



PumpLines

Innovation...Technology...Leadership

FALL 2002

PumpSmart® Relieves Maintenance Headaches at Millennium Chemical

At a chemical plant in Brunswick, Georgia, a process pump was encountering operating conditions that produced a mean time between failure of only 17 days. With the installation of the PumpSmart control system from ITT Industries, pump repairs, maintenance and energy usage have all been dramatically reduced.

Millennium Chemicals is a major international chemicals company, with leading market positions in a broad range of commodity, industrial, performance and specialty chemicals. Among the products from Millennium are terpene-based fragrance and flavor chemicals produced at their plant in Brunswick, Georgia. These fragrances are used in consumer products such as detergents and soaps. Consumer products companies such as Proctor and Gamble will use Millennium fragrance bases to make their product's ultimate fragrance.

A MTBF of Only 17 Days

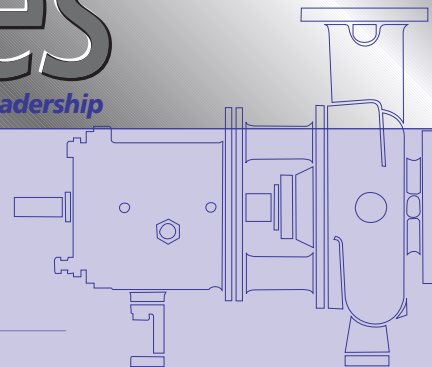
In one application at Millennium's Brunswick plant, a

Goulds 3196 XLTX centrifugal pump was being used in a distillation tower as a circulating pump. The Goulds pump was recirculating the liquid through a heat exchanger and back through a reboiler, keeping it hot.

Running at a fixed speed, the pump was pumping out of a tank to fulfill a process need of a batch chemical process. As the level of liquid in the steel pot was distilled off, the level would go from 100 % to virtually 0%. As a consequence, the pump was experiencing dramatically different head conditions. With the severe operating conditions in this service, the pump was experiencing mechanical seal failure every 17 days on average.

According to Troy Greaves, the Sales Manager of PumpSmart Control Solutions, "This pump would work fine except for the last hour of each process when there was insufficient NPSH. Because they were pumping the tank out, the pump would experience extreme NPSH cavitation, which would

continued on page 2



IN THIS ISSUE:

Feature:

PumpSmart® Relieves Maintenance Headaches at Millennium ChemicalPage 1

A-C Pump Launches New Website www.acpump.com.....Page 2

Tech Talk:

ITT Tech Fair Promotes New Technologies.....Page 3

Virginia Student Wins ITT Sponsored Stockholm Junior Water Prize..... Page 4

Product News:

PumpSmart PS200 Named Finalist in Product of the Year CompetitionPage 4

Going Hog Wild! Lean Manufacturing Results In Price Reductions on Trash Hog® Pumps.....Page 5

Material Matters:

Duplex Stainless Steels For Sea Water ServicePage 5

Service Solutions:

Innovation Reduces Refinery Costs.....Page 7

Sealless Vertical Sump Pump Provides Efficient OperationPage 7

ITT ProCast Offers Pump Parts On-Line.....Page 8

View this issue and previous issues of PumpLines on our website at www.gouldspumps.com

© Copyright 2002
Goulds Pumps, Incorporated,
a subsidiary of ITT Industries, Inc.

Goulds Pumps

 **ITT Industries**
Engineered for life

Millennium...

continued from page 1

rapidly deteriorate the mechanical seal of the pump."

With only 17 days between failures, the failures were costing Millennium approximately \$54,000 per year just in seal replacement. Greaves noted that, "The pump was fine for the service, but the operating conditions were killing the seals."

Frank Upton, maintenance manager for Millennium said that, "We were running a double seal pressurized fluid pot, but cavitating the heck out of it. When the pump was cavitating, you could hear it from the parking lot."

