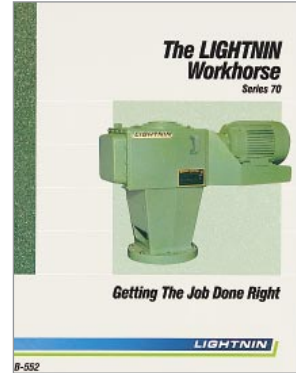


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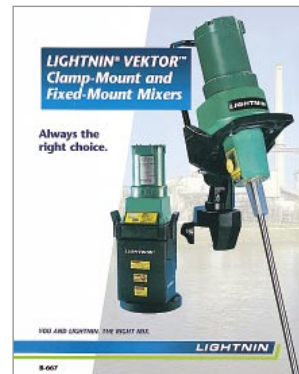
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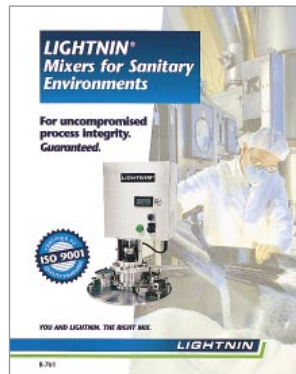
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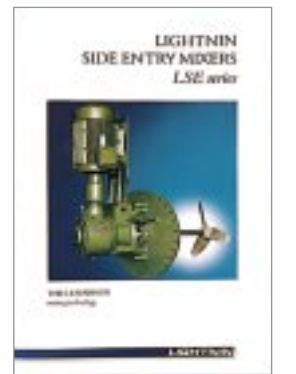
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B-772



B-761



LIGHTNIN SIDE-ENTRY MIXERS LVSES Series



*Affordable.
 Easy to maintain.*

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and easy to maintain

LIGHTNIN LVSES Series Side-Entry Mixer

Fixed angle and variable angle designs available

Choice of V-belts and tooth belts accommodate metric frame and NEMA frame motors. Choice of standard and special reduction ratios.

Choice of four sizes optimized for the range of 2.2 kW to 55 kW.

One-piece cantilever design output shaft helps eliminate runout, increasing seal life. No intank bearings or sleeves that add to maintenance.

Simple step-by-step seal removal instructions located inside the cover guard for easy access and reference.

Shaft is jacked forward to engage a taper. Standard stainless steel mating faces help eliminate corrosion. Vent valve/check is included to test the shut-off.

All openings have full guards which conform to rigorous safety standards.

Fast and easy seal change reduces downtime and simplifies maintenance. Unlike competitive designs, there is no need to loosen the motor support or remove belts, drive pulley and bearings to access the mechanical seal.

Stainless steel used for all shaft shut-off parts to eliminate rusting and corrosion.

Product lubricated single mechanical seals are available. Also available are barrier fluid lubricated double mechanical seals for containment of health or environmentally hazardous fluids.

Packed gland stuffing box design available for paper stock service.

As the leader in process technology, LIGHTNIN relies on its 75 years of application experience to offer an array of impellers from traditional propellers to high-flow efficiency LIGHTNIN A310 and A312 for optimum process results.

Mounting Flange ANSI 150RF (fixed angle mixer) and API 650 (variable angle mixer) available.

L10 bearing life exceeds 100,000 hours.

Standard high-performance LIGHTNIN bearings and oil seals are available from stock from any LIGHTNIN factory for fast turnaround.

and selection criteria

crude storage

All side-entry mixer applications require high flow efficiency in order to meet one or more of the following criteria: Homogenizing (preventing stratification), blending components, preventing the build-up of solids and heat transfer.

EXAMPLES: Edible Oils

Agitation is required in crude edible oil tanks with “foots” (seeds or husks) in order to maintain the solids in suspension and ensure draw-off of a uniform product for down stream operations.

In addition, the mixers are required to provide heat transfer and prevent stratification.

Chemical Processing and Water Treatment

Mixers are employed to combine additives to achieve uniformity. This routinely includes moderate viscosities, shorter blend times, and smaller volumes, which makes the LVSES the ideal choice for cost-efficient mixing.

Asphalt

Mixing is required to eliminate the build-up of sludge or tar on the tank bottom and provide uniform heat distribution to prevent the asphalt from solidifying during cooling.

