

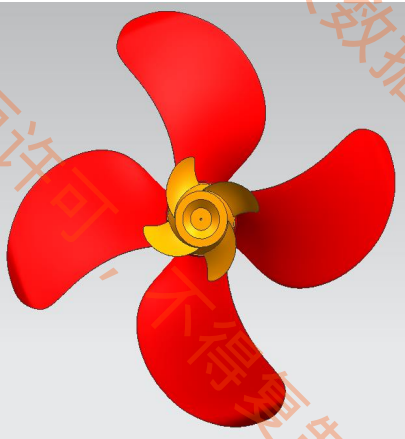


中船(上海)节能技术有限公司  
CSSC SHANGHAI MARINE ENERGY SAVING TECHNOLOGY CO., LTD.

# CMES-HVAF®

## 消涡鳍客户手册

### MANUAL OF HUB VORTEX ABSORBED FINS

	船名&船号 SHIP NAME&NO.	金海正/鑫/众
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中国·上海

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# HVAF

消 涡 鳍

HUB VORTEX ABSORBED FINS

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# 1 简介 INTRODUCTION

## 消涡鳍 Hub Vortex Absorbed Fins



消涡鳍是一种安装在螺旋桨将军帽上的小叶片，与螺旋桨的叶片数相同，能够有效地减少螺旋桨毂涡能量损失；

HVAF is attached with small fins on the boss cap. The number of fins is same as that of the propeller blades. HVAF mainly recovers the energy loss of propeller hub vortex in propeller down stream.

消涡鳍具有结构简单，重量轻，安装方便，安全实用等优点；

The geometry shape of HVAF is very simple, and HVAF can be installed behind the propeller easily as original boss cap, which rotates together with the propeller.

无论在新船还在旧船上安装，均可收获2%~5%的节能效果。

HVAF can save fuel consumption by 2%~5% as operating at the same speed.

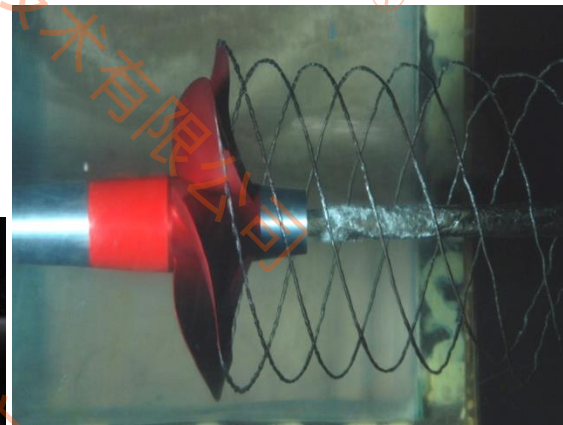
## 节能原理 Hydrodynamic Mechanism of HVAF

校直螺旋桨尾流和打散毂涡；

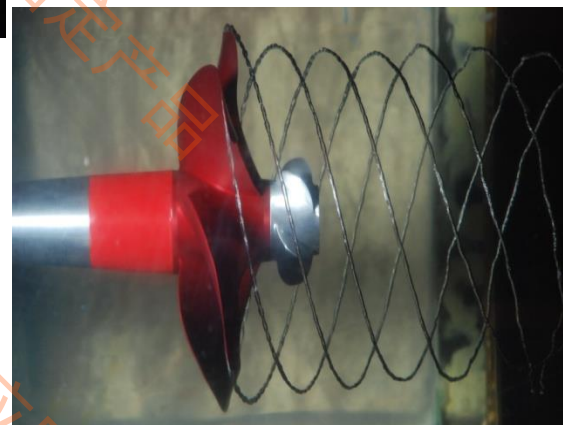
HVAF can rectify the strong down stream from propeller blade trailing edge and break up the hub vortex.

降低螺旋桨扭矩，增加螺旋桨推力。

HVAF will produce force, reduce propeller shaft torque by 2%~3% and increase thrust by over 1%~2%.