A Perfect Case for PumpSmart

Chris Van Dyke, the branch manager for Hudson Pump, the local Goulds Pumps distributor recalls, "Millennium is my responsibility. Frank Upton and I were doing a plant survey to identify his top ten pumps that were experiencing the highest failure rates. We were going to start by doing a complete system survey." During the survey, Upton noted that the bottoms pump was definitely his highest failure rate pump. Van Dyke recalls that, "It jumped out that this would be a perfect candidate for PumpSmart."

After viewing a PumpSmart seminar for Millennium's plant and process engineers, Upton decided to target a PumpSmart for this problem application. "I figured that the VFD would be perfect because the process conditions change as the steel pot level decreases and as that level decreases, the PumpSmart slows the pump down."

How PumpSmart Works

PumpSmart is a control system that uses a standard centrifugal process pump in conjunction with ITT Industries' unique and patented PumpsSmart Control System and Software.

The software, which resides on the controller microprocessor chip, is the "brains" of the system, allowing the pump to monitor and react to any system condition. As a result, PumpSmart automatically reacts to process system changes and upsets and will not cavitate, run dry or run against a closed suction or discharge valve.

In a situation such as the Millennium Chemical pump installation, PumpSmart detects the changing conditions and prevents the pump from cavitating. The pump will react by stopping, slowing down, alarming or any combination of these actions, depending upon how the PumpSmart controller is programmed.

No More Seal Failures

The PumpSmart drive was installed on the Goulds pump at Millennium. There were no other changes to the pump. The process of the mechanical and electrical installation took place in a single day, with the calibration taking another half day to accomplish.

Since being installed, the pump has gone from an MBTF of 17 days to almost no failures. After 185 days, a seal that had already been running under the unprotected conditions before PumpSmart was installed failed. There have been no other failures in the past fourteen months.

Now when the level in the suction tank drops, the PumpSmart controller slows down the pump gradually and does not let the pump cavitate. Before PumpSmart, the pump was running at a single speed. Now it finds the level at which it has enough static head to operate.

According to Greaves, "The nice thing is that Millennium has been able to increase their product yield because they can run the pump longer. With the non-controlled pump, they had to shut off sooner just to get the 17 days of operation." Upton notes that, "The productivity enhancements have been great. **There is now zero downtime. Productivity has increased from 5%-10% because we can now get more out of the steel pot.**"

Dramatic Energy Savings

According to Upton, energy savings with PumpSmart have also been remarkable. "We are saving \$25 a day based on 4 cents per kilowatt hour." Millennium had been using a 40 horsepower motor running the pump at 1,200 rpm for this application. The application of PumpSmart as a control system for this pump proves the oversized condition of that pump motor. Upton continues, noting that, "We are currently using between 7 and 10 horsepower now and running the pump at between 550 and 700 rpm. **I could justify the PumpSmart alone on the \$25 a day of energy savings.**"

The Millennium facility has recently installed a second PumpSmart unit on a Goulds 3196 process pump. This process pump is being used in pump out duty and as circulation for filters. As the filters begin to clog, PumpSmart will speed up the pump to maintain the flow until a certain Delta-P is reached. When that point is reached, a PumpSmart will shut down the pump.

Van Dyke said that an assessment of the first PumpSmart installation was made and, "It turned

out that if you look at energy, maintenance and downtime, the PumpSmart installation has paid for itself in just over 60 days."

Summary of Savings

Enhanced Reliability Seal replacements @ \$2,500

Labor (2 @ \$50 x 8 hours) = \$800

\$3300 x 21 Failures/Year = \$69,300

Energy

\$25/day (based on \$.04/kwh) = \$9,125

Total Annual Savings = \$78,425 ■■■

A-C Pump Launches New Website

www.acpump.com

A-C Pump, one of the Industrial Product Group brands, has launched an information-filled website for water and wastewater pump users. This new pump portal enables you to navigate through pump types to select the specific A-C model to meet your specifications. Complete parts information, including a specially priced, excess inventory listing can also be accessed. Downloadable sales brochures fully outline the features and capabilities of each product line. Installation, Operations and Maintenance manuals can also be read and downloaded to help keep your A-C (Allis-Chalmers) pumps running at peak performance. All of the latest technical news and product releases are also available at www.acpump.com.

