:

Optimum sizing of supply and discharge lines (i.e. long lines will increase the stabilization time):

Similarly, internal bore of pressure tubing & connections to valve ends should be adequately sized to ensure time to pressurise & depressurise valve is not excessive.

Minimize wastage of nitrogen or helium supply:

To make efficient use of time, thermal cycling should be carried out at times that will have least impact on the duration of the test, i.e. for larger size valves, heating and/or cooling should be done at night.

In order to demonstrate total independency of the test programme, provisions shall be made to ensure the test valves and test rig settings remain undisturbed at times when Shell Global Solutions staff is not present. Controlled heating or cooling steps and mechanical cycling shall be recorded.