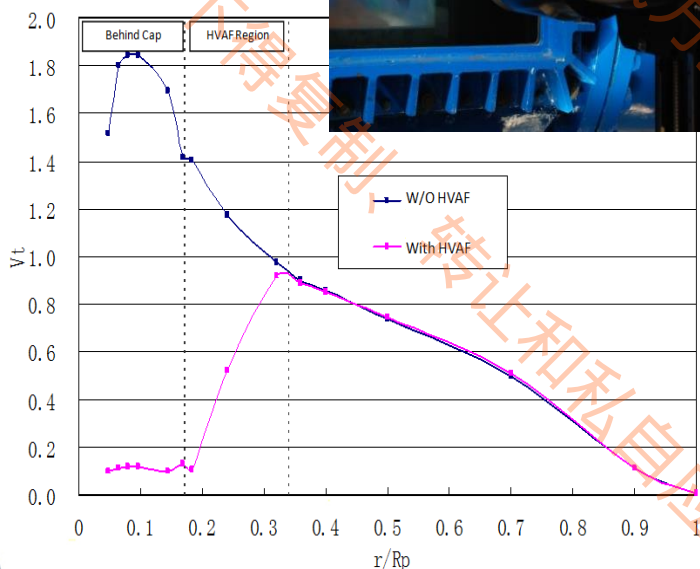


with Conventional Cap



with HVAF

有/无消涡鳍时螺旋桨尾流切向速度LDV测试结果  
LDV result of tangential velocity behind propeller  
with/without HVAF



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消涡鳍简介  
INTRODUCTION

序号 ITEM	件数 NUMBER	名称 NAME	材质 MATERIAL	说明 REMARK
1	1	M 30 吊装孔螺塞 M 30 LIFTING PLUG	Cu3	用于封堵吊装孔 CLOSING OF LIFTING HOLE
2	1	M 30 吊环螺栓 M 30 LIFTING EYE BOLT	SUS304	用于起吊消涡鳍 LIFTING OF HVAF
3	2	M 18 注油孔螺塞 M 18 OIL INJECTION HOLE PLUG	Cu3	用于封堵注油孔 CLOSING OF OIL INJECTION HOLE
4	2	注油孔紫铜垫圈 RED COOPER WASHERS	Red Copper	与注油孔螺塞配套 FOR OIL INJECTION HOLE PLUG
5	12	M 20 × 75 六角头带孔螺栓 M 20 × 75 HEXAGON BOLTS WITH HOLES	SUS316/A4-70	用于装配消涡鳍和螺旋桨 ASSEMBLY OF HVAF
6	12	螺栓孔紫铜垫圈 RED COOPER WASHERS	Red Copper	与装配螺栓配套 FOR HEXAGON BOLTS
7	1	消涡鳍大端面耐油无石棉垫片 ANTI-OIL NON ASBESTOS SHEET PACKING	ANTI-OIL NON ASBESTOS (ARAMID FIBER)	用于密封消涡鳍和螺旋桨 SEALING BETWEEN PROPELLER AND HVAF
8	1	Φ1.5mm × 8 m 锁紧钢丝 Φ1.5mm × 8 m LOCKING WIRE	SUS304	用于锁紧装配螺栓 LOCKING FOR HEXAGON BOLTS
9	1	消涡鳍 HVAF	Cu3	



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产品清单  
PARTS LIST

## 主要参数 Principal Dimensions

叶数 Number of Blades:	4
直径 HVAF Diameter:	1690 mm
侧斜角度 Skew Angle:	-28.7 degrees
旋向 Direction of Rotation:	Right-handed
重量 Total Weight of the HVAF:	About 840 kg
惯性矩 Moment of Inertia in Air:	About 154 kg·m <sup>2</sup>

## 公差要求 Tolerances

几何公差 Dimensional Tolerances:	ISO 484/2 CLASS I
粗糙度 Tolerances on Surface Roughness:	ISO 484/2 CLASS I