The LVSES is extremely effective in this high-viscosity, severely abrasive, environment.

Crude Oil

Proper mixing is required to control or prevent accumulation of the bottom sludge and water (BSW) in the crude prior to shipment in addition to blending different crudes and additives.

The LVSES provides highly efficient blending at lower horsepower levels where tank fill times and allowable blend times are longer. You can rely on *LIGHTNIN*'s expertise regarding the effects of stratified and non-stratified fluid motion on a mixer's mechanical design to help you size and select the optimal mixer.

A swivel angle design is available when the primary goal is tank cleaning and the prevention of sludge build-up in the tank. Fixed angle designs are also available when blending, homogenation (preventing stratification) and heat transfer are the primary objectives.



Gasoline

The goal of gasoline blending is to blend components to uniformity in a specified time through top-to-bottom turnover.

Some gasoline blends may contain up to ten components that are charged into the tank either concurrently or over time. Frequently, the addition of components occurs over several days resulting in stratification if the mixer is not operated. In gasoline applications, the flow (and hence, the power requirement) is highly dependent on the density range of the components and how the mixer(s) is operated (e.g. during pump-up or from a stratified tank).

LIGHTNIN's understanding of process parameters is reflected in the design of the LVSES which provides optimal flow patterns in stratified and non-stratified tanks.

Pulp and Paper

Applications in the paper industry include blending of stock, high density storage towers and couch pits.

From minimal agitation to keep the pump suction clean, to maximum blending to incorporate chemical dyes into the stock, the LVSES is the one mixer that can best meet the multiple requirements of the pulp and paper industry.

chemical processing

edible

Generally, horsepower levels are proportional to process results for a given type of impeller and running speed. Horsepower requirements for a particular application depend on the following mixing variables:

- Blend time
- Tank height/diameter ratio and tank volume
- Viscosity
- Density difference
- Impeller orientation

Motor horsepower is determined by applying the formula:

$$(\text{Volume Factor}) \times (\text{Time Factor}) \times (\text{Viscosity Factor}) \times (\text{Density Difference Factor})$$

Blend Time

Mixer selection, to a large degree, is based on the blend time required to achieve process results. It's important to note that half the power is required to achieve blending in 20 minutes versus blending the same tank contents in 10 minutes.

Also, required horsepower can be reduced if the mixer is operated during completion of pump-up. In many cases, running the mixer during filling will reduce the mixing time needed to obtain uniformity after completion of pump-up.

The order in which different density components are added to the tank also has an impact on blend time. Mixing time can be reduced by filling the tank with the highest viscosity and density components first.

When blending rather than storage is the primary objective, feed pipe location has a significant impact on horsepower requirements. Ideally, pipes should feed into the area of the greatest discharge velocity.

for typical mixing regimens

Tank Volume

As depicted in the General Sizing Chart, required horsepower needed to achieve process results is a function of tank volume.

