

Pump repair options & alternatives

Presented by Bob Gaskey
of



My background

- Worked in a foundry and machine shop
- 27 years in aftermarket pump industry
- Worked for a Sturm Machine distributor-traveling drafting team
- Expertise with older vintage pumps
- Expertise with pump retrofits

My background

- Project manager on several wastewater cso deep tunnel pump repairs
- Worked in a foundry and machine shop
- Worked for a large full service pump distributor
- Currently the Pump Repair Manager with Pumping Solutions in Blue Island, IL.

Course Overview

- Emphasis on large water pumps typically found in fresh water, wastewater, power, steel & general manufacturing.
- Promote awareness of options to consider when faced with the decision to repair or replace pumps.

Goals of the course

- Machining principles
- How centrifugal pumps are made
- Stabilizing your pump and motor train
- Take ownership & responsibility of your pumps
- Establishing warranty clarity
- Tracking and logging your pumps
- Application scenarios

Why keep older pumps running?

- Capital budgets
- Piping changes
- Foundation changes
- Pumps may not be able to be taken off line
- Build quality of older pumps-mass



PUMP0098

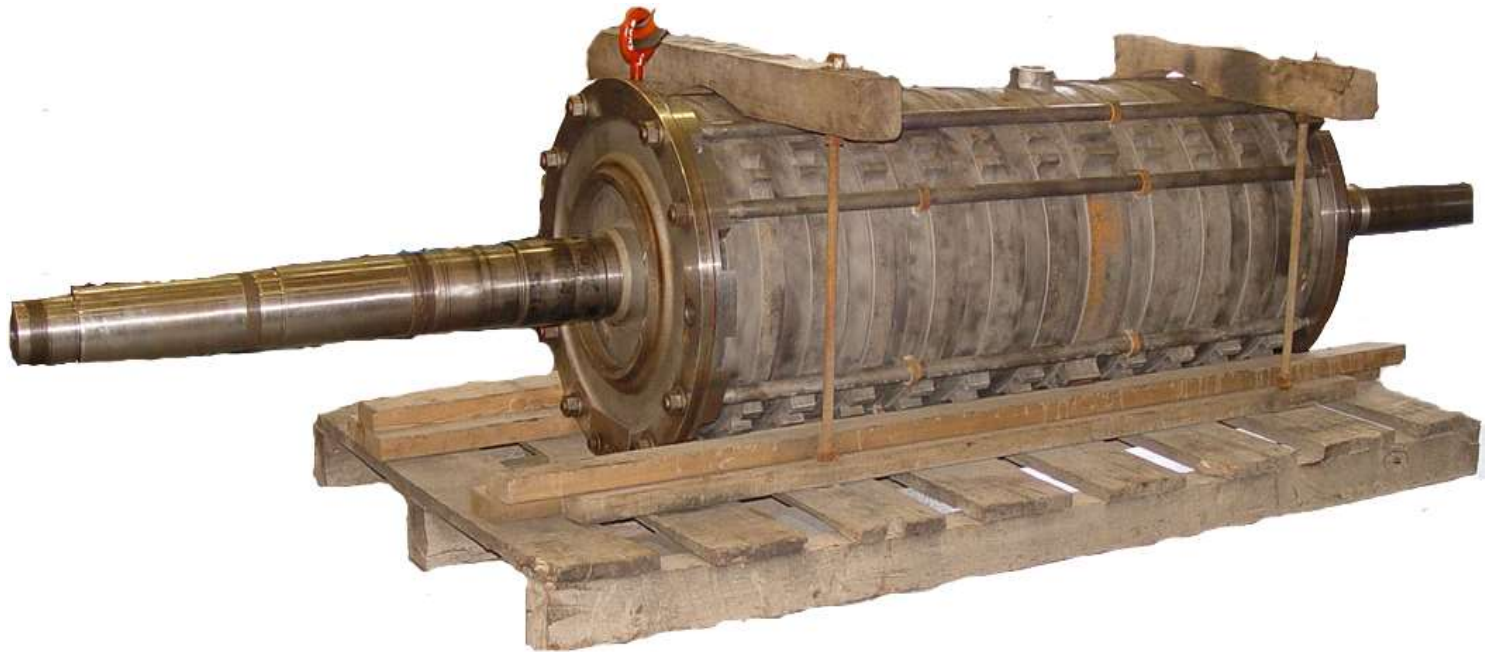
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Reasons for replacing pumps?