A-C Industrial pumps (which have been integrated into the broad line of Goulds Pumps) and A-C Fire Pump Systems can both be accessed via prominent, home page links. ■■■

Tech Talk

ITT Tech Fair Promotes New Technologies

Gene Sabini, Director Research
ITT Industrial Products Group

ITT Fluid Technology, the management company of ITT Industrial Products Group, held its first annual "Technology Fair" at Inn-on-the-Lake, Canandaigua in upstate New York last month. There were 140 Technology Representatives from across ITT Fluid companies. Gunnar Hovstadius, Director – Technology and Bjorn von Euler, Director – Corporate Communications hosted the Fair.

The purpose of the Fair was to have the different value centers Research & Development and Product Engineers showcase their newest technology and develop a better understanding of future technology needs using "Voice of Customer" techniques. The other purpose of the Tech Fair was to have the participants get to know each other and thereby fostering technology cooperation.

The Fair began with eight guest panelists discussing Market Technology Drivers. Discussions covered market trends and what new supplier technologies will be required? The presenters were:

Mr. R. Asdal	Hydraulic Institute Moderator
Dr. F.W. Hennecke	BASF Retired Pump Expert
Mr. M. Purvis	Publisher, World Pump
Mr. S. Bolles	Process Energy Services
Mr. J. Swalley	DuPont Retired Pump Expert
Mr. B. Went	Thames Water
Mr. S. Kleist	Vermillion Community College

Mr. C. Edmondson James M. Pleasants Co.

Each presenter provided a short presentation followed by a Q&A session.

Each Value Center presented their market view on major technology changes envisioned by 2005, and the resulting technologies that will be required to maintain or enhance ITT's competitive advantage. Each presentation provided an overview of how changing core market "needs," will require new or enhanced product, service or systems solutions. The markets discussed were:

- Water-Residential and Commercial
- Wastewater and Dewatering
- Treatment Process
- BioPharm
- Building Trades/HVAC
- Industrial Process



Jerry Quill of IPG R&D explains a new technology development to ITT colleagues.

Of great interest to all participants were the many tabletop displays showcasing technologies from all of the fluid value centers. The Industrial Products Group previewed its Wireless Cavitation/Vibration Detection Device and Smart Nameplate.

Identifying common technology development needs across all Value Centers that respond to customer needs was an important part of the Technology Fair. Sessions were held to build relations between all participants and influence and inspire one another. Teams were formed to discuss development of common technologies and agree on action plans to address these needs. The teams formed were:

- Hydraulic design and testing
- Electrical drives
- Sealing technology
- Design – Technical data management / design and simulation
- Materials technology
- Lining technology
- Pump control methods
- Failure prevention / failure prediction
- Pre Engineered System Packaging

Denise Swink of the U.S. Department of Energy gave a presentation on Life Cycle Cost/Energy Conservation as a buying influence & competitive factor in the US and globally.

Dick Arra of ITT Industries gave a presentation on Value Based New Product Development & Innovation.

The highlight of the Tech Fair was the Technology Awards dinner. Bob Ayers, President & CEO of ITT Fluid Technology, made presentations to the 2002 winners.

ITT Vogel Pumpen 1st Place Team Award - Sensorless Control Systems

Team Vogel

Manfred Sacher	Johann Kneissl
Markus Holzmann	Gunter Schwarz
Reinhold Pfeiffer	Roman Kettler
Gabi Taubeck	Sabrina Tome



Tony Stavale accepts the team award for the PumpSmart PS200 development from Bob Ayers, CEO ITT Fluid Technology as Ken Napolitano VP IPG Sales looks on.

The application of this control system allows ITT companies to make variable speed pumps without the use of costly sensors.

Tomas Borjesson, ITT Flygt 1st Place Individual Award - Computational Fluid Dynamics

Borjesson's modeling techniques allows ITT engineers to find efficient and reliable solutions to hydraulic flow problems.

