



搅拌机

MIXER BROCHURE



上海丙瑞实业有限公司
SHANGHAI BINRUI INDUSTRIAL CO., LTD.

联系我们

上海丙瑞实业有限公司
Shanghai BinRui Industrial Co., Ltd.



公司介绍 ▶ Company Introduce

Shanghai BinRui is Founded in 2015.

Most Products: Mixer

Application industries: Chemical/Petrochemical/Phosphoric acid sulfuric acid/Mining/WWT/
Pharmacy/Food

Total People: 25 persons

Plant: Shanghai Baoshan District

Headquarters: Room 1108, No. 6088 Humin Road, Minhang District, Shanghai

Technical Advantages: Adopts foreign advanced design concept and design calculation software

Gearbox: FLENDER /SIEMENS/NORD/SEW

Motor: ABB/WEG/SIEMENS

Shaft: General Solid Shaft

Maximum Impeller Diameter: over 7m

Maximum Shaft Length: over 20m

Maximum Mixer Power: over 400HP

上海丙瑞成立于2015年

主要产品：搅拌机

应用行业：化工/石化/磷酸硫酸/采矿/污水处理/制药/食品

总人数：25人左右

工厂：上海市宝山区

总部：上海市闵行区沪闵路6088号1108室

技术优势：采用国外先进的设计理念和设计计算软件

变速箱：弗兰德/西门子/诺德/SEW

电机：ABB/WEG/西门子

轴：一般实心轴设计

最大叶轮直径：超过7m

最大轴长：超过20m

最大搅拌机功率：超过400HP

目录

Contents

- Process Design & Impeller Selection
- Mechanical Design & Agitator Features
- Application Industries Photo
 - WWT
 - FGD
 - Chemical /Pharmacy
 - Mining
- 工艺设计和叶轮选择
- 机械设计和搅拌器特点
- 应用行业照片
 - 水处理
 - 脱硫FGD
 - 化工/制药
 - 采矿

工艺设计及浆叶选型

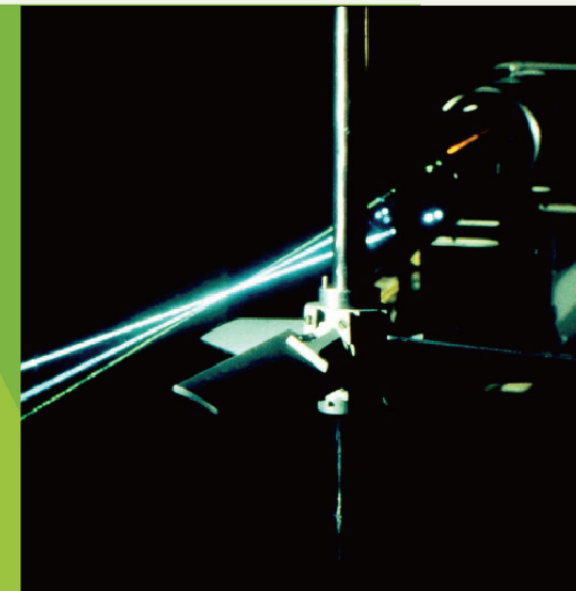
Process Design & Impeller Selection

Process Design 工艺设计

- Liquid – Liquid Blending 液液混合
- Liquid – Solid Suspension 液固混合
- Liquid – Gas Dispersion 液气混合

浆叶类型

Impeller Type



Flow 流动
Pressure 压力
Shear 剪切

桨叶类型选择 Impeller Selection Guidance

Application 应用	Impeller Type 桨叶类型
Miscible Liquid Blending 混溶液体混合	A310, A312, A200
Solid Suspension 固液悬浮	A310, A312, A200
Gas Dispersion 气体分散	R100, R130, R131
Miscible Liquid Dispersion 液液分散	R500, A200
High Viscosity Liquid 高黏度液体	Helix Ribbon, Anchor, Screw

桨叶计算公式 Impeller Calculation Formulas

Impeller Power Consumption: 功率消耗计算

$$P \propto N_p \times N^3 \times D^5 \times SG$$

Impeller Pumping Capacity: 桨叶排液量计算

$$Q \propto N_q \times N \times D^3$$

Impeller Reynolds Number: 雷诺数计算

$$N_{re} \propto N \times D^2 \times SG / \mu$$

N_p – Impeller Power Number 功率准数
 N_q – Impeller Pumping Number 流动准数
 N – Shaft Speed 转速
 D – Impeller Diameter 桨叶直径
 SG – Specific Gravity 比重
 μ – Material Viscosity 黏度

液液混合

Liquid – Liquid Blending

contact with liquid 与液体接触	Classification 分类	Difficulty & process response 困难和过程反应	Req'd data for agitator selection 用于选择搅拌器所需的数据
Liquid 液体	L-L blending 液液混合	Liquid viscosity, Blend time 液体粘度、混合时间	Liquid S.G. & viscosity, Blend Time 液体 S.G. 和粘度, 混合时间

搅拌强度

ChemScale®

Bulk Fluid Velocity Calculation 主流速度计算

$$V \text{ (ft/min)} = Q \text{ (ft}^3\text{/min)} / A \text{ (ft}^2\text{)}$$

V = Bulk Fluid Velocity; 主流速度

Q = Flow Rate; 排液量

A = Cross Sectional Area of Tank 罐子横截面面积

Experience has shown the majority of Blending and Motion problems are solved with Bulk Fluid Velocities of 6 to 60 ft/min

It is then possible to assign “Agitation Intensity Levels” to these Velocities calls these levels “ChemScale”.

