DEP SPECIFICATION

TANK MIXERS AND AGITATORS

DEP 31.51.10.31-Gen.

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DESIGN AND ENGINEERING PRACTICE

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TABLE OF CONTENTS

1. INTRODUCTION 4
1.1 SCOPE 4
1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS 4
1.3 DEFINITIONS 4
1.4 CROSS-REFERENCES 5
1.5 SUMMARY OF MAIN CHANGES 5
1.6 COMMENTS ON THIS DEP 5
1.7 DUAL UNITS 5

2. DESIGN AND ENGINEERING 6
2.1 GENERAL 6
2.2 AREA CLASSIFICATION 6

3. GENERAL REQUIREMENTS FOR MIXERS AND AGITATORS 6
3.1 GENERAL 6
3.2 ELECTRIC DRIVER 6
3.3 TRANSMISSION 6
3.4 PROPELLERS 8
3.5 SHAFT 8
3.6 MECHANICAL SHAFT SEAL 9
3.7 BEARINGS 10
3.8 BEARING LUBRICATION 10
3.9 HIGH TEMPERATURE MIXERS 11
3.10 SHUT-OFF DEVICES 11
3.11 VIBRATION AND BALANCING 12
3.12 NOISE CONTROL 13
3.13 DATA AND INFORMATION TO BE SUBMITTED 13

4. SPECIFIC REQUIREMENTS FOR SIDE-ENTRY MIXERS 14
4.1 GENERAL 14
4.2 LIFTING LUGS 14
4.3 TIE-ROD/PEDESTAL SUPPORT AND BRACKETS 15

5. ADDITIONAL REQUIREMENTS 16
5.1 FLANGE FACE SURFACE FINISH 16
5.2 NAMEPLATES, RATING PLATES, ASSET NUMBER PLATES 16
5.3 SURFACE PROTECTION, PAINTING AND COATING 16

6. INSPECTION AND TESTING 17
6.1 GENERAL 17
6.2 INSPECTION AND TESTING AT THE MANUFACTURER'S FACILITY 17

7. REFERENCES 20

Documents
Document Sharing Hub

Full document details: SHELL 31.51.10.31 0

1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the design of permanently mounted side and top entry tank mixers, and top and bottom entry agitators.

Top-entry mixers should be preferred over side-entry mixers for very toxic substances (refer to DEP 01.00.01.30-Gen. for definition of very toxic substances).

This is a revision of the DEP of the same number dated September 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 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.

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
Agitators	Agitators are used to properly mix gases, liquids and/or solids in a pressurized or unpressurized reactor or vessel to achieve the desired material properties required by the process system. Agitators are considered vital equipment. They are generally permanently mounted to the vessel nozzle.

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Term	Definition
Tank Mixers	Tank mixers are used to mix continent in atmospheric tanks or open vessels to either keep solids in suspension or mix solids with liquids. Tanks mixers are small in power and not consider vital to the process unit as they are generally spared or can be quickly repaired.

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 (7).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the DEP of the same number dated September 2011. This revision has been extensive and it is not practical to list all the changes.

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.

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2. DESIGN AND ENGINEERING

2.1 GENERAL

The data/requisition sheet shall be used for the exchange of information between the Principal, Contractor and Manufacturer.

Design and construction shall be proven in practice, robust and reliable.

The Manufacturer shall certify or obtain independent certification that all materials of construction used, meet the requirements specified.

The Manufacturer shall obtain all local authority certificates that are required.

Manufacturer shall submit details of all weld sections before fabrication for Purchaser's approval, along with the relevant WPS (Welding Procedure Specification) and PQR (Procedure Qualification Record). WPS/PQR shall be qualified to internationally recognised standards; e.g., AWS D 1.1 or ASME SEC. IX.

2.2 AREA CLASSIFICATION

Electrical equipment shall be suitable for the hazardous area classification in which it will be installed.