Per Strinning, ITT Flygt - Lifetime Achievement Award

His work on developing SEDI, Flygt's hydraulic design program.

Honorable mention was given to:

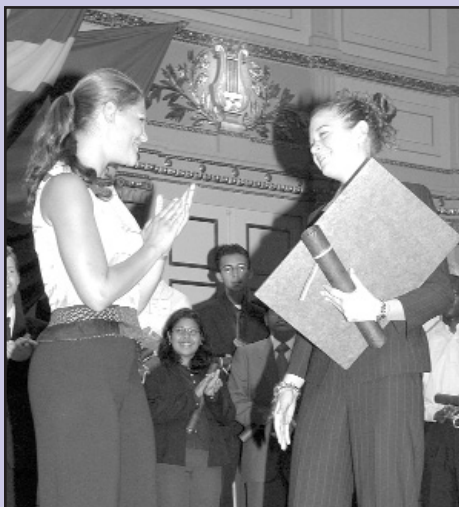
Anthony Stavale, Ken Napolitano and Nick Ganzon, Goulds Pumps IPG - PumpSmart PS200

Reducing the number of sensors on PumpSmart from four to one has made PumpSmart technology more affordable and attractive to customers.

The opportunity to share ideas and recognize achievement within the ITT R&D community will certainly result in a continuous stream of cutting edge technology for our customers. ■

Tech Talk

Virginia Student Wins ITT Sponsored Stockholm Junior Water Prize



Crown Princess Victoria of Sweden presents the 2002 Stockholm Junior Water Prize to Katherine Holt of the USA.

The Water Environment Federation's (WEF) nominee Katherine Holt, of Williamsburg, Va., is winner of the 2002 International Stockholm Junior Water Prize. HRH Crown Princess Victoria of Sweden awarded Holt, better known as the "Oyster Lady," the prize of \$5,000 and a crystal sculpture at a gala ceremony held August 13 in Stockholm.

"Katherine is a very talented young water scientist," said WEF President, Jim Clark. "We are excited to be able to sponsor her participation in the most prestigious international award for youth water-related research." Holt's winning project, "Cleaning the Chesapeake Bay with Oysters," includes a scientific and business analysis of introducing Asian oysters to clean the Chesapeake Bay.

Her research looked at how the foreign species (*Crassostrea ariakensis*) could be introduced to benefit the Chesapeake while preserving the Bay's native oyster species (*Crassostrea virginica*) and meeting national environmental goals.

A panel of WEF water quality experts selected Holt to be the U.S. Representative earlier this year

at the national competition in Dallas, TX. She was among forty-five finalists from 22 countries sent to Stockholm to compete in the international competition. According to WEF Executive Director, Bill Bertera, "the Stockholm Junior Water Prize competition is an important element in WEF's efforts to attract the very best people to the water quality field. The competition promotes excellence. Its rewards are realized by the individual and the entire environmental community."

The International Stockholm Junior Water Prize was established in 1995 to engage and support the interest of young people in water environment issues. It is awarded annually to high school students who have contributed to water conservation and improvement through outstanding research.

ITT Industries and WEF co-sponsor the SJWP in the United States; ITT is the international sponsor. For more information, please visit <http://www.wef.org/publicinfo/stockholm/>.

Product News

PumpSmart PS200 Named Finalist in Product of the Year Competition

The Board of Judges has selected PumpSmart PS200 as a finalist in the 2002 Plant Engineering Product of the Year competition. PS200 will be presented in the November issue of Plant Engineering magazine for their 110,000 readers to vote and select a winner. Awards will be presented at a special ceremony in Chicago concurrent with Manufacturing Week in March, 2003.

Goulds Pumps Model PS200 is a new microprocessor based, variable speed drive, programmed specifically for centrifugal pumps up to 700 HP. The PS200 is designed for both simplicity and functionality, making it ideal for a wide range of plant applications where previously process controllers were too costly and complex.