经验表明，大多数混合和运动问题都可以通过 6 至 60 英尺/分钟的主流体速度来解决，然后将“搅拌强度水平”分配给这些速度，称这些水平为“搅拌强度”。

Process Response to be Considered for L-L Blending 要考虑的流程反应用于L-L混合

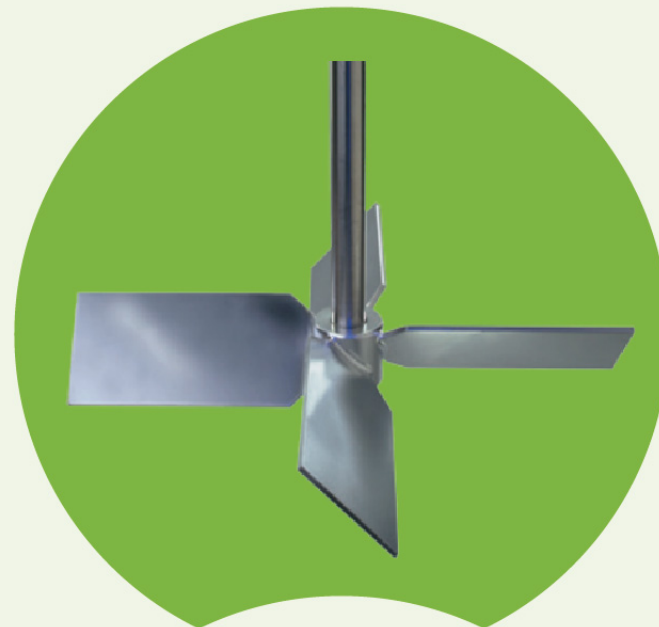
搅拌强度 ChemScale®	Bulk Velocity Ft/min 主流速度	Agitation Intensity 搅拌程度
1-2	6 - 12 ft/min	Mild 适中
3-6	18 - 36 ft/min	Middle 中等
7-10	42 - 60 ft/min	Strong 强烈
10+	> 60 ft/min	Violent 剧烈

A200 桨叶

A200 Impeller

Axial flow design, suitable for variable viscosity range
Applicable for L-L blending, heat transfer and solid suspension
Applicable for L-L blending and solid suspension which requires partial shear capability
Capable to handle partial gas rate
Np=1.3
Power Number Np=1.3

轴流设计，适用于可变粘度范围
适用于L-L混合，传热和固体悬浮液
适用于需要部分剪切能力的L-L混合和固体悬浮液
能够处理部分气体速率
NP=1.3
功率数 np=1.3

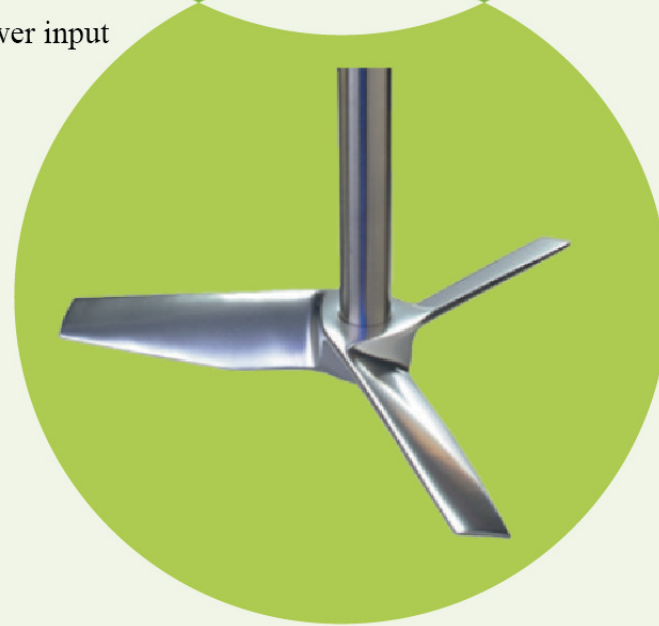


A310/510 桨叶

A310/510 Impeller

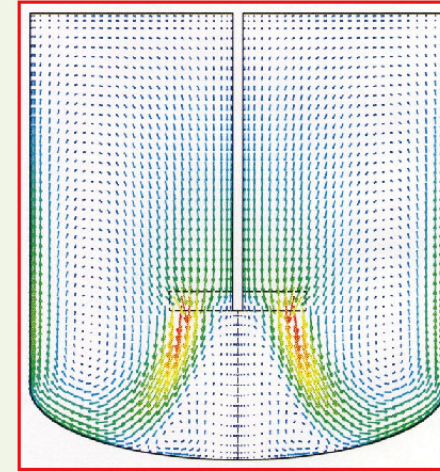
High efficiency axial flow impeller
Generate great pumping capacity but consumes low power input
Ideal choice for L-L blending and solid suspension
Np=0.36
Impeller Np=0.36

