

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

TECHNICAL SPECIFICATION

SIDE-ENTRY MIXERS FOR STORAGE TANKS AND VESSELS

PTS 31.51.10.31

JANUARY 2009



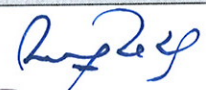
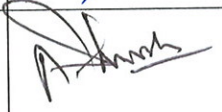
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PTS Circular 2009 - 1	PETRONAS 
PTS No:	PTS 31.51.10.31
Publication Title:	SIDE-ENTRY MIXERS FOR STORAGE TANKS AND VESSELS
Base PTS Version:	Release 13; December 1998

This revision of PTS 31.51.10.31, Release 13: December 1998 for SIDE-ENTRY MIXERS FOR STORAGE TANKS AND VESSELS has been reviewed based on new information issued by relevant industry code and standards and found in order. Therefore, there is no comment on this PTS as on date and good for use.

Document Approval

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Revision History

Date	Version	Description of Updates	Author
15.01.09	Rev. 1	Reviewed, no comment	Ramle Bin Awang

PREFACE

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TABLE OF CONTENTS

1.	INTRODUCTION	5
1.1	SCOPE.....	5
1.2	DISTRIBUTION, APPLICABILITY AND REGULATORY CONSIDERATIONS	5
1.3	DEFINITIONS	5
1.4	CROSS-REFERENCES	5
1.5	SUMMARY OF MAIN CHANGES	6
2.	PURPOSE	7
3.	DESIGN AND ENGINEERING	8
3.1	AREA CLASSIFICATION.....	8
4.	SPECIFICATION FOR SIDE-ENTRY MIXERS	9
4.1	GENERAL	9
4.2	POWER.....	10
4.3	ELECTRIC DRIVE	11
4.4	TRANSMISSION	12
4.5	PROPELLERS	14
4.6	SHAFT	15
4.7	SHAFT SEALS	16
4.8	BEARINGS.....	18
4.9	BEARING LUBRICATION.....	19
4.10	OPTIONAL DEVICES	20
4.11	LIFTING LUGS.....	22
4.12	TIE-ROD/PEDESTAL SUPPORT AND BRACKETS	23
4.13	HIGH TEMPERATURE SIDE-ENTRY MIXERS	24
4.14	SHUT-OFF DEVICES	25
4.15	VIBRATION LEVELS	27
4.16	NOISE CONTROL	28
4.17	DATA AND INFORMATION TO BE SUBMITTED	29
5.	INSTALLATION OF SIDE-ENTRY MIXERS	30
5.1	TANK AND VESSEL DATA	30
5.2	MOUNTING OF SIDE-ENTRY MIXERS.....	30
5.3	LOCATION OF SIDE-ENTRY MIXERS	30
5.4	PROPELLER CLEARANCE	31
5.5	ELECTRICITY SUPPLY	31
6.	ADDITIONAL REQUIREMENTS	33
6.1	FLANGE FACE SURFACE FINISH	33
6.2	NAMEPLATES, RATING PLATES, ASSET NUMBER PLATES.....	33
6.3	SURFACE PROTECTION, PAINTING AND COATING	33
7.	INSPECTION AND TESTING	34
7.1	GENERAL	34
7.2	INSPECTION AND TESTING AT THE MANUFACTURER'S WORKS.....	34
7.3	SITE TESTS AND COMMISSIONING.....	35
8.	REFERENCES	37