The PS200 features:

Process Control – Optimum Control of Your Process without Deviation

Accurate control of virtually any process parameter is obtained by the continuous monitoring and reaction to both pump conditions and system demands. Pump output is matched to the exact flow and head required by the process.

Energy Savings – Documented Payback

Energy savings in the 30-70% range are obtained because at lower demands, the PS 200 reduces the motor speed eliminating the extra energy that's used to overcome the pressure drop of control valves.

Life Cycle Enhancing Reliability – No Pump Failures

Pump reliability is optimized because the PS 200 protects the pump from upset conditions including dry running, low suction, cavitation, dead heading and, excessive run out. These conditions are the cause of most pump and mechanical seal failures.

Flexibility – Controls up to 4 Pumps

The PS200 enables the control of 2 to 4 pump systems without the need for separate PLCs and custom programming. Lead sharing is seamless, and automatic pump alternation provides even wear and maximum pump life.

The new PS200 can be applied to ANY centrifugal pump in a wide range of industrial applications including: cooling water, transfer and loading, paper stock pumps, reboiler and bottom pumps, wastewater, filtration, slurry pumps and boiler feed. ■



Product News



Going Hog Wild!

Lean Manufacturing Results In Price Reductions on Trash Hog® Pumps

Goulds Pumps has recently announced savings up to 50% on most sizes and metallurgies of its popular Trash Hog solids handling, self-priming centrifugal pumps. These pumps are specifically designed to handle municipal and industrial

wastewater. They are capable of handling solids up to 3" (76 mm) in diameter and are the ideal pump for sewage lift stations, sewerage treatment facilities, as well as many industrial processes.

Taking advantage of Lean Manufacturing techniques and leveraging ITT's size to maximize global sourcing opportunities, Goulds has been able to slash the price of many Trash Hog models.

Free Hats and Shirts

Celebrating this Lean success, Goulds is giving away Hog Hats and Hog Wild T-Shirts. To every buying team purchasing a genuine Trash Hog through the end of the year.



Features

Trash Hog features include a non-dog design, a removeable wearplate, and a large lightweight cleanout covers, top and front. Trash Hog provides a heavy-duty power end which can extend pump life even in the toughest services. Optimum hydraulic performance can be renewed easily with an external impeller adjustment design requiring no shims.

Trash Hog offers capacities to 6,000 GPM (1363m³/h), heads to 140 feet (43 m) and temperatures to 225°F (107°C). It's available in cast iron, 316 stainless, CD 4Mcu and hardened chrome iron. Sizes range from 3 inches (7.6 cm) to 12 inches (30.5 cm).

For information on reduced prices for specific models call your local Goulds representative. ■

Material Matters

Duplex Stainless Steels For Sea Water Service

Stephen Morrow

Global Manager of Materials Technology
ITT Industrial Products Group

Introduction

Over the last several decades, there has been an increased interest in the use of duplex stainless steel for pumps used in marine environments. The synergistic effect of increased levels of chromium, molybdenum and nitrogen have been shown to provide outstanding benefits for localized corrosion resistance of the duplex alloys comparable to those of the highly alloyed austenitic alloys. Today both the super-austenitic and super-duplex stainless steels are widely being utilized in seawater pumps.

It has been noted for many years that it is mainly the lack of localized corrosion (i.e. pitting and crevice corrosion) resistance that has limited the suitability of stainless steels for seawater services. This understanding has provided the motivation for developing more highly alloyed duplex stainless steels that offer superior corrosion resistance in seawater and other chloride media.

None of the earlier first or second-generation duplex stainless steels were resistant enough for seawater use until nitrogen and higher molybdenum alloying was introduced, and the so-called super-duplex stainless steels were made available. The combined effect of molybdenum and nitrogen enhancement has been found to be

beneficial for improved localized corrosion resistance.

Modern seawater resistant duplexes usually contain at least 25% chromium and have increased levels of molybdenum and nitrogen alloying over the standard duplex offerings such as wrought UNS S32900 (AISI Type 329), and cast UNS J93370 (ACI Type CD4Mcu).

