

DEP SPECIFICATION

**CENTRIFUGAL PUMPS
(AMENDMENTS/SUPPLEMENTS TO ISO 13709)**

DEP 31.29.02.30-Gen.

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ECCN EAR99

DESIGN AND ENGINEERING PRACTICE

DEM1



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TABLE OF CONTENTS

PART I	INTRODUCTION	5
1.1	SCOPE.....	5
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	5
1.4	CROSS-REFERENCES	6
1.5	SUMMARY OF MAIN CHANGES.....	6
1.6	COMMENTS ON THIS DEP	7
1.7	DUAL UNITS.....	7
PART II	GENERAL.....	8
PART III	PUMPS FOR NON-ESSENTIAL SERVICE AND SPARED PUMPS FOR ESSENTIAL SERVICE (AMENDMENTS/SUPPLEMENTS TO ISO 13709:2009)	9
1.	Scope	9
3.	Terms and definitions.....	9
3.43	pressure casing	9
3.65	continuous operation	9
3.66	hazardous service.....	9
3.68	abrasive service	10
3.69	vital, essential and non-essential services	10
3.70	certified test.....	10
4.	General.....	11
4.2	Classification and designation	11
6.	Basic design	11
6.1	General.....	11
6.3	Pressure casings	13
6.4	Nozzle and pressure casing connections	13
6.6	Rotors.....	13
6.7	Wear rings and running clearances.....	13
6.8	Mechanical shaft seals	14
6.9	Dynamics	14
6.10	Bearings and bearing housings	14
6.11	Lubrication.....	14
6.12	Materials.....	15
7.	Accessories	16
7.1	Drivers	16
7.2	Couplings and guards	17
7.3	Baseplates	17
7.4	Instrumentation	18
7.5	Piping and appurtenances	18
8.	Inspection, testing and preparation for shipment.....	19
8.1	General	19
8.2	Inspection	19
8.3	Testing	20
9.	Specific pump types	22
9.1	Single stage overhung pumps.....	22
9.2	Between-bearings pumps (types BB1, BB2, BB3 and BB5).....	22
9.3	Vertically suspended pumps (types VS1 through VS7)	23
10.	Vendor's data	25
10.2	Proposals.....	25
Annex A	Specific speed and suction-specific speed (informative)	25
Annex G	Materials class selection guidance (informative).....	25

Annex L	Vendor drawing and data requirements (informative)	25
Annex N	Pump datasheets and electronic data exchange (informative).....	25
PART IV	PUMPS FOR VITAL SERVICE AND UNSPARED PUMPS FOR ESSENTIAL SERVICE (AMENDMENTS/SUPPLEMENTS TO ISO 13709:2009)	26
1.	Scope	26
6.	Basic design	26
6.1	General	26
6.4	Nozzles and pressure casing connections	26
6.6	Rotors	26
6.7	Wear rings and running clearances	26
6.10	Bearings and bearing housings	26
7.	Accessories	27
7.1	Drivers	27
7.2	Couplings and guards	27
7.3	Baseplates	27
7.4	Instrumentation	27
7.5	Piping and appurtenances	28
7.7	Mounting of auxiliaries	28
8.	Inspection, testing and preparation for shipment.....	28
8.2	Inspection	28
8.3	Testing	28
8.4	Preparation for shipment	29
9.	Specific pump types	29
9.2	Between-bearings pumps (types BB1, BB2, BB3 and BB5).....	29
10.	Vendor's data	30
10.1	General	30
PART V	REFERENCES	31

APPENDICES

APPENDIX 1	MATERIALS SELECTION	33
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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for centrifugal pumps.

This DEP is based on ISO 13709:2009. Part III and Part IV of this DEP amend, supplement and delete various clauses of ISO 13709.

All clauses of ISO 13709 not modified by this DEP remain valid as written.

NOTE: API 610, 11th edition, is identical to ISO 13709:2009.

Part III of this DEP applies to pumps for non-essential service and to spared pumps for essential service.

Part IV of this DEP applies, in addition to Part III, to pumps for vital service and to unspared pumps for essential service.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual DEM 1 – Application of Technical Standards.

This is a revision of the DEP of the same number dated February 2011; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall be implemented; this is of particular importance when existing facilities are to be modified.

If national and/or local regulations exist in which some of the requirements could be more stringent than in this DEP, 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 the safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP 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 DEP 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 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.

NOTE: In ISO 13709, the term **Vendor** is used. In this DEP, the term Vendor shall be understood to mean the Manufacturer/Supplier.

The **Principal** is the party that initiates the project and ultimately pays for it. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

NOTE: In ISO 13709, the term **Purchaser** is used. In this DEP, the term Purchaser shall be understood to mean the Principal.