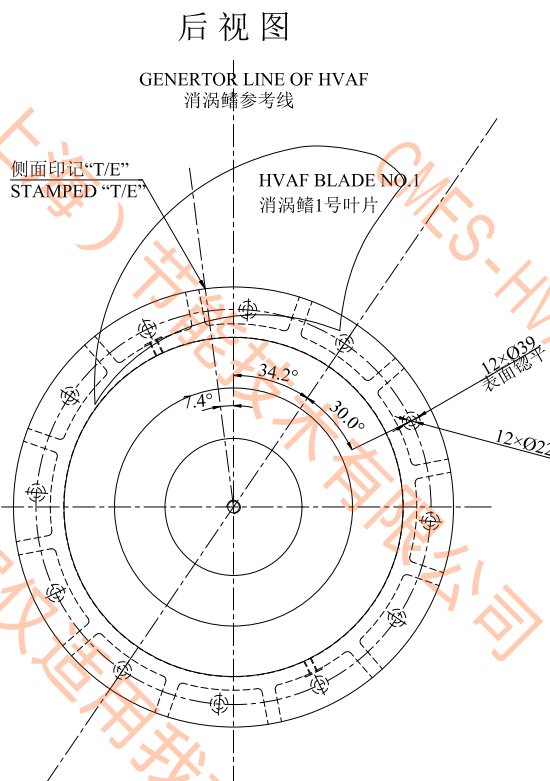
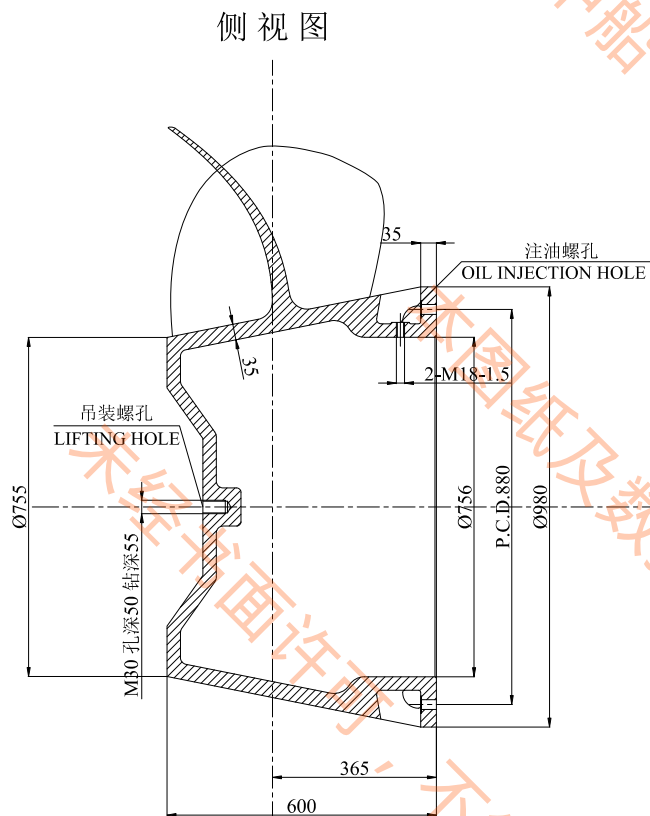
## 材料和机械性能 Material and Mechanical Characteristics

材质 Material:	Ni-Al-Bronze Cu3
密度 Density:	7.60 g/cm <sup>3</sup>
抗拉强度 Minimum Tensile Strength:	$R_m \geq 590.00 \text{ N/mm}^2$
规定非比例延伸强度 0.2% Proof Strength:	$R_{p0.2} \geq 245 \text{ N/mm}^2$
断后伸长率 Elongation :	$A_5 \geq 16\%$



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主要技术参数  
MAIN TECHNICAL DATA



消涡鳍主参数 Principal Dimensions of the HVAF:

叶数	Number of Blades	4
消涡鳍直径	HVAF Diameter	1690 mm
消涡鳍形式	Type of HVAF	Varying pitch HVAF
旋转方向	Direction of Rotation	Right-handed
消涡鳍重量	Total Weight of the HVAF	About 840 kg
重心距大端	Distance of Gravity Center from the Large End of the HVAF	About 306 mm
空气中惯性矩	Inertial Moment of the HVAF in Air	About 154 kg•m <sup>2</sup>
材质	Material	Ni-Al-Bronze Cu <sub>3</sub>

提供如下配件 SERVED WITH:

- 1) M30吊装孔螺塞一个(CU3);  
M30 LIFTING PLUG (CU3) × 1;
- 2) M30带吊环起吊螺栓 (SUS 304)一个;  
M30 LIFTING EYE BOLT (SUS 304) × 1;
- 3) M18-1.5注油螺塞(CU3)和紫铜垫圈各两个;  
M18-1.5 OIL FILLING HOLE PLUGS (CU3) AS WELL AS RED COPPER WASHERS × 2;
- 4) M20×75 六角头带孔 (φ4mm)螺栓(SUS 316)和紫铜垫圈各12个;  
M20×75 HEXAGONAL BOLTS WITH HOLES (φ4mm) ON THE HEAD FOR STAINLESS WIRE SECURING (SUS 316) AS WELL AS RED COPPER WASHERS × 12;
- 5) 消涡鳍大端面耐油无石棉垫片一个;  
ANTI-OIL NON ASBESTOS GASKET BETWEEN THE END OF PROPELLER AND HVAF × 1;
- 6) φ1.5mm×8 m (SUS 304)锁紧钢丝一根;  
LOCKING WIRE φ1.5mm×8 m (SUS 304) × 1.