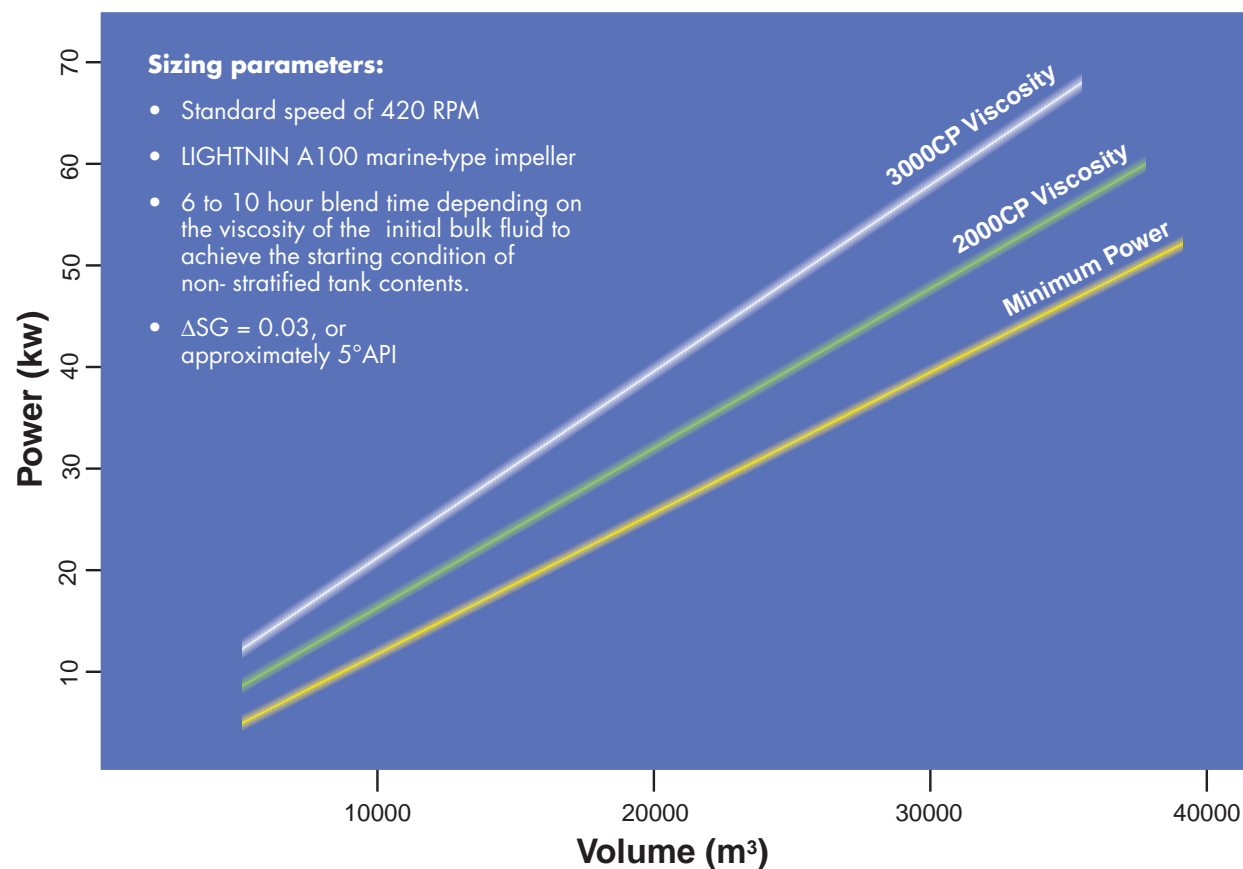
Tank geometry must also be considered. Side-Entry mixers produce flow which starts at the impeller, sweeps across the tank bottom, and flows up the opposite side to the surface of the liquid. The relationship between a tank's maximum height/diameter ratio (Z/T ratio) and tank volume is critically important to achieving desired mixing results.

Density

The density difference between components being mixed has an effect on horsepower. As the density difference increases, more power is required to produce a uniform mix.