高效轴流叶轮
产生较大的泵送能力，但消耗低功耗输入
L-L 混合和固体悬浮液的理想选择
Np=0.36
叶轮Np=0.36

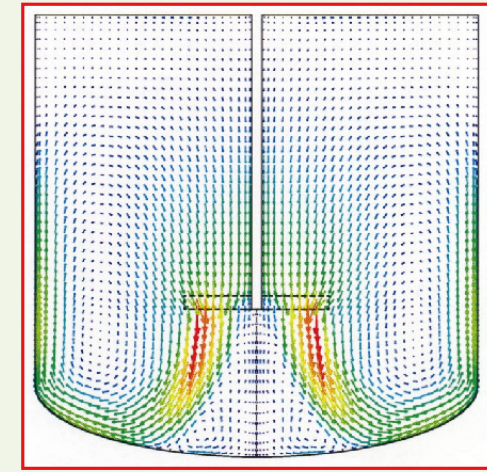


A200和A310 桨叶对比

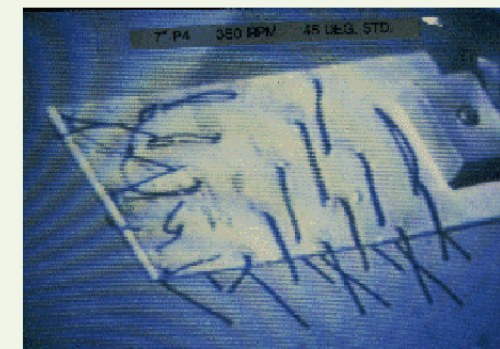
Comparison between A200 and A310



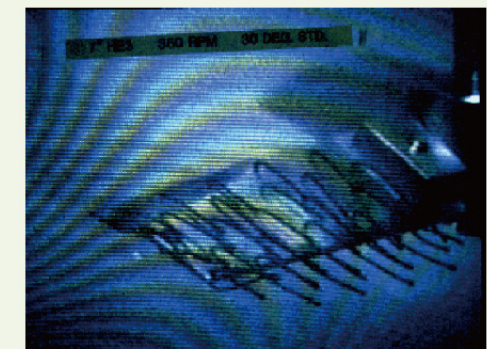
A200 Impeller CFM Drawing
A200 桨叶CFM图



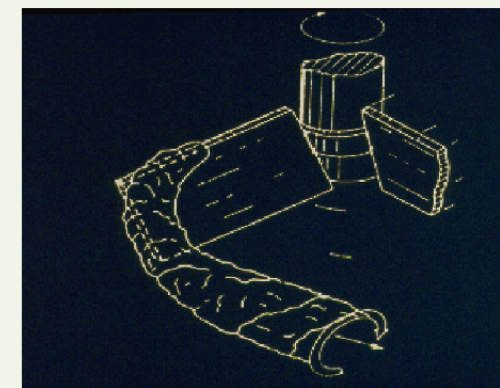
A310 Impeller CFM Drawing
A310 桨叶CFM图



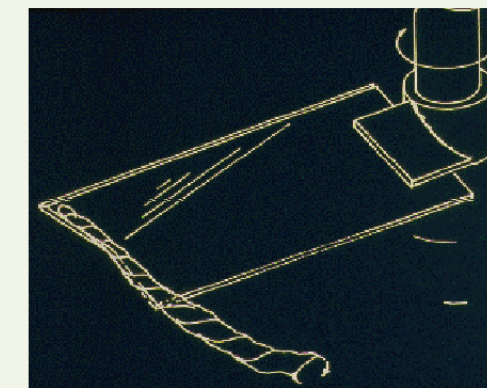
Flow Status of A200 Impeller
A200桨叶流场



A310 Impeller CFM Drawing
A310 桨叶CFM图

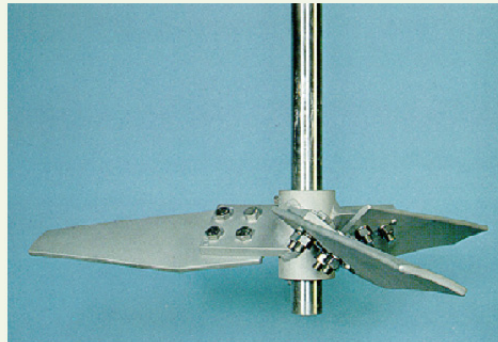


Tip Swirl Status of A200 Impeller
A200叶轮的尖端涡流状态

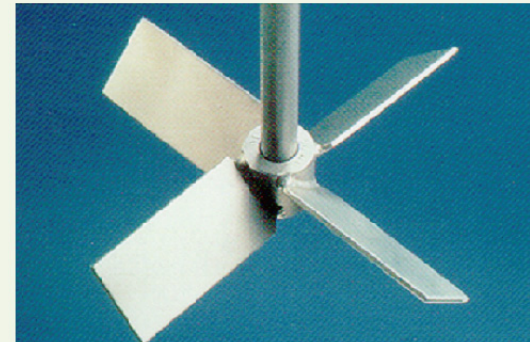


Tip Swirl Status of A310 Impeller
A310叶轮的尖端涡流状态

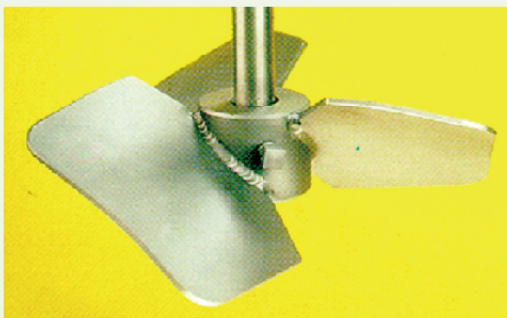
桨叶技术 Impeller Technology



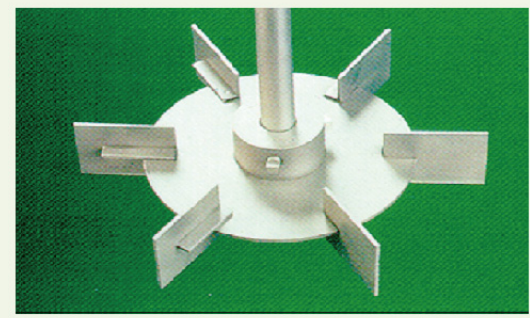
A310 & A510E32
The Np: 0.36
Liquid-liquid, solid-liquid,
turbulent, the most widely used
液-液、固-液、湍流, 应用最广泛