APPENDICES

APPENDIX 1	RECOMMENDED MIXER (FIXED-ANGLE) POSITIONS FOR EFFECTIVE BLENDING, HOMOGENEITY AND TEMPERATURE UNIFORMITY	40
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APPENDIX 2	RECOMMENDED MIXER (SWIVEL-ANGLE) POSITIONS FOR EFFECTIVE B.S. AND W. CONTROL IN CRUDE OIL TANKS	41
APPENDIX 3	POSSIBLE LAYOUT OF A HIGH TEMPERATURE GREASE PURGE SYSTEM	42
APPENDIX 4	LEAKAGE-CONTROL-SYSTEM	43
APPENDIX 5	EXAMPLE OF AN EMERGENCY COLLAR SEAL.....	44
APPENDIX 6	EXAMPLE OF A REMOTELY ACTUATED EMERGENCY SEAL FOR HIGH TEMPERATURE SIDE-ENTRY MIXERS.....	45
APPENDIX 7	STORAGE TANK SIDE-ENTRY INSTALLATION	46
APPENDIX 8	MANHOLE MOUNTING NOZZLE FOR FIXED OFFSET ANGLE MIXER.....	47

1. INTRODUCTION

1.1 SCOPE

This PTS specifies requirements and gives recommendations for the design, fabrication, assembly, testing, inspection and installation of side-entry mixers for storage tanks and vessels.

This PTS shall be used in conjunction with Data/requisition sheet PTS 31.51.10.93.

Note: Top-entry mixers should be used for toxic and similar products.

This PTS is a revision of the PTS of the same number dated December 1998; a summary of the main changes is given in (1.5).

1.2 DISTRIBUTION, APPLICABILITY AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS Group, Contractors and to Manufacturer/Supplier nominated by them.

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

If national and/or local regulations exist in which some of the requirements are more stringent than in this manual, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards to safety, economic and legal aspects. In all cases the contractor shall inform the Principal of any deviation from the requirements of this document 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 with the object of obtaining agreement to follow this document as closely as possible.

1.3 DEFINITIONS

The **Contractor** is the party which 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 which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which 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.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced by this PTS are listed in (8).

1.5 SUMMARY OF MAIN CHANGES

This is a revision of the PTS of the same number dated December 1998.

This has been mainly an editorial revision, with no significant technical changes.

2. PURPOSE

Side-entry mixers are installed in storage tanks and vessels to fulfil one or more of the following duties:

- a. BS&W
Control or prevention of accumulation of tank bottom deposits such as sand, silt, water, clay, paraffin, heavy ends or other waxy components, mainly in crude oil tanks. These deposits are commonly referred to as BS&W (Base Sediment and Water).
- b. Maintain the homogeneity
Maintain the homogeneity of finished or intermediate products/feed stocks to ensure uniform product specification.
- c. Blending
Blend different components to obtain a homogeneous blend in a specified time to specified requirements.
- d. Heat transfer or to maintain temperature uniformity.

For case a as above, it is not necessary to mix the whole tank/vessel contents but to create a flow pattern in the lower part of the storage equipment. The side-entry mixers are used before and during discharge so that:

- the solids are kept in suspension;
- the whole tank/vessel contents remain pumpable;
- the tank/vessel bottom will suffer less from corrosion because the stagnant layer, containing mostly salt water and other corrosive media, is replaced by a less corrosive mixture;
- laborious and costly tank/vessel cleaning is required less frequently;
- discharging slugs of water, with consequent process upsets, will be prevented.

For cases b, c and d complete movement throughout the tank/vessel with top to bottom "turnover" as well as circulation round the tank/vessel will be required to ensure that the total liquid content is uniform to specification. For heat transfer duty the locations of the mixers relative to the heating elements are important to the success of the application.

At least one of above described duties shall be filled in on Data/requisition sheet PTS 31.51.10.93 by the Principal, including a blending time for case c.

3. DESIGN AND ENGINEERING

Data/requisition sheet PTS 31.51.10.93 shall be used for the exchange of information between Principal, Contractor and Manufacturer.

Where the Data/requisition sheet shows alternatives, those items which are not applicable shall be deleted.

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 for his account all local authority certificates that are required.

3.1 AREA CLASSIFICATION

Electrical equipment shall be suitable for the hazardous area classification (see IP Model Code Part 15) in which it will be installed and shall have a type of protection in accordance with IEC 60079-14.