3. GENERAL REQUIREMENTS FOR MIXERS AND AGITATORS

3.1 GENERAL

Mixers or agitators shall be designed - including the drive, transmission and shaft assembly - to cover the most stringent operating cases including restarting with vessel of process material, maximum viscosity at cold start-up conditions or other conditions mentioned in the data requisition.

Mixers or agitators shall be complete with appropriate mountings, and when specified, shall be shop assembled before shipment and ready for installation.

Optional devices such as ignition gap, bearing protection system, automatic swivel actuation system in swivel angle side-entry mixers or automatic belt tensioner for belt drives shall be approved by the Principal.

3.2 ELECTRIC DRIVER

Mixers and agitators shall be driven by an electric driver that complies with DEP 33.66.05.35-Gen. for North American application and with DEP 33.66.05.31-Gen. in general. Complete assembly shall be suitable for continuous operation and shall be suitable for the hazardous area classification (2.2).

For bearing life expectancy refer to (3.7).

The Principal shall specify how the driver shall be connected to the side-entry mixer.

The driver nameplate power, exclusive of service factor, shall be at least 110 % of the power required for any specified operating condition.

The drive-end bearing of the driver shall be capable of accepting the forces associated with belt drives.

3.3 TRANSMISSION

3.3.1 General

For side-entry mixers, the following drive transmissions are acceptable and listed in order of preference:

a. tooth belt drive;

b. spiral bevel gear and hypoid bevel gear transmission;

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c. worm gear transmission.

In general, a belt drive is preferred for side-entry mixers because the purchase and maintenance costs of gearbox drives are expected to be higher. V-belt drives and wedge belt drives shall not be used.

Belts shall be oil resistant, as well as fire resistant and anti-static.

Belts shall be durable and shall be marked legibly on the non-working face, indicating the belt type, belt cross-section, and nominal pitch length.

The belt pulleys shall have taper lock bushing for ease of removal.

Gearbox drives are preferred for heavy duty agitators and top entry mixers.

3.3.2 Tooth belt drive

Toothed belts shall be of the high torque drive (HTD) type.

The tooth belt polyester tensile cores shall be helically wound, to create strength, flexibility and resistance to elongation. The belt tensile member shall be encased by neoprene teeth and backing.

The wearing surfaces of the belt shall have a nylon facing to minimise friction.

The belts shall have a minimum service factor of 2.25 and a rated life of 25,000 hours.

3.3.3 Gearbox drive

Gear units shall comply with API STD 677.

Gearbox drive shall utilise high efficiency spiral bevel gears that comply with AGMA 6013-A06).

Gearbox drive shall have a minimum load (service) factor of 1.75 and design life of 10 years or shall have helical gears made of die-forged, precision hardened steel.

The gears shall be splash oil lubricated.

The gearbox shall be suitably sized to ensure adequate heat dissipation and noise levels as specified in equipment noise limitation sheet, DEP 31.10.00.94-Gen.

a. The gearbox shall have an inspection cover for inspection of the gears.

b. The gearbox shall be removable for shop maintenance as one unit, without disturbing motor mounting alignment or removing coupling halves.

c. The gearbox of mixers over 40 kW (54 hp) shall have a dial oil temperature indicator in the oil reservoir.

d. Gearbox housing should have an external oil level sight glass. Bulls eyes in the gearbox are not acceptable.

e. Gearbox shall have a 13 mm (0.5 in) NPT connection for a nitrogen purge.

The gear bearings shall be self-aligning ball, spherical roller or tapered roller bearings with a minimum L-10 rating of 25,000 hours.

3.3.4 Coupling

All couplings shall be metal flexible element spacer type. Use of elastomeric couplings shall be approved by the Principal.

3.3.5 Guards

Rotating parts of the transmission shall have guards.

Belt guards or coupling guards for gear type transmissions shall be made of weatherproof and non-sparking material:

a. aluminium or aluminium alloy with a maximum content of 2 % magnesium or 0.2 % copper,

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