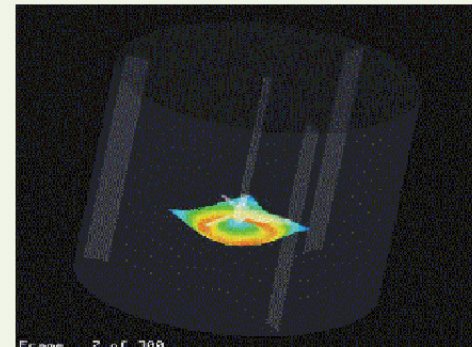
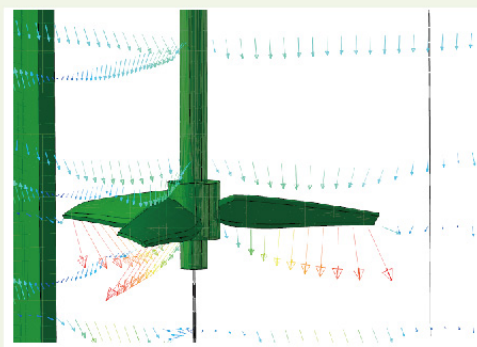
Pitch Blade Turbine
A200
The Np: 1.27
Solid liquid, gas liquid,
the second most widely used
固体液体、气态液体中应用第二广泛



A320
The Np: is 0.7
Liquid, laminar flow
液体、层流



Rushton Turbine
R100@6
Np:5.2
Radial flow, gas-liquid, solid-liquid,
mass transfer, heat transfer, reaction
径向流动、气液、固液、传质、传热、反应



固液悬浮 Liquid- Solid Suspension

contact with liquid 与液体接触	Classification 分类	Difficulty & process response 困难和过程反应	Req'd data for agitator selection 用于选择搅拌器所需的数据
Solid 固体	L-S Suspension 固液悬浮	Solid Particle Settling Velocity, Suspension Requirement 固体颗粒沉降速度, 悬浮要求	Liquid S.G & Viscosity, Solid Particle Size, S.G, Solid Content (%wt.) 液体 S.G 和粘度, 固体粒径, 标准, 固体含量 (%wt.)

Process Response to be Considered for L-S Suspension
要考虑的流程反应用于固液悬浮

Solid Motion 固体运动
Complete Suspension 完全悬浮
Uniform Suspension 均匀悬浮

气液混合 Liquid-Gas Dispersion

contact with liquid 与液体接触	Classification 分类	Difficulty & process response 困难和过程反应	Req'd data for agitator selection 用于选择搅拌器所需的数据
Gas 气体	L-G Dispersion 气液分散	Surface Gas Flow Rate, Mass Transfe 气体表面流量, 质量传递	Gas Type, Flow Rate, Inlet Pressure & Temp. Liquid Viscosity, Aerate Time 气体类型、流量、入口压力和 温度液体粘度, 充气时间

R100 Impeller
R100 桨叶



Np = 5.5
Pg/Pu = 0.4
Gas Capacity = 1.0

R130 Impeller
R130 桨叶



Np = 3.2
Pg/Pu = 0.65
Gas Capacity = 2.4

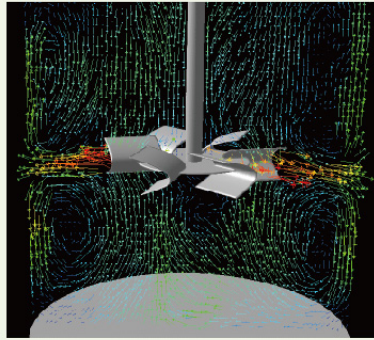
R131 Impeller
R131 桨叶



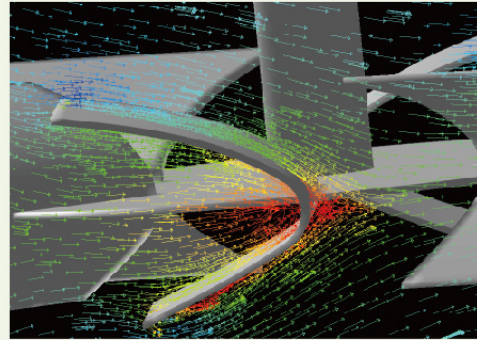
Np = 2.4
Pg/Pu = 0.85
Gas Capacity = 5.4

径向浆叶 Radial Flow Turbine

Flow Pattern in Vessel
在罐内流场



Flow Around Impeller Blades
叶轮叶片周围的流动



Gas Dispersion Retrofit Comparison
气体分散效果比较



R100 Impeller

R130 Impeller

R131 Impeller

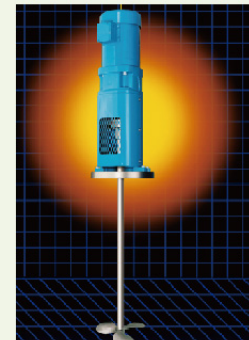
Mechanical Design & Agitator Features
机械设计及搅拌特点



VT Agitator



GT Agitator



DT Agitator

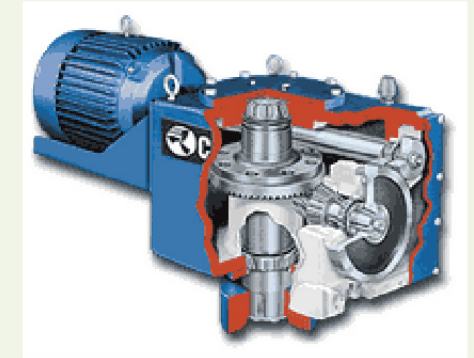
VT type top-in right angle drive gear mixer features VT型顶置式直角驱动齿轮搅拌器特点

Special deceleration device for mixer:

- Compact right angle gear transmission
- Hard tooth surface helical gear and helical bevel gear transmission
- Easy to replace variable speed gear design
- Super strong TIMKEN tapered bearings, L-10 life
- More than 100,000 hours

搅拌器专用减速装置:

- 紧凑型直角齿轮传动
- 硬齿面斜齿轮和斜齿锥齿轮传动
- 易于更换的变速齿轮设计
- 超强铁姆肯公司圆锥轴承, L-10寿命
- 超过 100,000 小时



- Extra thick solid output shaft that can carry larger ones
- Shock loads
- No external bearing frame is required for auxiliary loading
- Splash self-lubricating method
- Dry well design, completely eliminate lubricating oil leakage
- 粗壮实心输出轴, 可承载更大的输出轴
- 冲击载荷
- 辅助载荷无需外部轴承架
- 飞溅自润滑方法
- 干井设计, 彻底杜绝润滑油泄漏