会 签

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				消涡鳍图 HVAF DRAWING				图号 DRAWING NO.	CMES-HVAF2024004-1B
								产品编号 SERIAL NO.	
设计 DESIGNED	常晟铭	日期 DATE	2023.12.23	材质 MATERIAL	Ni-Al-Bronze Cu <sub>3</sub>	重量 WEIGHT	abt. 840 kg	详细设计 DETAIL DESIGN	
校对 CHECKED	严周广	日期 DATE	2023.12.23						
审核 VERIFIED	董郑庆	日期 DATE	2023.12.23						
标准化 STAND.	季越红	日期 DATE	2023.12.23						
批准 APPROVED	黄国富	日期 DATE	2023.12.23						

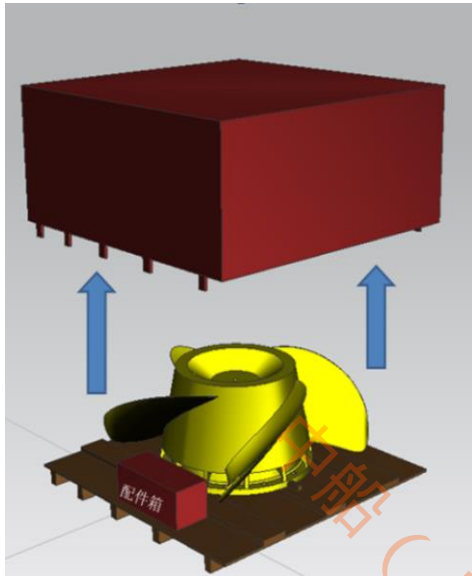
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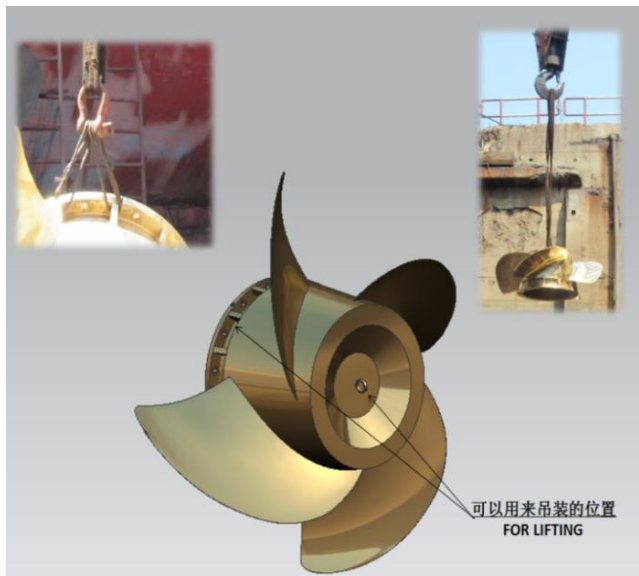


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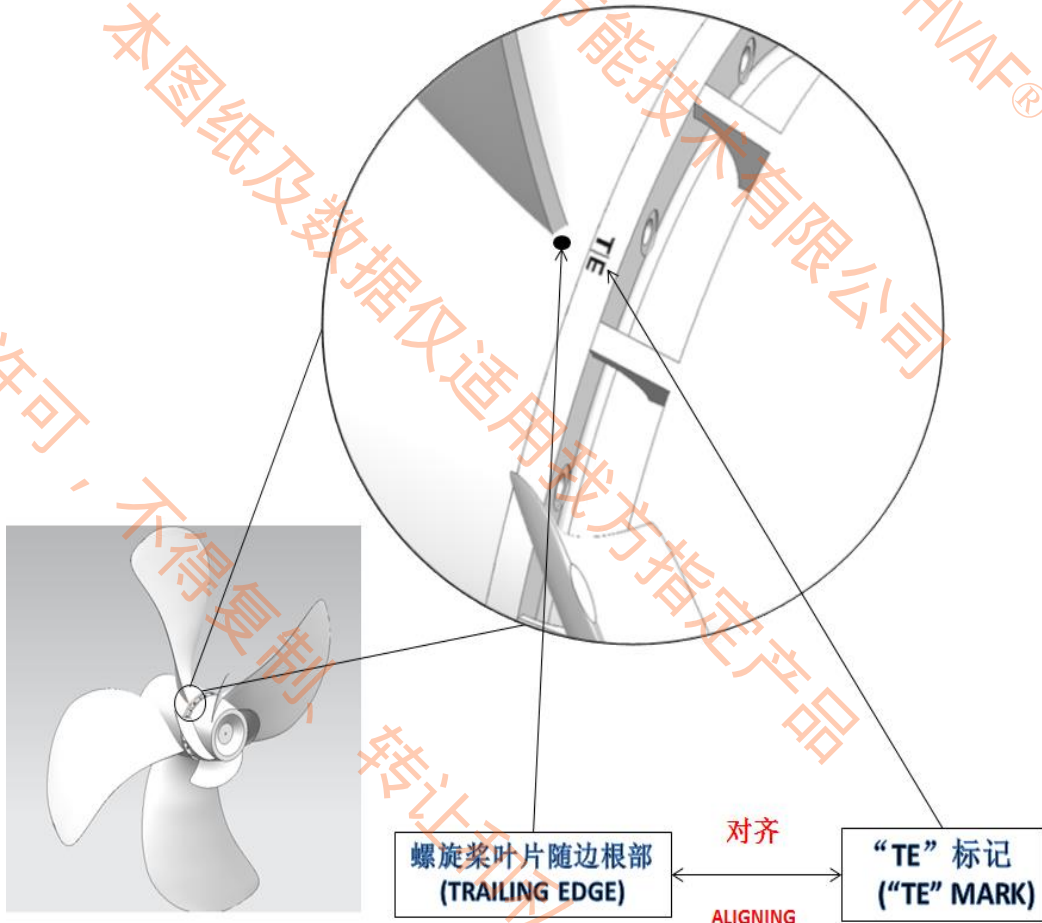