The word **shall** indicates a requirement.

The capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (Part V).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated February 2011.

The following are the main, non-editorial changes.

Clause	Change
Part III, 3.43	added amended definition for pressure casing
Part III, 3.66	changed definitions of Category 1, Category 2 and Category 3.
3.7	Certified test/inspection definition added
4.2.2.15	Clause deleted due revised attitude to VS4 pumps
6.1.8	Deleted redundant first paragraph since stated in ISO 13709. Note added from DEP 31.29.02.11-Gen. clause 3.5.3
6.1.9	Text added from DEP 31.29.02.11-Gen. clause 3.4.6. Existing text deleted in favour of new clause at Annex A.
6.1.11	Second sentence deleted for clarity
6.1.12	Added from DEP 31.29.02.11-Gen. clause 3.4.3
6.1.14	Requirement to specify guaranteed sound power and pressure revised to suit industry practice.
6.3.6	Previously wrongly referenced 6.3.5
6.3.9 a)	Revised to modify clause rather than replace
6.3.9 c)	Added from DEP 31.29.02.11-Gen. clause 3.4.1
6.7.2	Additional exception added where both materials are non galling
6.10.1.2	Deleted redundant text covered by ISO 13709
6.10.2.6	Replaced "Non SPEC pumps with" by "Unless specified otherwise"
6.12.1.12	Text added to heading to clarify intention to also replace sub-clauses
6.12.3.4 e)	Added to deleted redundant ISO 13709 text
7.1.7, 7.1.8 & 9.3.6.2	Revised to allow option for thrust in motor on VS1/6 pumps, without compromising maintainability.
7.2.2 g)	Was 200 degrees C
7.2.4	" , unless pump speed is greater than 3600 RPM" text added
7.3.5	New text added to ensure recording of baseplate flatness during manufacture
7.5.1.2	Clause rewritten for clarity and to ensure consistency with DEP 31.29.00.33 and to correct incorrect reference to Table H.5 in ISO 13709

Clause	Change
8.2.2.1	Previously incorrectly numbered 8.2.2.3
8.3.3.6	Previously incorrectly numbered 8.3.3.3. Requirement to not exceed 110 % relaxed based on Pump Vendor advice.
8.3.3.5	Second sentence added
8.3.4.3 (i) & (II)	"Rated" added for clarity
9.3.6.2	Reworded for clarity
Annex A	Text added to correct typing errors in ISO 13709 and to use Shell units for flow
Annex H	Text deleted due revision to Appendix 1
Annex N	Text added to use DEP datasheet not ISO
Part IV 1.	Part IV was Part III and Part III was Part II
Part IV 6.7.3	Redundant text deleted, already covered in ISO 13709
Appendix 1 Table A1.2	Revised to use ISO 13709 table H.1 material classes and associated table H.2 materials for Group 2, 9, 12 & 13 components

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://sww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

PART II GENERAL

(Part III) and (Part IV) of this DEP are written as amendments and supplements to ISO 13709:2009. Wherever reference is made to ISO 13709:2009, it shall be understood to mean ISO 13709:2009 as amended/supplemented by this DEP.

For ease of reference, the clause numbering of ISO 13709:2009 has been used throughout (Part III) and (Part IV) of this DEP.

Clauses in ISO 13709:2009, which are not mentioned in this DEP, shall remain valid as written.

PART III PUMPS FOR NON-ESSENTIAL SERVICE AND SPARED PUMPS FOR ESSENTIAL SERVICE (AMENDMENTS/SUPPLEMENTS TO ISO 13709:2009)**1. Scope**

Add to clause 1:

(Part III) of this DEP applies to pumps for non-essential service and to spared pumps for essential service.

3. Terms and definitions

Replace clause 3.43 with:

3.43 pressure casing

Composite of all stationary pressure-containing parts of the pump, including all nozzles, seal chambers and auxiliary process liquid piping permanently attached to the pump casing or seal chamber, but excluding the gland plates and the stationary and rotating members of mechanical seals.

Add new clause 3.65:

3.65 continuous operation

Uninterrupted operation for a period of at least 24 000 h at the specified operating conditions.

NOTE: This does not include intermittent operations such as:

- pumps started and stopped automatically at intervals by process-operated controls;
- pumps started up and stopped manually for batch transfer;

Add new clause 3.66:

3.66 hazardous service

Service comprising the following categories, which shall be specified on the data/requisition sheets:

Category 1

- Liquids classified as "very toxic - acute", in DEP 01.00.01.30-Gen.
- Liquids containing ethylene oxide

Category 2

- Liquids classified as "very toxic - chronic", in DEP 01.00.01.30-Gen.
- Hydrocarbon liquids at an operating temperature above their auto-ignition temperature.