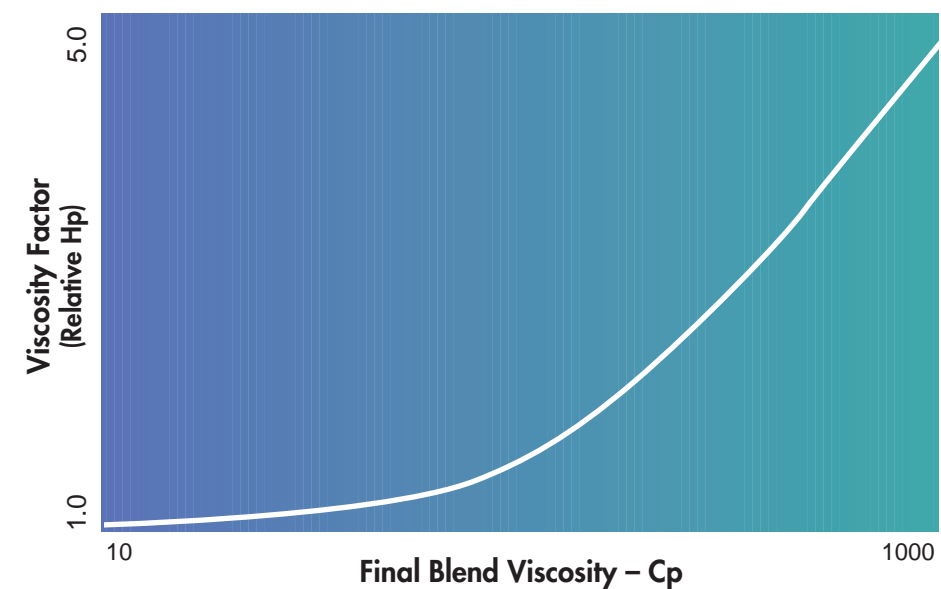
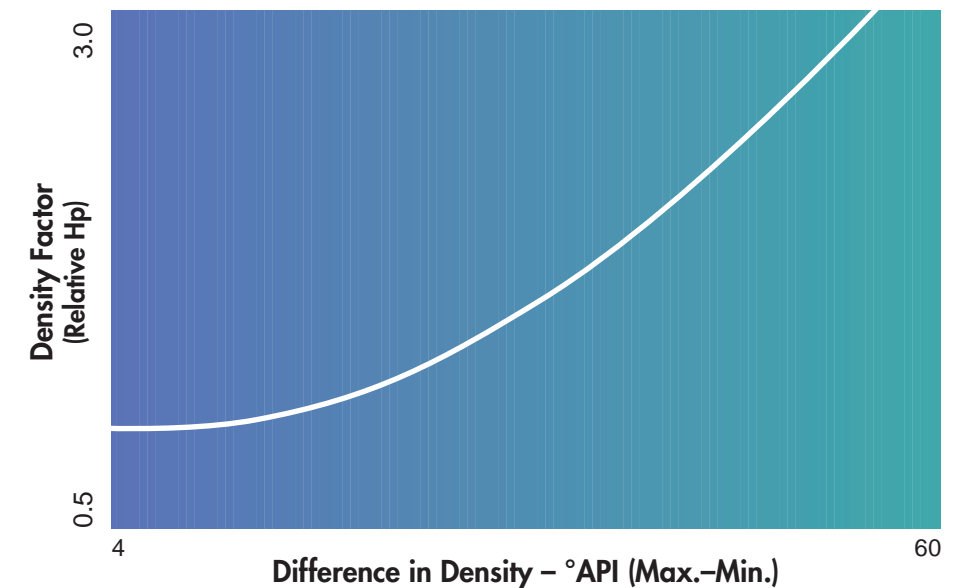
- Sizing strategy applies for most typical API tank configurations, limiting tank heights to 15m to 18m. Within these heights, there is no Z/T correction. However, actual initial Z/T should be greater than 0.25. Otherwise, the required mixing flow pattern will not be properly developed.
- Use of LIGHTNIN's high efficiency impellers can reduce power requirements or blend time by 40% or more.
- If conditions vary from those in this example, please consult your LIGHTNIN sales engineer for mixer sizing and selection assistance.

General Sizing Chart



Viscosity

Greater horsepower is required for higher viscosity blends due to the increased viscous drag on the tank wall and the decreased energy level in the mixer stream when reaching remote areas of the tank.



The process capabilities and mechanical requirements of all side entering mixers greatly depend on impeller design. *LIGHTNIN* impellers are designed to meet a wide range of process objectives for solids suspension, blending, and heat transfer and homogenization.

Impeller Selection Considerations

1. Power consumption is a function of the following:
 - Impeller speed
 - Impeller diameter
 - Physical properties of the fluid
 - Tank size and geometry
 - Impeller location in the tank
2. Power consumption is completely independent of process performance and should *not* be used as a basis of comparison.
3. Every impeller has a distinct flow and power number used to define the characteristics of the impeller. These numbers vary with the Reynolds number in the laminar and transitional zones, but remain fairly constant in the turbulent regime.
4. Mixing objectives and the mixing environment determine selection of the most appropriate impeller type.
5. Impellers for side entry mixing applications are of a high flow design, since the mixer's primary objective is to suspend solids or blend fluids.



A100 Impeller

The A100 Superpitch® propeller has been widely used in petroleum and edible oil storage applications. Designed on the screw theory, this proven axial flow impeller features a continuous increase in blade angle from the blade tip to the hub.

Better than a marine propeller, the A100 has a pitch ratio of 1.5:1 which maximizes its pumping capacity per unit of power consumption. The A100 is often considered where low capital cost is more important than long-term savings in operating costs.