开箱并检查配件  
OPEN AND CHECK



起吊  
HANG



定位示意图  
ALLOCATION



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安装示意图  
INSTALLATION DIAGRAM



## 消涡鳍安装步骤

1. 请确认消涡鳍法兰侧面上刻有"TE"记号。
2. 安装消涡鳍之前，应将消涡鳍的法兰面和螺旋桨的对接面清理干净，将提供的大端垫片对准相应的螺栓孔。
3. 使用记号笔从螺旋桨A叶片的根部后端（随边）划一条线引至端面处，一边把消涡鳍吊起，一边将"TE"与划线对齐。
4. 进一步调整消涡鳍的安装角度，使得消涡鳍上的螺栓孔与螺旋桨的螺栓孔完全对准，此时，"TE"与划线的相对位置可能会出现一定的偏差。
5. 再用记号笔从消涡鳍A叶片根部前端（导边）划一条线引至端面处，测量两条划线之间的弧长长度L， $L \approx 329$  mm，由于桨叶根部具有倒角，以及加工制作中产生的误差，实测L值允许偏差  $\pm 60$  mm。
6. 请使用扭力扳手根据拧紧扭矩要求，设定扭矩为 285 N-M，安装螺栓时按照对角线顺序安装，使用相同的扭矩大小将螺栓拧紧，所有螺栓安装完成后，请再拧一遍，确保全部按照要求拧紧。
7. 安装好螺栓后，请用锁紧钢丝穿过螺栓头部小孔，将相邻的两个螺栓以"Z"形连接，然后绞紧钢丝确保锁紧。
8. 将牛油从注油孔注入到消涡鳍内部，然后在消涡鳍减轻孔（螺栓安装槽）填充水泥，至此，安装工作结束。

补充说明：

若螺栓孔数目为桨叶数的整数倍，则可用任意叶片替换步骤3和5中的A叶片。

## INSTALLATION PROCEDURE

1. Finding the stamped "TE" mark on your HVAF.
2. Before installation, cleaning up each of the fitted surfaces of HVAF's flange and propeller's boss aft end.
3. Using the marking pen to draw a line from the trailing edge of blade A of propeller to the boss aft end. Then hold HVAF and match HVAF's "TE" mark with the line drew on the boss.
4. Further adjust the installation angle of HVAF, making the bolt holes of propeller and HVAF perfectly aligned. The relative position of "TE" and the marked line may appear a certain deviation.
5. Using the marking pen to draw a line from the leading edge of HVAF blade A to the boss fore end. Measuring the arc length L between two marked line,  $L \approx 329$  mm. For propeller blade has a fillet(R) on its root and there is a blade dimensions deviation within manufacturing tolerance, measured L allow  $\pm 60$  mm.
6. Fastening fixing bolts by using the torque wrench set by 285 N-M. Each of the fixed bolt should be fastened equally in the diagonal manner not in circle direction. Please fasten the bolts again in order to confirm they are securely fastened.
7. After fastening the fixed bolts, adjoined two bolts should be connected by locking wire through the hole at the rib of bolt recess like a figure of "Z" and twist the wire firmly without slack.
8. Injecting grease into the HVAF's boss inside, then the installation work will be completed after filling recess parts for bolts with cement.