- Completely different technologies
- Efficiency/energy savings
- Manufacturer out of business
- Parts are obsolete
- Worn out beyond repair
- Duty point has changed

Pump repair considerations



Pump repair shop check list

- Crane capacity
- Press configuration/capacity
- Balancing capabilities
- Horizontal/vertical lathe capacity
- Cleaning methods
- Experience of personnel
- Engineering capabilities
- Experience repairing similar pumps

Balancer capacity



Balancer capacity



Balancer capacity



Balancer capacity



Press capacity



Horizontal lathe capacity



Vertical lathe capacity



Welding equipment & procedures



Repairs-on site inspections

- Inspect shop before repair is awarded
- Inspect pump after initial disassembly & cleaning
- Inspect pump when rotor is assemble and ready for final assembly

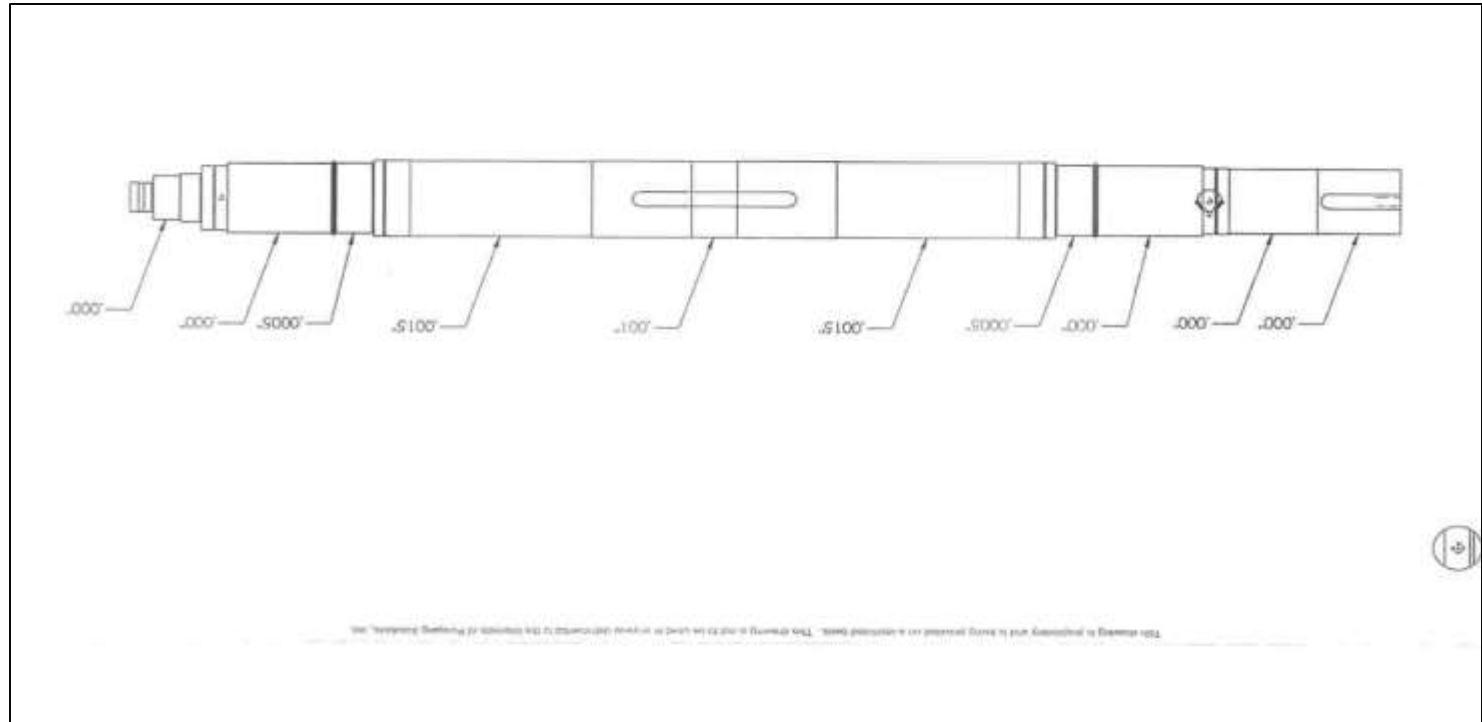
Repair documentation - establishing warranty clarity

- Repair documentation
- As found sizes
- As built sizes
- Shaft TIR
- Balance report
- Bearing housing sizes/concentricity
- Casting NDE report
- Metal certification
- Hardness report
- Alignment report

Repair documentation

- Accurate reports help narrow the troubleshooting process.