A310 Impeller

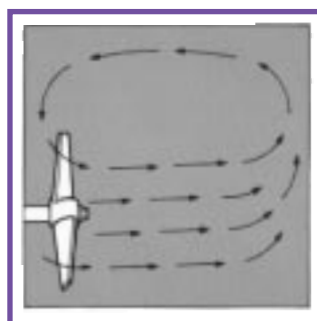
The A310 is the first impeller designed using advanced laser doppler velocimetry technology. The pitch angle and blade width are increased along the length of the blade to provide a uniform flow at every point on the impeller blade, and a strong axial flow across the diameter of the impeller. The impeller is available in one-piece cast and bolted on construction.



LIGHTNIN A310

More efficient than the marine prop and the A100, this impeller allows for a 20% savings in energy costs at the same speed and a 40% savings at lower speeds. The efficiency of the A310 impeller makes it an ideal choice when operating costs are a primary consideration.

A310 Typical side-entering flow pattern



The directionalized flow pattern of the A310 impeller helps ensure effective mixing even in the largest tanks. Strong flow characteristics contribute to high turnover and entrainment levels which increase mixing effectiveness of the bulk flow in remote areas of the tank.

selection guide for LVSES mixers

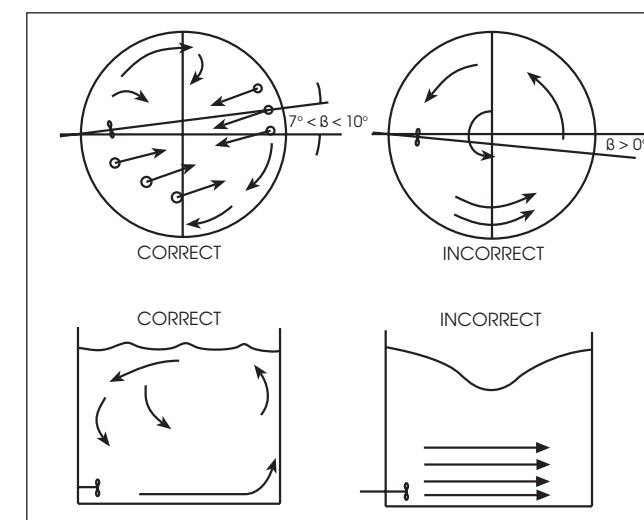
A312 Impeller

For severe-duty chemical processes, petro-chemical processes, flue gas-desulphurization and pulp and paper applications, the *LIGHTNIN* A312 impeller combines patented A310 flow technology with a severe duty blade design.

In addition, less energy is lost, so pulp and paper stock can roll over more efficiently. Lower fluid forces and decreased torque result in less stress on both the shaft and blades to deliver superior durability, maintainability, and operating efficiency.



LIGHTNIN A312



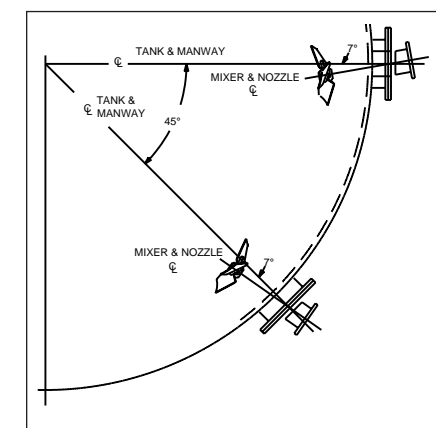
Correct Angle to Achieve Flow Pattern vs Incorrect Angle

Impeller Placement

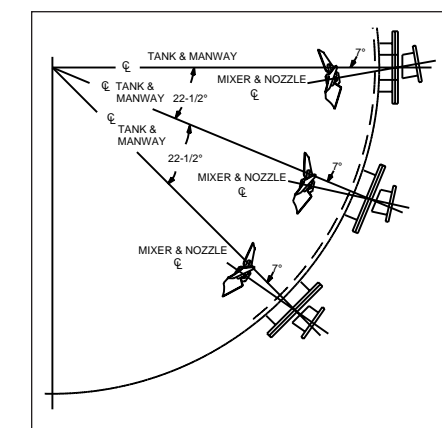
For general chemical processing and crude oil tanks up to 15 meters in diameter, side entering mixers should be mounted 7° from the tank center line. For larger tanks, the angle should be increased to 10°.

