

DEP SPECIFICATION

GEARS - SELECTION, TESTING AND INSTALLATION

DEP 31.29.00.41-Gen.

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DESIGN AND ENGINEERING PRACTICE



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

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1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for the type selection, testing and installation of gears.

This DEP is intended for gears in vital, essential, and non-essential services; see (1.3.2). It is not intended to apply to gears integral with other equipment.

Special purpose gears were covered during the Shell Standardization process with certain gear Manufacturers. DEP 31.29.00.32-Gen. reflects agreements with various gear Manufacturers during the Standardization process.

Epicyclic gearing, while not covered by this DEP or API standards, should be considered for applications where conventional parallel-shaft gearing either requires large length-to-diameter (L/d) ratios of the pinion, or two-stage gearing. The Supplier's experience should be carefully reviewed for these applications.

Spurs gears are not covered by this DEP or API standards since they are not recommended for these applications given that for the same gear size and accuracy, helical gears operate more smoothly and quietly than spur gears.

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 authorisation 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 API 613 and API 677, the term **Vendor** is used. In this DEP, the term Vendor means the same as 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.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Term	Definition
Continuous Operation	Uninterrupted operation for a period of at least 24000 h at the specified operating conditions.
Intermittent Operation	Operation that is not classified as continuous operation. Examples: - Gears started up and stopped automatically at intervals by process-operated controls; - Gears started up and stopped manually for batch transfer.

Vital, essential, 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 , resulting in jeopardy to life and/or major damage (fire, explosion, etc.).	A service in which failure of equipment renders a plant inoperable or reduces performance to a level unacceptable to the Principal.	A service in which failure of equipment renders a plant inoperable or reduces performance to a level unacceptable to the Principal.	All other services.
Selection Criteria	Equipment shall be adequately spared to ensure as near as practical 100 % availability of the service under all circumstances	A decision not to install spare equipment is based upon economic considerations and proven equipment availability. Non-spared equipment availability may be upgraded by means of additional Capex to match required plant availability.	Installed spare equipment is normally selected where potential losses due to equipment outage greatly outweigh equipment Capex. Sparing philosophy shall be economically evaluated and is typically 2x100 % or 3x50 %.	Economic evaluation required to justify spared equipment.
Driver Selection Criteria	Independent power sources shall be selected to ensure near 100 % service availability		Independent power sources may be selected, for start-up and utility availability reasons	
Examples	• Firewater pumps with diesel and motor drives; • Emergency shut-down (ESD) systems; • Emergency Instrument Air (EIA) compressor.	• Hydrocracker Unit (HCU) feed pump; • HCU recycle compressor; • Fluid Catalytic Cracking Unit (FCCU) main air compressor; • Forced Draft (FD) and Induced Draft (ID) fans.	• Boiler Feed Water (BFW) pumps; • Fractionator bottom pumps; • Fresh gas compressors (HCU).	• Drinking water pumps; • Sewage pumps.

1.3.3 Abbreviations

Term	Definition
AGMA	American Gear Manufacturers Association
ANSI	American National Standards Institute
HCU	Hydrocracker Unit
IPF	Instrumented Protective Functions
L/d	Length-to-diameter
SME	Subject Matter Expert
SPL	Sound Pressure Levels

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 (6).

1.5 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

1.6 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.

2. GENERAL

2.1 APPLICATIONS

The selection of gears and the technical evaluation of bids from the Manufacturers shall be based on the requirements of this DEP together with the requirements of DEPs relevant to the type of gear concerned. These are:

DEP	Subject	Relevant API Standard
31.29.00.32-Gen.	Special Purpose Gear Units	API Std 613, 5 th Edition
31.29.00.38-Gen.	General Purpose Gear Units	API Std 677, 3 rd Edition

In this DEP, references to API 677 shall be understood to mean API Std 677, 3rd Edition. API 677 covers the minimum requirements for general purpose, enclosed single and multistage gear units incorporating parallel shaft helical and right angle spiral bevel gears. API 677 is not intended to apply to gears integral with other equipment.

In this DEP, references to API 613 shall be understood to mean API Std 613, 5th Edition. API 613 covers the minimum requirements for special purpose, enclosed, precision single and double helical, one and two stage speed increasers and reducers of parallel shaft design. API 613 is not intended to apply to gears integral with other equipment, such as integrally geared compressors covered by API 617, Chapter 3, Integrally Geared Compressors, or API 672. API 617 Chapter 3 states that gears with a ratio of 7:1 or greater shall be rated in accordance with Annex 3F of API 617, all other gears shall be rated to API 613.

Special purpose gears and general purpose gears covered by API standards (including auxiliaries) shall be designed and constructed for a minimum service life of 20 years and at least 5 years of uninterrupted operation.

API standards have improved the reliability of gears by mandating conservative ratings. Minimum service factors are specified in each API standard based on the type of driver and type of driven equipment. However, one should always investigate any other equipment options that could eliminate the need for a gear (i.e., variable speed motor, high speed motor, steam turbine, etc.) to see what is best from an overall equipment train reliability point of view. Currently there are no ISO equivalent standards to API 613 or API 677.

2.2 PROTOTYPE GEARS

Gear units shall be supplied by Vendors qualified by referenced experience in manufacturing gear units with closely similar duties and build specifications to those being proposed.

To qualify, the Vendor shall have manufactured at least three gear units of comparable power rating, selection factor, pinion speed and pitch line velocity. Each of these gears shall have acquired at least 24000 hours of trouble-free operation.

2.3 OPERATING DATA

All necessary operating loads/speed data (i.e., normal, start-up, shutdown, load reversals, etc.) shall be stated on the data/requisition sheet(s).

2.4 NOISE CONTROL

The gear Vendor shall submit guaranteed sound pressure levels (SPL) of the equipment, together with any relevant information as specified in the data sheet DEP 31.10.00.94. The main driven equipment Manufacturer shall indicate what special silencing measures, if any, are proposed in order to meet the specified levels.

The SPL around the equipment shall be less than 90 dB(A) as average at 1 meter around skid. If a component of the equipment train has a projected SPL above 90 dB(A) average,