4. SPECIFICATION FOR SIDE-ENTRY MIXERS

4.1 GENERAL

Side-entry mixers shall be either of the fixed-offset angle type or of the swivel angle type. In both cases, the direction of rotation, as seen from the motor and looking towards the propeller, shall be clockwise and the pumping action shall be away from the tank or vessel shell.

The design shall allow for installation or removal of the mixer assembly (including the propeller) from the tank/vessel simply by bolting or the mounting nozzle cover on which the mixer is assembled.

Side-entry mixers shall be supplied assembled, complete with appropriate mountings and ready for installation in accordance to (5.2).

4.1.1 Fixed-offset angle type

Fixed-offset angle type side-entry mixers shall be used for blending or homogenising purposes. The fixed-offset angle α (refer to Appendix 1 and Appendix 8) shall be to the left of the tank radius running through the centre of the mounting flange cover in which the mixer is to be installed. A mounting adapter angled at ten degrees shall be used for all tank sizes.

4.1.2 Swivel-angle type

Swivel-angle type side-entry mixers shall normally be used for BS&W control, with occasionally a further requirement for blending.

The swivel mechanism shall be manually operated, and shall be capable of moving the propeller shaft in the horizontal plane between 30 degrees left and 30 degrees right of the tank radius or vessel radius through the centre of the manhole cover (Refer to Appendix 2). It shall have a facility for setting the propeller angle, in relation to the tank or vessel, in the zero position and at 10, 20 and 30 degree angles both left and right of the zero setting. The angle settings shall be clearly marked and a device shall be provided to ensure that the mixer remains securely locked at the selected angle during operation.

The swivel mechanism shall be designed for heavy duty.

The spherical ball on which the mixer swivels is mounted shall be of austenitic stainless steel (AISI 316 type material as minimum). The hardness difference between ball and swivel mechanism shall be greater than 150 H Brinell, in order to minimise wear.

The spherical ball shall be polished to a surface finish smoother than 0.4 microns Ra.

The seal between the moving and stationary parts shall be compatible with both the product and salt water and shall be capable of withstanding a five (5) years period in the environment without any maintenance, apart from occasional tensioning of the packing gland nuts.

4.2 POWER

The motor power shall be rated to cover all possible variations in demand, imposed by the specified operating conditions.

In determining the power requirements, the design of the tank or vessel geometry and components, such as floating roofs, heaters, extended filling lines, etc., losses due to gear boxes, and physical properties (density and viscosity) at all anticipated conditions shall be taken into account.

4.3 ELECTRIC DRIVE

The side-entry mixer shall be driven by an electric motor which shall comply with PTS 33.66.05.31. The mixer and its driver shall be suitable for continuous operation and shall be suitable for the hazardous area classification as per (3.1).

For bearing life expectancy refer to (4.8).

For all electric motors, requisition sheets according to PTS 33.66.05.93 shall be completed by the electric motor Manufacturer. The Purchaser shall specify in requisition PTS 31.51.10.93 how the driver shall be connected to the side-entry mixer.

Care shall be taken that the drive-end bearing of the electric motor is capable of accepting the forces associated with belt drives.

4.4 TRANSMISSION

4.4.1 General

The following drive transmissions are acceptable and listed in order of preference:

- Tooth belt drive;
- Direct single or multi V-belt drives and wedge belt drives;
- Spiral bevel gear and hypoid bevel gear transmission;
- Combined helical gear transmission and V-belt drive;
- Worm gear transmission.

In general a belt drive is preferred because the purchase and maintenance costs of gearbox drives are expected to be higher.

V-belts, multi-V-belts and tooth belts shall conform to one of the following specifications:

- API 1B;
- BS 3790 and BS 4548;
- ISO 4184; or
- DIN 7753 parts 1 and 2.

Belts shall be oil resistant in accordance with BS 903 part A16, as well as fire resistant and anti static "FRAS" conforming to BS 3790. For general information on electrical resistance of conductive and anti-static products made from polymeric material see BS 2050.