To swirl the tank bottom in order to suspend basic sediment and water in petroleum storage, an angle of 20° is required of fixed angle units.

Alternatively, swivel angle designs available for the LVSES also enable operations to suspend the basic sediment and water.



In-tank Placement of Two Mixers



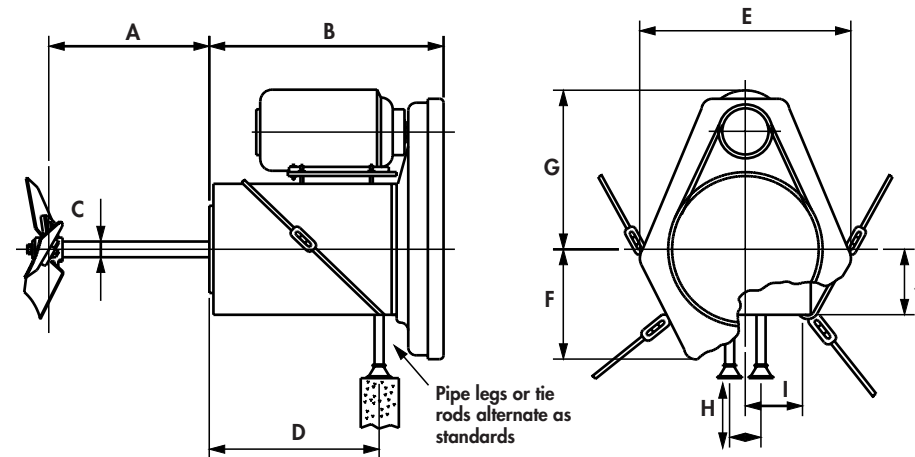
In-tank Placement of Three Mixers

Multiple Mixers

For most applications, a single mixer per tank is adequate. However, as viscosity and tank diameter increase, multiple mixers may be required. When two mixers are required, they are placed within the same quadrant of the tank, such that the center-lines of each impeller to the tank wall are 45° apart.

When three mixers are required, they are still placed within the same quadrant of the tank, but the center-lines of each impeller to the tank wall are now 22.5° apart.

DIMENSIONS



MODEL SERIES	kW	AGITATOR WGT. (kgs) LESS MOTOR	MOTOR DATA		A	B	C	D	E	F	G	H	I	J
			FRAME	WGT kgs										
1LVSES	2.2	270	D100L	37	610	810	50	615	660	300	550	250	155	185
	4		D112M	47							565			
	5.5		D132S	73							585			
	7.5		D132M	86							585			
2LVSES	11	420	D160M	125	710	965	65	715	880	350	610	300	195	225
	15		D160L	146							665			
	18.5		D180M	190							685			
3LVSES	22	635	D180L	200	810	1065	75	815	1050	400	685	350	230	260
	30		D200L	270							750			
	37		D225S	310							775			
4LVSES	45	710	D225M	380	810	1065	90	815	1050	400	775	350	230	260
	55		D250S	485							800			

General Notes:

1. Refer to order specifications for details of your unit.
2. Dimensions are for reference only. Mounting dimensions may be certified.
3. Standard mounting flange data:

150 LB ANSI SERIES DRILLING						
MODEL SERIES	ANSI SIZE	O.D.	BOLT CIRCLE	NO. OF HOLES	HOLE DIA.	FLANGE THICKNESS
1LVSES	8	345	298.5	8	22	38
2LVSES	10	405	362	12	26	38
3 & 4 LVSES	12	485	432	12	26	44

Flange Bolt Holes Straddle Vertical Centerline.

4. Impeller type and diameter will vary according to service conditions.
5. Actual belt guard dimensions will depend on belt ratio and type used.
6. Dimensions in mm except ANSI flange size which is in inches.