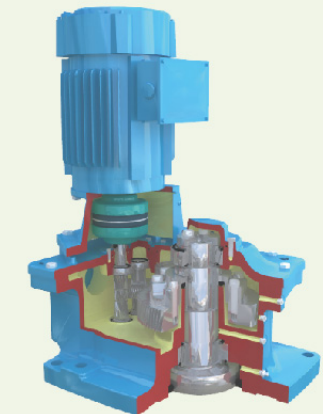
GT type top-in Parallel shaft gear mixer features GT型顶入式平行轴齿轮搅拌器特点

Special deceleration device for mixer:

- Parallel shaft gear transmission
- Hard tooth surface helical gear transmission
- Super strong TIMKEN tapered bearings, L-10 life
- More than 100,000 hours

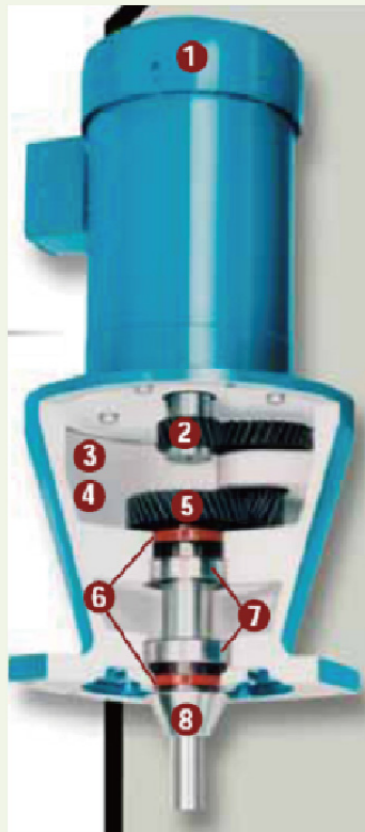
搅拌器专用减速装置

- 平行轴齿轮传动
- 硬齿面斜齿轮传动
- 超强铁姆肯公司圆锥轴承, L-10寿命
- 超过 100,000 小时



- Extra thick solid output shaft that can carry larger ones
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- Splash self-lubricating method
- Dry well design, completely eliminate lubricating oil leakage
- 粗壮实心输出轴, 可承载更大的输出轴
- 冲击载荷
- 辅助载荷无需外部轴承架
- 飞溅自润滑方法
- 干井设计, 彻底杜绝润滑油泄漏





DT type mixer features
DT型搅拌器特点

- Motor or air motor
 - Advanced and reliable, heat-treated gear set
 - Permanent lubrication with high-performance synthetic grease
 - Sealed gear reducer prevents grease and product contamination
 - AGMA high quality helical gear set makes the operation smooth and quiet
 - Elastomeric material skeleton seal
 - Can be installed with standard ANSI flange
 - The chuck coupling can easily remove the mixing shaft
-
- 电机或气动马达
 - 先进可靠的热处理齿轮组
 - 使用高性能合成润滑脂进行永久润滑
 - 密封齿轮减速器可防止油脂和产品污染
 - AGMA 高品质斜齿轮组使操作平稳安静
 - 弹性材料骨架密封
 - 可与标准ANSI法兰安装。
 - 卡盘联轴器可轻松拆卸搅拌轴

机械设计
Mechanical Design

Motor Loading:

Shaft Power < 80% Motor Rating Power

Mechanical Strength:

Force on the Shaft < Material Allowable Force

Mechanical Vibration:

Agitator Operation Speed < 80% 1st Critical Speed

电机负载:

轴功率 < 80% 电机额定功率

机械强度:

轴上的力 < 材料允许力

机械振动:

搅拌器运行速度 < 80% 第一临界速度

机械设计
Mechanical Design

Summary of Session:

- Mixer Loads
- Critical Speed
- Design Problem Solving
- Mounting Design Loads
- AGMA Rating and Gear Quality

摘要:

- 搅拌器负载
- 临界速度
- 设计问题解决
- 安装设计载荷
- AGMA 评级和齿轮质量

Mixers generate dynamic loads.
搅拌器产生的动态负载

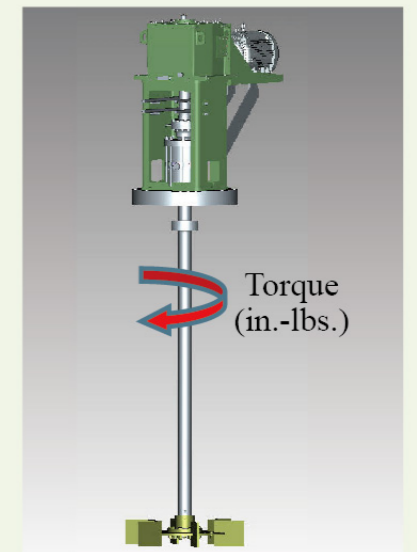
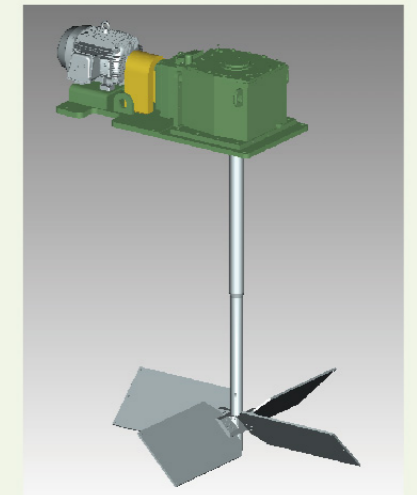
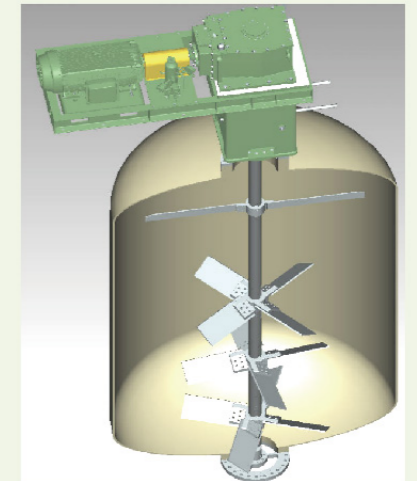
- Torque
- 扭矩
- Fluid Force/Bending Moment
- 径向力/弯矩
- Thrust
- 推力