Shaft TIR



Balance report



DYNAMIC BALANCING TEST CERTIFICATE

Instrumentation: EasyBalance 2.2, Date: 2013-02-22, Time: 14:05

Pumping Solutions, Inc.

2850 W 139th St
Blue Island, IL 60406

Phone:

Fax:

Comments

Operator Name

lgoff

Rotor name

15-3573

Balancing Program

Both planes between supports (Tolerance in correction planes)

No Key Compensation

No Tooling Compensation

Balancing Quality Standard

ISO G2.5

Service speed

1800 RPM

Rotor weight at supports

Left: 97,000 lb

Right: 97,000 lb

Left Radius

Distance a

Distance b

Distance c

Right Radius

12,000 in

10,000 in

11,750 in

21,500 in

12,000 in

Balancing speed

Left Tolerance

Right Tolerance

845 RPM

42,952 g-in

42,038 g-in

CURRENT RESULT:

Correction Weight:

Left

Right

Displacement:

- 2.383 g at 10°

- 1.775 g at 151°

Unbalance:

0.038 mil at 173°

0.050 mil at 208°

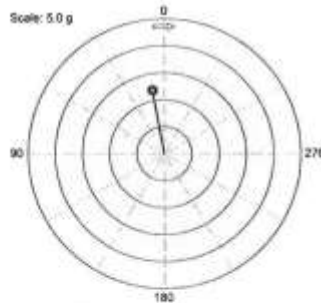
28,590 g-in

21,295 g-in

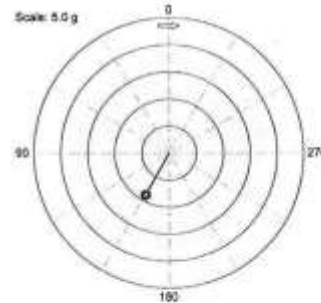
OK (0.67 x Tol)

OK (0.51 x Tol)

Scale: 5.0 g



Scale: 5.0 g




Operator Signature

Verified By

Approved By

8.50.6.1

Metal certification



CERTIFICATE OF TEST Page 01 of 02

Certification Date
17-AUG-2012

CUSTOMER ORDER NUMBER	EARLE M. JORGENSEN COMPANY	Invoice Number
40018	601 REDMA TERRACE	T834672
CUSTOMER PART NUMBER	CINCINNATI OH 45215	
68205		

SOLD TO: RPM INC	SHIP TO: RPM INC	
12015 MIDLAND TRAIL ROAD	12015 MIDLAND TRAIL ROAD	
ASHLAND KY 411027711	ASHLAND KY 41102	

Description: 4140/4142 HR Q&T BAR 255/321 BHN ASTM A3
 10-1/2 RD S/C 12*9.625" (153.625") Line Total: 3772.7739 LB
 WHAT: 3415H ITEM: 500539

Specifications:
 ASTM A388 ASTM A29 93 ASTM A304
 ASTM A434 BC ASTM E705 EN 10204 3.1

CHEMICAL ANALYSIS

C	MN	SI	P	S	CR	NI	CU
0.42	0.83	0.29	0.015	0.027	1.05	0.04	0.03
NO	AL	BN	V	TI	N	H	
0.191	0.029	0.003	0.005	0.0016	0.005	1.10	

MCPT: R76933B
 MILL: MAGELLAN PRO CHI COUNTRY OF ORIGIN: CZECH REPUBLIC

MECHANICAL PROPERTIES

DESCRIPTION	YLD STR	ULT TEN	%ELONG	%RED	HARDNESS
	KSI	KSI	IN 02 IN	IN AREA	BHN
	92.0	122.0	15.0	50.4	304

PUMPING SOLUTIONS PO ER12-00238 ITEM #1 #ER1-0023-P01 SHAFT 4140 S/S P81000094 RPMW
 PSL-22484 RPM 5D 68205 PG 1 OF 2


The above data were transcribed from the manufacturer's Certificate of Test after verification for completeness and specification requirements of the information on the certificate. All test results remain on file subject to examination.

We hereby certify that the material examined by this report will meet the applicable requirements described herein, including any specifications forming a part of the description.

The willful recording of false, fictitious, or fraudulent statements in connection with test results may be punishable as a felony under federal statutes.

Material did not come in contact with mercury while in our possession.