Mixer Mounting Considerations

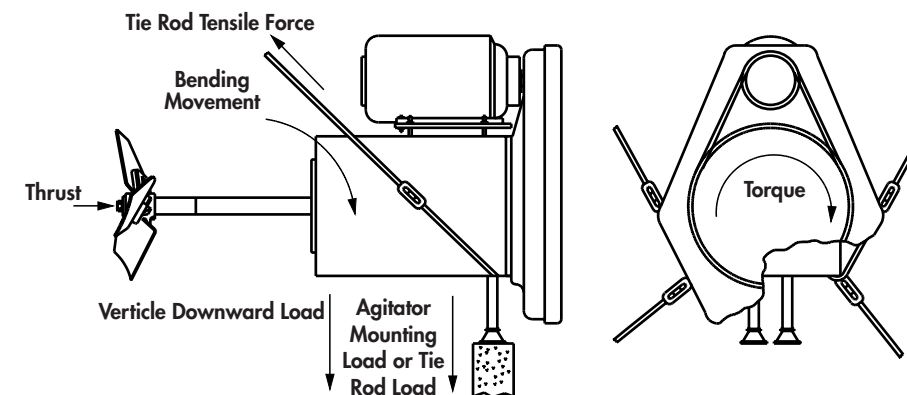
Petroleum tanks have the equivalent of paper-thin walls: Typically a metal thickness of 20-25mm for a tank diameter of 70-90m. Installed mixers cause stress concentration and ideally the loads should be distributed over as large an area as possible. Tie rods and pipe legs are methods of doing this.

Four tie rods are used to support the outboard end of the mixer. Rods have turnbuckles so that each rod can be tensioned. Clips are like hooks which are welded to the tank wall to engage the rods. Clip location can be advised by *LIGHTNIN*.

Pipe legs serve the same purpose by fixing the outboard end of the mixer to a solid foundation. For some installations, this arrangement is more convenient than tie rods. Both options are available for the LVSES.

The nozzle on the tank wall, the manway on the tank wall, or the nozzle on the manway coverplate should be checked for strength and rigidity. Customers can be assured that an installation is reliable by using the Design Loads indicated in the chart provided. It is common practice on larger tanks to have a reinforced plate in the nozzle area to distribute the loads over a greater area.

Design Load



LIGHTNIN MODEL	DESIGN LOADS			
	1LVSES	2LVSES	3LVSES	4LVSES
Torque (Nm - Newton meters)	460	920	1850	2290
Bending Movement (Nm)	900	1820	3030	3620
Thrust (N - Newton)	4100	8500	14500	20000
Tie Rod Load (N)	9000	18200	24600	26200
Vertical Downward Load (N)	12000	24300	33000	35000

Installation

Installation depends on impeller type, diameter, nozzle inside diameter and nozzle standoff (the distance from the inside of the tank wall to the flange face). The impeller type and diameter is also a function of the mixer power selected and the running speed.

Generally speaking, the preference is to install and remove mixers with the impellers attached. LVSES mixers can, therefore, be designed to be installed on standard 24" manways with the impeller attached.

LIGHTNIN engineers traditionally examine all aspects of mixer installations including nozzle openings and projection, elevation, and orientation of the mixer in the tank.

These parameters are critical for meeting process requirements and for making recommendations regarding optimum installation, removal, and maintenance of equipment. Where possible, *LIGHTNIN* ensures that the installation can be performed without personnel having to enter the tank.

LIGHTNIN is also the only mixer manufacturer that has a global service organization, *LIGHTNIN* Process Equipment Services. A network of experienced and certified *LIGHTNIN* Service Engineers and Technicians perform all aspects of mixer installation and maintenance.

LIGHTNIN Side Entry Installation Sampling:

China	Daqing Oil Field Zhenghai Refining
Egypt	APC
France	Mobil
Germany	EXXON
Indonesia	Sinar Mas Pulp and Paper Pertamina
Iran	Behran Oil Co. NIOC
Italy	AGIP EXXON Cerestar Roquette SISAS
Japan	Japan Oil Engineering Co.
Korea	Hyundai Ampol Samsung
Malaysia	Pan Century Edible Oil Sime Darby Plantation Shell Refining Company
Nigeria	Mobil
Pakistan	Union Texas Petroleum
Philippines	Fluor Daniel
Poland	Petrochemia Plock S.A.
Saudi Arabia	Aramco
Singapore	Singapore Refining Company Mobil Oil Singapore Caltex (Asia) Ltd. PUB Power Station EXXON Chemical
Sweden	Nynas Petroleum
Thailand	Mobil Thailand Castrol Thailand
UK	Guinness
USA	EXXON Shell Southern California Electric Texaco