How is Torque related to Horsepower?
扭矩与马力有什么关系?

$$Torque = \frac{HP \times 63025}{RPM}$$

- Where RPM (Revolution per Minute) is the Mixer Shaft Speed
- and 63,025 is the conversion factor to obtain Torque in "in-lb"

其中 RPM (每分钟转数) 是搅拌机轴转速
63,025 是获得 "in-lb" 扭矩的转换系数



机械设计 Mechanical Design

What effect does torque have on the machine?
扭矩对机器有什么影响?

- Generates shear load in the high speed coupling and mixer shaft
- Generates loads inside gear reducer
- Generates bending load on the impeller blades and ears
- 在高速联轴器和混合轴中产生剪切载荷
- 在齿轮减速机内产生负载
- 在叶轮叶片和耳上产生弯曲载荷



What Parameters affect the magnitude of the Fluid Forces?
哪些参数会影响流体力的大小?

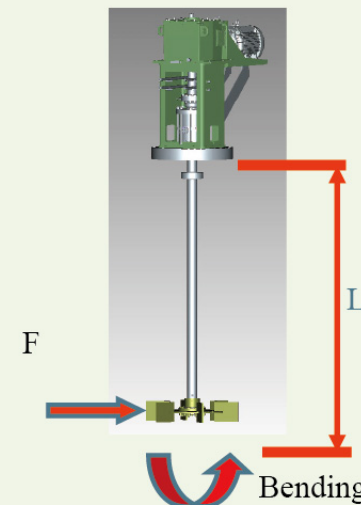
- Impeller Type
- Impeller Diameter
- Rotating Speed
- Fluid Regime & Process Conditions
- Proximity
- Flowing Streams
- Gas
- 叶轮类型
- 叶轮直径
- 转速
- 流体状态和工艺条件
- 接近
- 流动的蒸汽
- 气体



Fluid forces at the impeller Create a Bending Moment
叶轮上的流体力产生弯矩

$$M = L \times F$$

- L – Shaft length from inboard support bearing
- 内侧支撑轴承的轴长
- F – Fluid force
- 径向力



机械设计 Mechanical Design

Generates mixer shaft deflection

- Results in low speed gear misalignment if directly coupled.
- Affects seal performance

Generates bearing reaction loads

- High reducer housing stresses
- Higher reaction loads lower bearing life

Generates stress in the shafting

- Overhung – Greatest at inboard support bearing
- Steady Bearing – Greatest at upper Impeller

产生搅拌器轴偏转

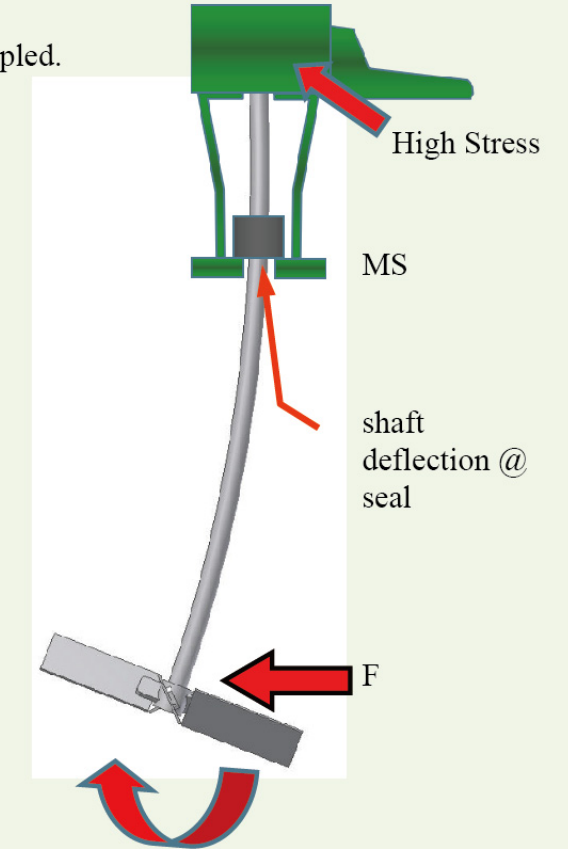
- 如果直接耦合，会导致低速齿轮不对中。
- 影响密封性能

产生轴承反作用载荷

- 高减速机外壳应力
- 较高的反作用载荷，缩短轴承寿命

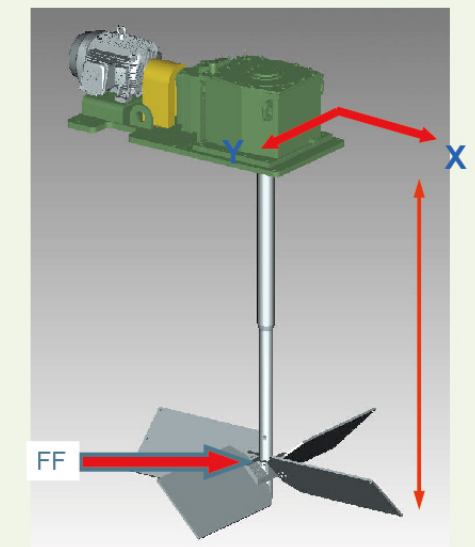
在轴系中产生应力

- 悬臂 – 最大舷内支撑轴承
- 稳定轴承 – 上叶轮最大



What Parameters affect the magnitude of the Fluid Forces?
哪些参数会影响流体力的大小?