TERRY RYNARD



MANAGER, QUALITY ASSURANCE

EMJ013

Alignment report

Laser Alignment
January 31, 2013
Page 2 of 3

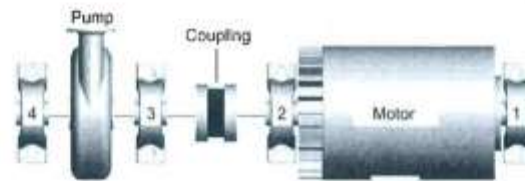
Job #: 56253

INSTRUMENTATION: Laser 200 Alignment Set

EQUIPMENT IDENTIFICATION:

EQUIPMENT: Pump 1

OPERATING RPM: 600 Motor 600 Pump



MEASUREMENTS

Laser Alignment Initial Readings -

	Horizontal	Vertical
Parallel	0.1144	0.2754
Angular	0.0006/ 1"	0.0006/ 1"

Laser Alignment Final Readings -

	Horizontal	Vertical
Parallel	0.0029	0.0022
Angular	0.0001/ 1"	0.0001/ 1"

OBSERVATIONS

Alignment -
Indications of misalignment.

ACTIONS

Actions Taken -
Motor misalignment corrected to within acceptable levels.

Taking pump out of standard

- Impeller bores
- Wear ring sizes
- Pump case machining
- Design upgrades

Parts swapping in repairs

- Newer pumps lend themselves to a parts swapping philosophy.
- Older pumps that have been repaired and re-machined repeatedly do not lend themselves to a parts swapping philosophy.

All or nothing strategy

Evolution of pump metallurgy

- Bronze fitted pumps
- 1970's pressure from aftermarket pump part companies.

Rotor stabilization

- Pump, motor (or turbine) gear box

Vibration analysis can expose:

- Multiple types of unbalance
- Eccentric rotor
- Bent shaft
- Multiple types of misalignment
- Resonance
- Mechanical looseness
- Rotor rub
- Journal bearing issues

Vibration analysis can expose:

- Rolling element bearing failure
- Hydraulic & aerodynamic forces
- Gear issues
- AC induction motor issues
- AC synchronous motor issues
- DC motor and control issues

Vibration analysis can expose:

- Belt drive issues
- Pulley issues
- Beat frequency vibration
- Soft foot, sprung foot & foot related resonance

Seal Advantages

- Seals-less drag on shaft sleeve thus saving energy
- When applied, installed with an appropriate piping plan-housekeeping
- Run dry capabilities

Packing Advantages

- Can help stabilize the rotor

Pump machining principles

- Centrifugal pumps are made up of individually machined components that mate together with register fits to form one common concentric centerline.

Pump part machining

- Faces must be flat, parallel & perpendicular
- Accurate sizes
- Most important-concentric common centerline