Belts shall be durable and shall be marked legibly on the non-working face, indicating the belt type (for wedge belts: SPZ, SPA, SPB or SPC; for V-belts: Y, Z, A, B, C or D and for tooth belts: XL, L, H, XH or XXH), belt cross-section, nominal pitch length and FRAS properties. Belt drives shall not be used with two-pole motors.

The belt pulleys shall conform to BS 3790 or BS 4548 and have taper lock bushes for ease of removal.

4.4.2 Tooth belt drives

Toothed belts shall be of the high torque drive (HTD) type conforming to BS 4548.

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.

4.4.3 V-belt drives and wedge belt drives

Wedge belts (narrow V-belts) are preferred to classic V-belts.

Design calculations for wedge and V-belt drives shall be in accordance with Appendix A of BS 3790. For determining the power transmission capability a service factor of 1.3 shall be used.

Wedge belts or V-belts shall only be used for duties up to 20 kW.

Integral multi-wedge belts or multi-V belts of the endless type shall be used for duties from 20 kW up to 55 kW. However, these multi-belts ("concorde-belts" or "poly-belts") are usually not available for all mixer power/speed combinations. Integral multi-belts are preferred over wedge belts and V-belts because their service life is approximately 5 times longer.

Wedge and V belts shall have a polyester core, a neoprene filler and neoprene impregnation.

4.4.4 Gearbox drives

Gear units shall comply with API 677. A gearbox drive shall utilise high efficiency spiral bevel gears according to AGMA 6010 and shall have a minimum load (service) factor of 1.5 or shall have helical gears made of die-forged, precision hardened steel. The gears shall be splash oil lubricated. The gear housing should be suitably sized to ensure adequate heat dissipation and noise levels as specified in equipment noise limitation sheet, PTS 31.10.00.94. The gearbox shall be constructed with an inspection cover for inspection of the gears. The gearbox shall be removable for shop maintenance as one unit, without disturbing motor mounting alignment or removing coupling halves.

4.4.5 Coupling

The coupling between the gearbox and the motor shaft shall be of the non-lubricated disc pack spacer type. The flexible coupling element between gearbox and motor shall be in accordance with DIN 28155 or BS 3170.

4.4.6 Guards

Rotating parts of the transmission shall not be left exposed. Belt guards or coupling guards for gear type transmissions shall be made of weatherproof and non-sparking material, in accordance with BS 5304. They shall be permanently fixed and sufficiently rigid to prevent contact with moving parts and be designed for easy removal and assembly.

4.5 PROPELLERS

4.5.1 Fabrication

Both cast marine type propellers and welded propellers are considered suitable for use with side-entry mixers.

If a welded propeller type is offered, only full penetration welds are acceptable. The propeller shall be checked thoroughly for welding defects, especially at the blade root, where stresses are at a maximum.

The propeller material shall be compatible with both the product and salt water.

The propeller shall be locked to the shaft. Positive fixing of the propeller to the shaft may be achieved by taper to taper, side fitting key and a corrosion resistant impeller retainer cone with cap screw. Keys are not allowed if cladded shaft material is used.

All propellers shall be statically and dynamically balanced in air as well as hydraulically balanced to ensure vibration free operation, optimum cavitation free conditions and promoting maximum pumping rate and entrainment for any given power.

4.5.2 Inspection

Propeller surfaces shall be free of adhering sand, scale, cracks and hot tears. Other surface discontinuities shall meet the visual acceptance standards specified in MSS SP-55.

Welded propellers shall be radio-graphically inspected in accordance with ASTM E 94. The interpretation of radiographs shall be in accordance with ASTM E 186, ASTM E 280 or ASTM E 446, whichever is applicable. The acceptance criteria shall be proposed by the manufacturer for the approval of the Principal.

Ultrasonic inspection in accordance with ASTM A 609 shall be performed if radiography is not possible.

The final arithmetic average blade surface roughness of the propellers shall be smooth finish (Ra 3.2 to 6.3 microns).