- | | |
|-----------------------|--------|
| - Shaft Length | - 轴长 |
| - Fluid Force | - 流体力 |
| - Impeller Type | - 叶轮类型 |
| - Impeller Diameter | - 叶轮直径 |
| - RPM | - RPM |
| - Orientation | - 安装位置 |
| - Off Center Mounting | - 偏心安装 |
| - Angular Mounting | - 角度安装 |
| - Fluid Regime | - 液体状态 |
| - Low Level Coverage | - 低覆盖率 |
| - Swirl | - 旋流 |
| - Vortex | - 旋涡 |
| - Gas | - 气 |



机械设计 Mechanical Design

Industry usually refers to the ratio of the operating speed divided by the Critical Speed to get the Critical Speed Ratio
工业上通常是指运行转速除以临界转速之比得到临界转速比

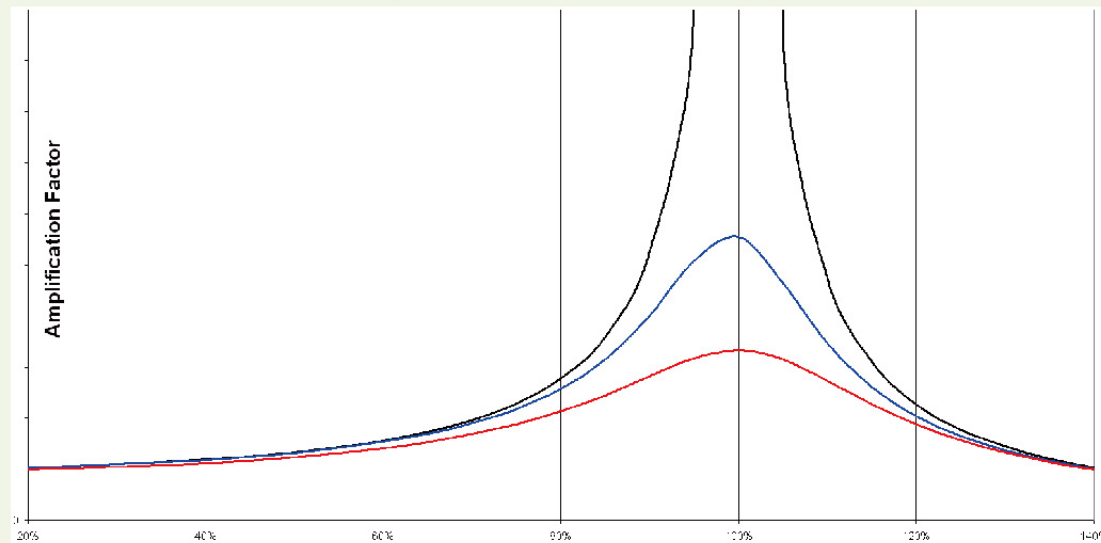
$$N_{CR} = \frac{\text{Operating Speed}}{\text{Critical Speed}} = \frac{N_o}{N_c}$$

NCR must be at or below 80% for Heavy Mixers
重型搅拌器的 NCR 必须等于或低于 80%

This is: The Mixer shall not operate above 80% of its Natural Frequency
这是：搅拌器不得在其固有频率的 80% 以上运行



临界速比及共振范围曲线图



Approximation Equation for a Straight, overhung shaft (results in RPM)
悬挂轴的近似方程 (结果以转速为单位)

$$N_c = K_1 \left(\frac{d}{L} \right)^2 \sqrt{\frac{E}{\left(\frac{L+a}{L} \right) \left(W + \frac{K_2 \times W_e}{L} \right)}}$$

机械设计 Mechanical Design

Critical Speed is directly proportional to:
- Shaft diameter (d)
- Material modulus of elasticity (E)

临界速度与以下各项成正比：
- 轴径 (d)
- 材料弹性模量 (E)

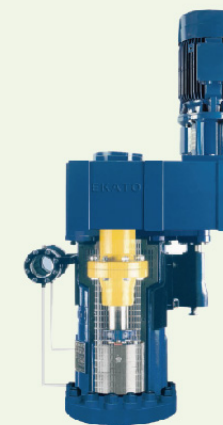
Critical Speed is inversely proportional to:
- Shaft length (L)
- Bearing spacing (overhung) (a)
- Equivalent weight of shaft and impellers (We)

临界速度与以下各项成反比：
- 轴长 (L)
- 轴承间距 (悬臂) (a)
- 轴和叶轮的当量重量 (We)

- Decreasing bearing spacing or increasing drive shaft diameter increases the stiffness of the mixer shaft and therefore INCREASES the Critical Speed (Nc)
- Decrease lower shaft length (Increase impeller off bottom)
- Step the shaft to decrease impeller weights & shaft weight
- Use a pipe shaft or pipe section
- Reduce Speed (Increase impeller diameter)
- Use a Steady Bearing

- 减小轴承间距或增加驱动轴直径会增加搅拌机轴的刚度，从而提高临界速度 (Nc)
- 减少下轴长度 (增加底部的叶轮)
- 步进轴以减轻叶轮重量和轴重量
- 使用管轴或管段
- 降低速度 (增加叶轮直径)
- 使用稳定的轴承

搅拌器机架设计 Pedestal Design of Mixers



- Drive versions with fixed or variable shaft speeds
- Different gearbox types (flat, bevel, helical gearbox...)
- Oil supply systems for the gearbox available
- Lanterns of cast or welded design
- Fast seal removal sideways and vertical
- Minimized space for maintenance required
- Split shaft design with bearing shaft and flange coupling
- Steady bearings or shaft deflection limiting rings