Application scenario #1



Application scenario #1



Application scenario #2



Application scenario #2



Application scenario #2



Application scenario #2



Application scenario #3



Application scenario #3



Application scenario #3



Application scenario #4



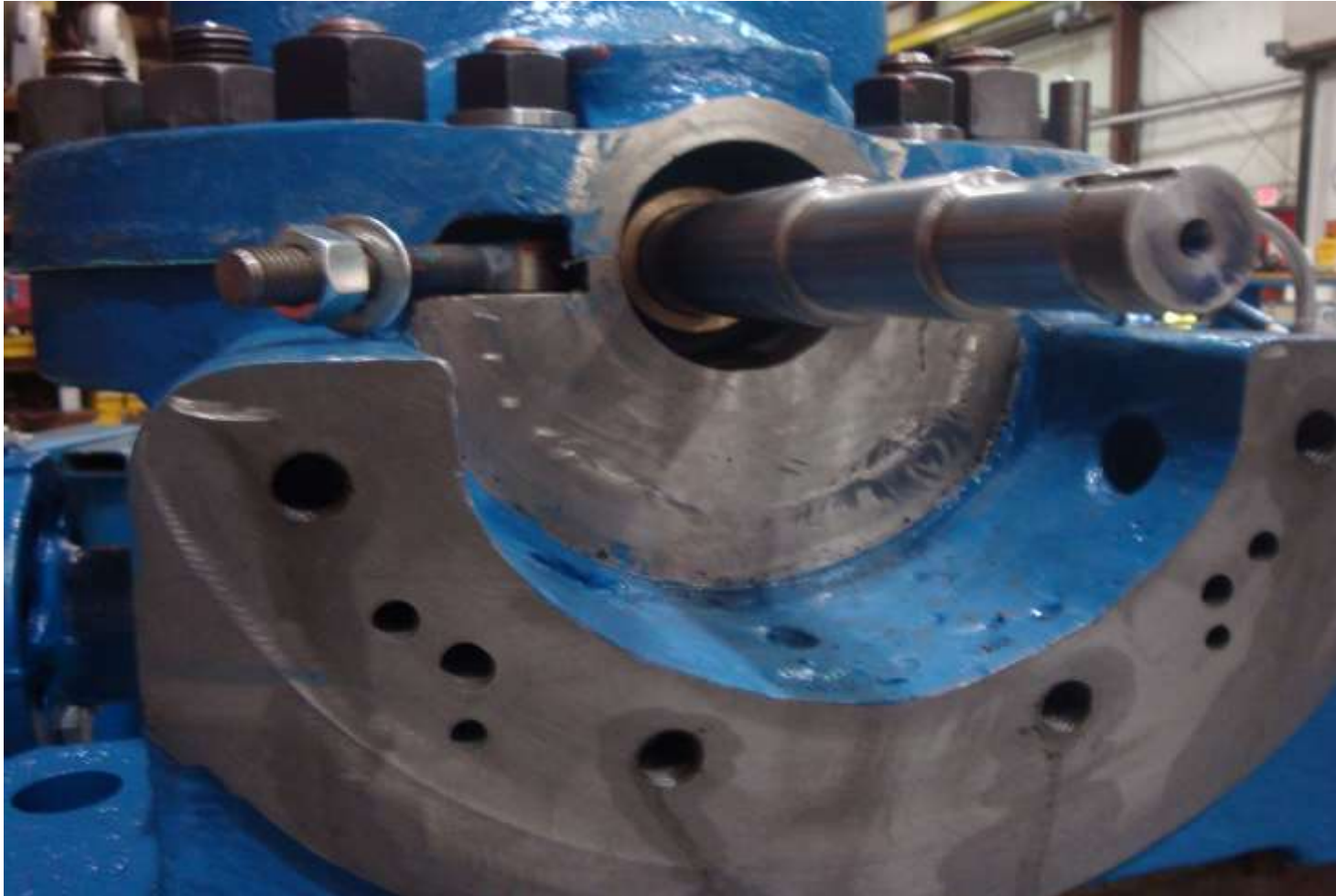
Application scenario #4



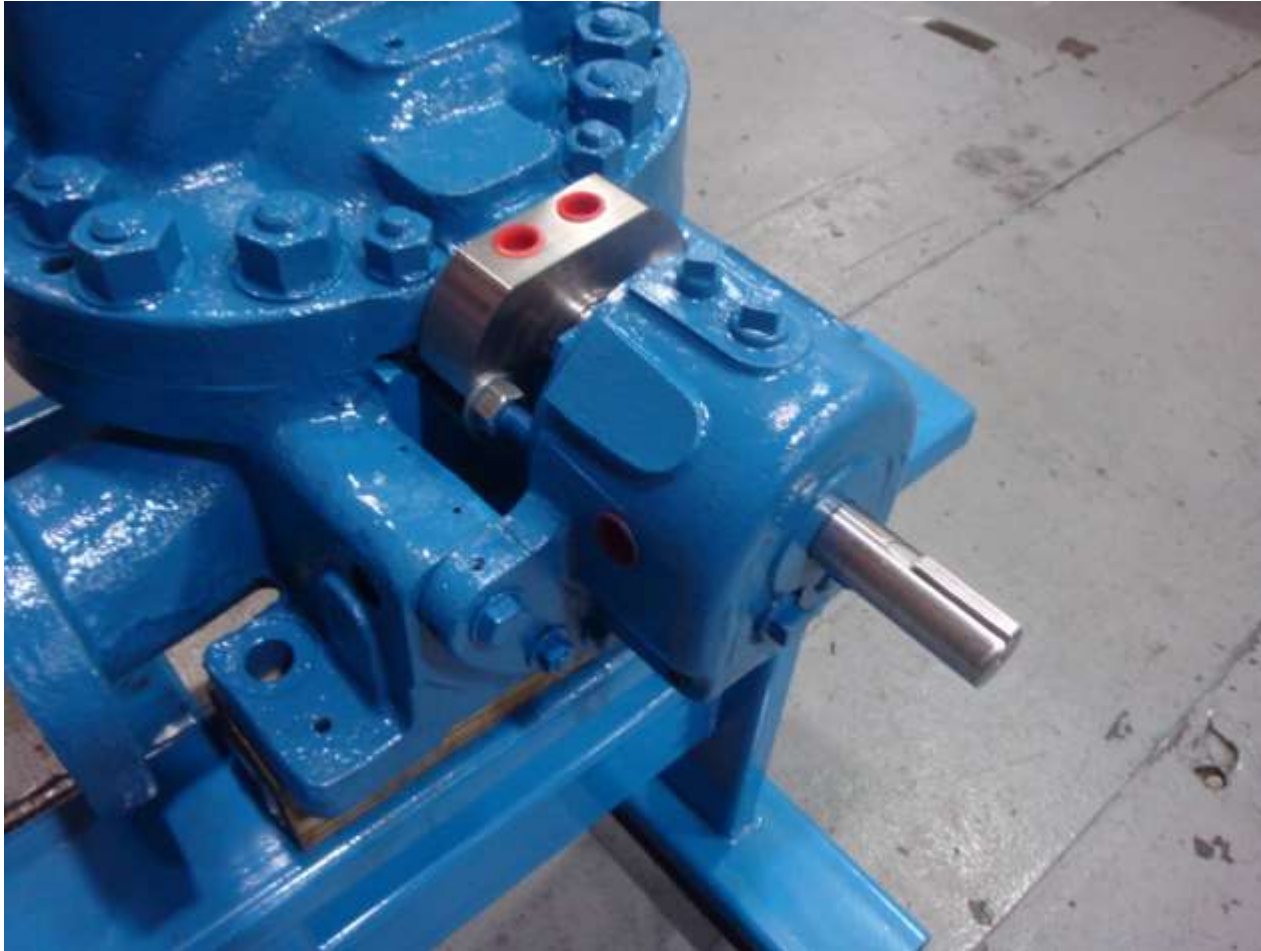
Application scenario #4



Application scenario #4



Application scenario #4



Application scenario #5



Application scenario #5



Application scenario #5



Application scenario #5



Application scenario #6



Application scenario #6



Application scenario #7



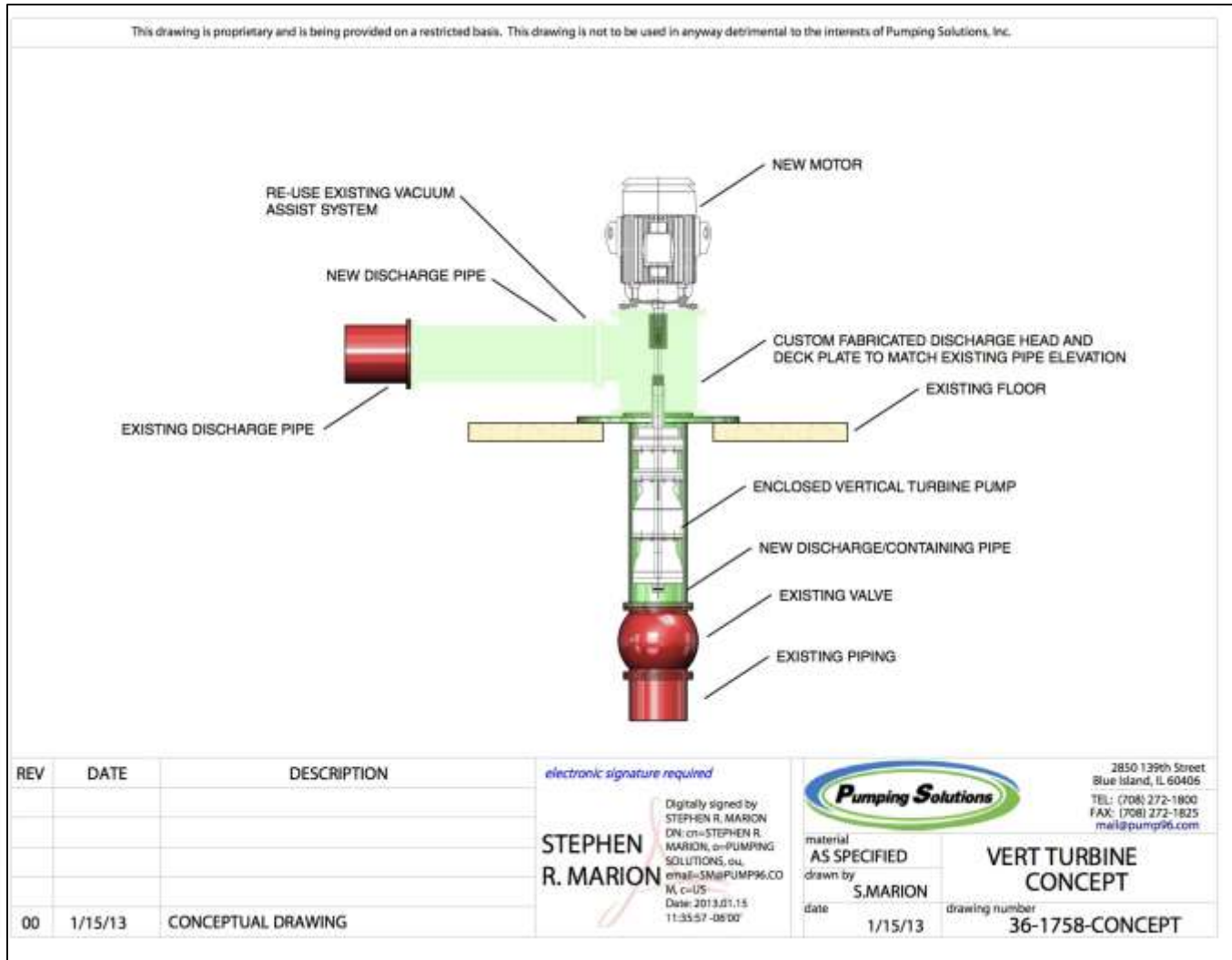
Application scenario #8