Category 3

- Hydrocarbon liquids with a seal chamber vapour pressure higher than 500 kPa (abs) (73 psia);
- Light hydrocarbon services (ISO 21049:2004, Clause 3.38);
- Liquids classified as "very toxic - environment", in DEP 01.00.01.30 Gen.

Add new clause 3.68:

3.68 abrasive service

Service in which there is an expected wear rate of 0.1 mm (0.004 in) or more per year, or where hard particles larger than 100 µm (0.004 in) exist in quantities exceeding 100 mg/kg (100 ppm).

Add new clause 3.69:

3.69 vital, essential and non-essential services

These terms are defined as follows:

	SAFETY EQUIPMENT	OTHER EQUIPMENT		
	SERVICE CATEGORY			
	VITAL	ESSENTIAL		NON-ESSENTIAL
		Non-spared equipment	Spared equipment	
Definition	A service in which failure of equipment causes an unsafe condition of the plant or installation resulting in jeopardy to life and/or major damage (fire, explosion, etc.).	A service in which failure of equipment renders a plant or process unit inoperable or reduces performance to a level unacceptable to the Principal.	A service in which failure of equipment renders a plant or process unit inoperable or reduces performance to a level unacceptable to the Principal.	All other services.
Examples	- <i>Firewater pumps with diesel and motor drives;</i> - <i>Emergency Shutdown (ESD) systems;</i> - <i>Emergency Instrument Air (EIA) compressor.</i>	- <i>Hydrocracker (HCU) feed pump;</i> - <i>HCU recycle compressor;</i> - <i>Cat Cracker (FCCU) main air compressor;</i> - <i>Forced Draft (FD) and Induced Draft (ID) fans.</i>	- <i>Boiler Feedwater (BFW) pumps;</i> - <i>Fractionator's bottom pumps;</i> - <i>Fresh gas compressors (HCU).</i>	- <i>Drinking water pumps;</i> - <i>Sewage pumps.</i>

Add new clause 3.70:

3.70 certified test

Certified inspection - inspection or test which Vendor conducts and certifies, without Purchaser involvement.

4. General

4.2 Classification and designation

4.2.2 Pump designations and descriptions

4.2.2.4 Pump type OH4

Add to clause 4.2.2.4:

Pump type OH4 shall not be used.

4.2.2.5 Pump type OH5

Add to clause 4.2.2.5:

OH5 pumps shall also comply with BS 4082-1, with a casing test pressure rating of Code R.

4.2.2.10 Pump type BB4

Add to clause 4.2.2.10:

Pump type BB4 shall not be used.

6. Basic design

6.1 General

Replace 2nd paragraph of clause 6.1.8 with:

- 6.1.8** The Net Positive Suction Head Available (NPSHA) shall exceed the Net Positive Suction Head Required (NPSH3) by at least 1 m (3 ft) throughout the range from minimum continuous stable flow up to and including the rated capacity, and by 0.3 m (1 ft) at the lesser of 120 % of rated flow and maximum system capacity. If the suction pressure at the pump is less than atmospheric, this margin shall be at least 2 m (6 ft). NPSH margin for high energy pumps are excluded from this guideline, and will be subject to Principal guidance and approval.

NOTE: Inducers may be used only if approved by the Principal and generally are only acceptable on high speed integrally geared (OH6) and vertical submerged motor cryogenic pumps.

For sulfinol, carbonate and amine services, NPSH margin ratio (i.e., NPSHA/NPSH3) shall be at least 1.3 for tip speeds up to 35 m/s, at least 1.5 for tip speeds between 35 and 60, and at least 2.0 for tip speeds above 60 m/s.

For liquids containing dissolved gases, to avoid cavitation damage due to vapour-induced flow path restrictions, NPSHA shall be 1.5 x NPSH3, with a minimum margin of 5 m (15 ft) between NPSHA and NPSH3.

Replace clause 6.1.9 with:

- 6.1.9** The suction specific speed (S) shall be calculated by the Manufacturer in accordance with Annex A (except SI unit of flows shall be m³/hr) and shall be stated in the proposal.

The value of S shall be 12,800 in SI units (11,000 in USC units) or less.

Selection of pumps with a value of S greater than above limits shall be subject to the approval of the Principal and shall be subject to the following additional conditions.

1. The Manufacturer shall indicate the stable operation range in which recirculation effect is absent.
2. The pump shall be installed with appropriate low flow control and/or low flow protection in order to maintain the pump in the stable operation range.
3. The pump shall be NPSH tested.