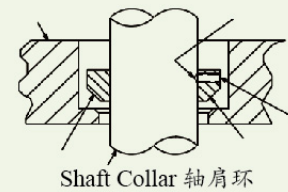
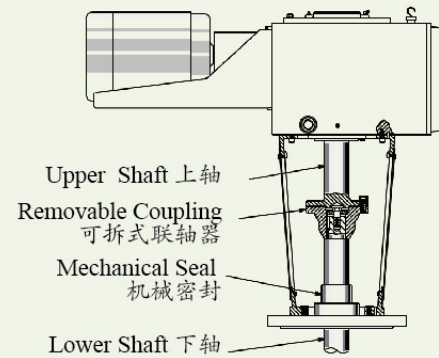
- 具有固定或可变转速的驱动装置
- 不同的变速箱类型 (扁平齿轮、锥齿轮、斜齿轮变速箱等)
- 提供变速箱供油系统
- 铸造或焊接设计的机架
- 侧向和垂直快速拆卸密封件
- 最小化所需的维护空间
- 带轴承轴和法兰联轴器的剖分轴设计
- 稳定轴承或轴挠度限制环

搅拌器机架设计 Pedestal Design of Mixers

MECHANICAL SEALS 机械密封

The replaceable cartridge design, a original, is standard on Series VS units. Light in weight. Easy to replace. Our design offers unrivaled convenience. Integral stuffing box and open tank designs also available. Each Cartridge seal is still tested 100% prior to shipment and offers the very best in reliability while our other seal selection meet performance. Additionally we continue to supply low and high pressure stuffing boxes. All fits are dowel or rabbet to assure alignment. You'll find this design makes for easy repacking.

可更换的集装式机封，是 VS 系列装置的标准配置。重量轻。易于更换。我们的设计提供了无与伦比的便利。还提供整体式填料箱和开放式储罐设计。每个集装式密封件在发货前仍经过 100% 测试，并提供最佳的可靠性，而我们的其他密封件选择符合性能。此外，我们继续供应低压和高压填料箱。所有配合都是销钉槽口，以确保对齐。您会发现这种设计便于重新包装。



水处理应用照片 WWT Photo



Plant Photo



矿业应用照片 Mining Photo

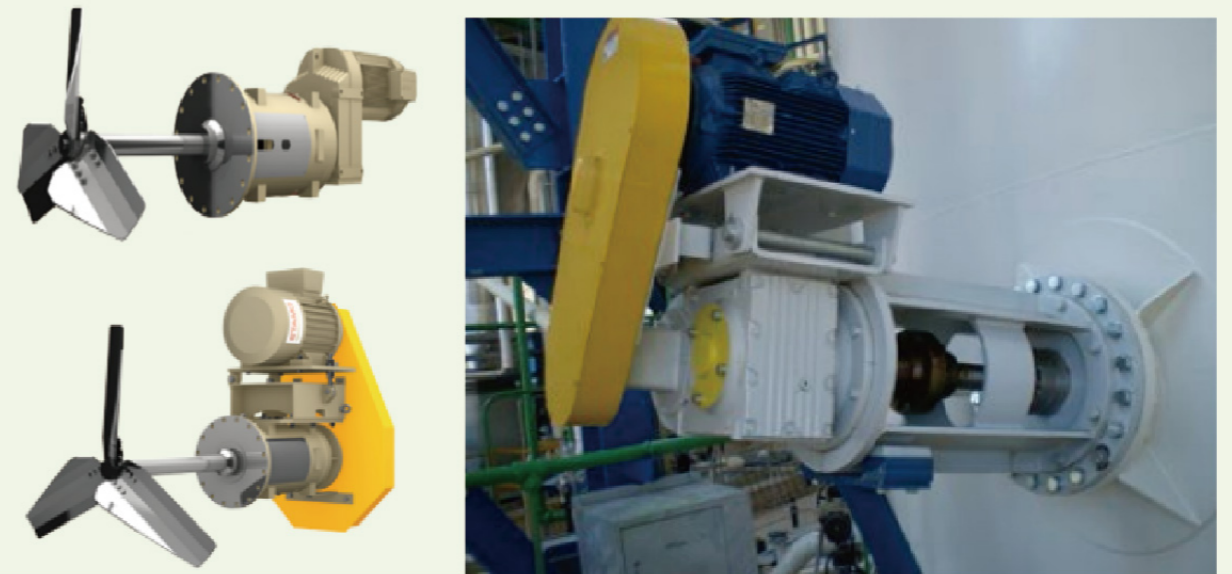
化工石化应用照片 Chemical/Petrochemical Photo



制药食品应用照片 Pharmaceutical/Food



FGD脱硫应用照片



FLUE GAS DE SULPHURIZATION 脱硫行业

Since company is founded in 2015's, more than 100 Top and Side Entering Agitators for FGD process operations have been successfully applied around the world. We have extensive experience in the design and supply of Gas Sparge Systems for Mass Transfer in many different markets and applications. Specifically a lance system has been developed for the required mass transfer for FGD Absorbers. The technology has proven successful in Europe, the US and China, and allows Scrubber suppliers and Utilities to optimize their Oxidation systems for maximum efficiency.

自 2015 年公司成立以来，超过 100 台搅拌器用于 FGD 工艺操作的顶部和侧面进入搅拌器已在世界各地成功应用。此设计和供应用于许多不同市场和应用的传质气体喷射系统方面拥有丰富的经验。专门开发了一种喷枪系统，用于脱硫吸收器提供所需的传质。该技术已在欧洲、美国和中国被证明是成功的，并允许洗涤器供应商和公用事业公司优化其氧化系统以实现最大效率。