Application scenario #8



Application scenario #8



Application scenario #9



Application scenario #9



Technical Data Sheet

Corrosion Resistant Type CA-6NM

Type CA-6NM is an iron-chromium-nickel-molybdenum alloy that is hardenable by heat treatment. It is similar in general corrosion resistance to type CA-15. Although the tensile strength properties of CA-6NM are comparable to those of CA-15, the impact strength is about twice as high, as is the resistance to damage from cavitation effects.

The alloy is normally used in the normalized and tempered condition in which the microstructure is essentially 100% martensite. This structure provides the optimum combination of strength, ductility, hardness and toughness.

Advantages of 13% Cr-4% Ni-Mo, CA-6NM

1. Better corrosion and cavitation resistance.
2. Improved toughness.
3. Decreased sensitivity to cracking during and after solidification of heavy sections. Section size changes as great as 5:1 have created no cracking problem with the alloy.
4. Good weldability with minimum necessity for repair welding because of lower sensitivity to cracking.
5. Preheating or postheating is unnecessary for repair welding of sections 2 to 3 inches thick and in some cases up to 5 inches thick.

Summary of Properties

Chemical Composition:

C	Mn	Si	P	S	Cr	Ni	Mo	Fe
0.06%	1.00%	1.00%	0.04%	0.04%	11.5-	3.5-	0.40-	Balanc
Max.	Max.	Max.	Max.	Max.	14.0%	4.5%	1.00%	e