Additional remark:

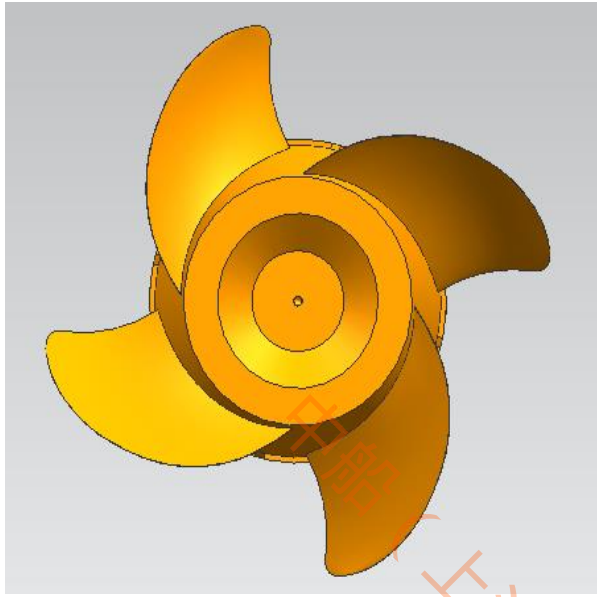
If the number of bolts is an integer multiple of blades, blade A in the steps 3 and 5 can be replaced by any blade.



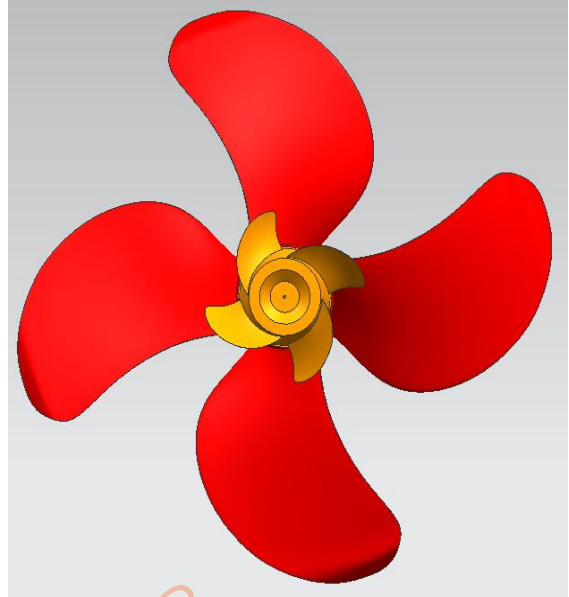
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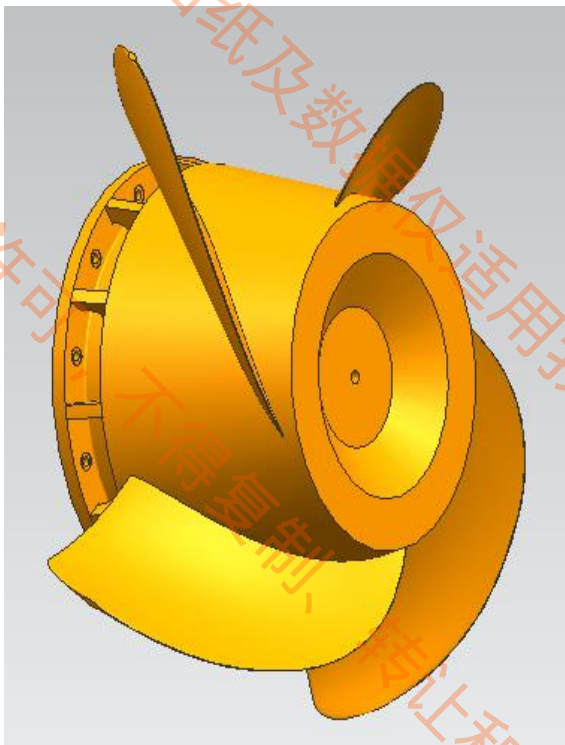
消涡鳍安装方法  
INSTALLATION PROCEDURE



消涡鳍后视图  
BACK VIEW



桨+消涡鳍  
PROPELLER+HVAF



消涡鳍斜视图  
OBLIQUE VIEW



消涡鳍侧视图  
SIDE VIEW



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三维造型  
3D VISUALIZATION