Application scenario #10



Application scenario #10



Application scenario #11



Application scenario #11



Application scenario #11



Application scenario #11



Application scenario #11



Application scenario #11



Application scenario #12



Application scenario #13



Application scenario #13



Application scenario #13



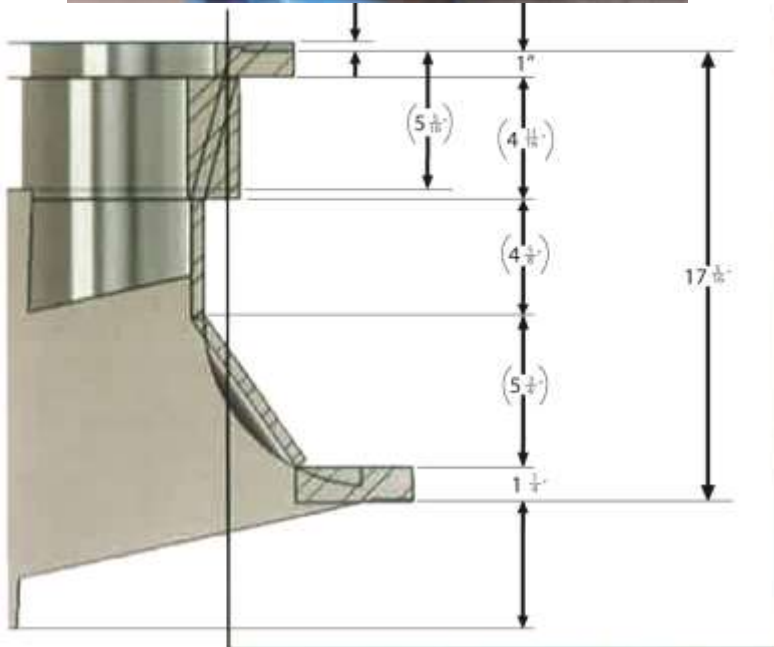
Application scenario #14



Application scenario #14



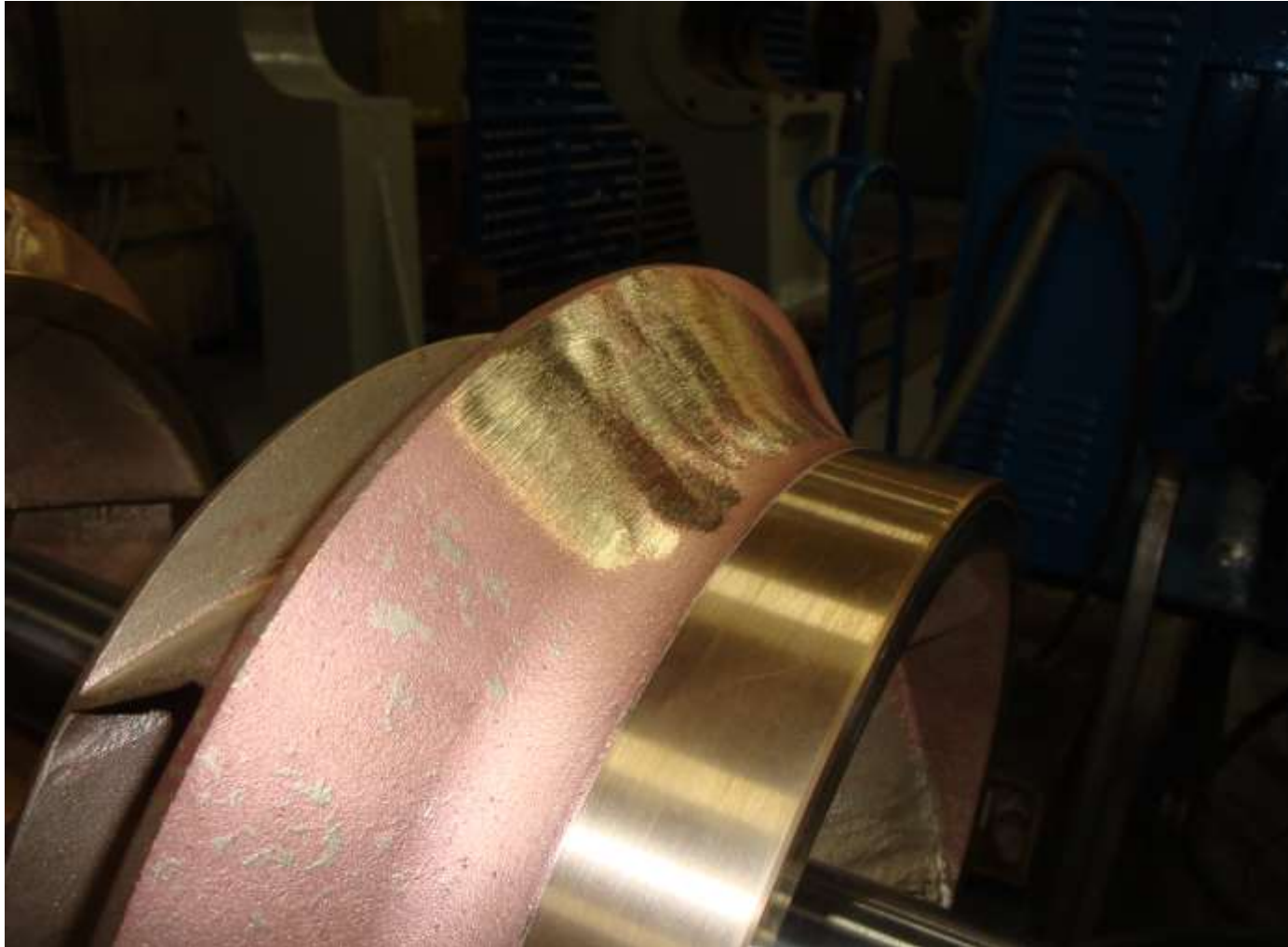
Application scenario #15



Application scenario #16



Application scenario #17



Application scenario #17



Application scenario #18



Application scenario #18



Application scenario #18



Application scenario #18



Application scenario #18



Application scenario #18



Application scenario #18