Table 1 summarizes various wrought super-duplex steels mentioned in the approximate order they were announced in the literature. Two of the first super-duplex steels, UNS 31260 (DP3) and UNS 32550 (Ferralium 255 and SD40), were introduced to the market in the seventies and improved versions in the nineties. Throughout the eighties and nineties a number of new super-duplex steels were introduced, all containing 25-27% chromium, 3-5% molybdenum, 0.15 - 0.30% nitrogen, and some include copper and/or tungsten additions⁽¹⁾.

Factors Affecting Seawater Resistance

From a corrosion viewpoint, seawater may be considered a neutral chloride salt solution that promotes localized corrosion in stainless steels. In saline waters or seawater environments at or near neutral pH levels the protective passive film on stainless steels renders them virtually immune to general corrosion. Unfortunately this passive film can break down locally in certain environments containing chlorides. At the intermediate temperatures existing in many seawater pumps, crevice and pitting corrosion are the major forms of corrosion damage most often observed.



Over the past 25 years a number of highly alloyed duplex stainless steels offering superior corrosion resistance have been introduced for seawater service. Many researchers and much of the materials/corrosion literature indicates that excellent resistance to localized corrosion can be achieved in neutral and acid chloride containing media by increasing chromium, molybdenum and nitrogen content in these materials. In addition more noble values are exhibited in seawater with increases of these key elements.

Increased nitrogen content has led to improved corrosion resistance due to a better balance of alloying elements between the dual austenite and ferrite phases, resulting in a decreased susceptibility towards alloy partitioning between these two phases. I will say more about this phase balancing later.

Regarding other alloying elements, it should be noted that some duplex stainless steels contain tungsten additions in the range of

continued on page 6

Material Matters

Duplex Stainless Steels...

continued from page 5

0.5 % to 2.0 %. Tungsten additions have been shown to improve crevice corrosion resistance, with benefits similar to that of molybdenum. Copper additions in certain duplex alloys along the order of 0.5 % to 3.25 % are used primarily to extend the application to include sulfuric acid service, and offer better resistance in polluted seawater that contains hydrogen sulfide or other reducing reactants.

Pitting Resistance Equivalent

A familiar aspect of these newer seawater worthy duplex stainless steels is a high content of the alloying elements chromium, molybdenum, and nitrogen. Attempts have been made to establish a measure of the localized corrosion resistance by assessing the relative effect of these important alloying elements in a weighted form. This calculated sum is often referred to as the PRE (pitting resistance equivalent) or PREN factor (when nitrogen is included), with a common expression for the austenitic and duplex steels as follows:

$$\text{PREN} = \%Cr + (3.3 \times \%Mo) + (16 \times \%N)$$

The passive film on stainless steels is significantly improved in seawater services when the alloy composition contains higher levels of these key elements and provides a PREN value of at least 38 or more. Long-term exposure in natural stagnant seawater has determined that only the higher molybdenum and nitrogen bearing duplex stainless steels with a PREN greater than 40 are highly resistant to localized (pitting & crevice) corrosion. Those super-duplex alloys with PREN greater than 40 successfully compete with the most resistant super-austenitic 6% molybdenum alloys such as UNS S31254 (Alloy 254SMO) and UNS N08367 (Alloy AL6XN), and are considered to be most suitable for seawater service.

It should be noted that it is only those alloys offering a PREN value of 40 and greater that are usually referred to as "super" stainless steels. Several of these are listed as cast alloy grades in the ASTM Duplex Standard Specification (i.e. ASTM A890⁽²⁾ as grades 1C, 5A and 6A). Table 2 summarizes some of the various cast duplex stainless steels that are suitable for seawater service.

Importance of Nitrogen and Phase Balancing

As mentioned earlier, the two phases in duplex stainless steel have different compositions, resulting in a different resistance to localized

**Table 1. (Source Ref. 1)
Wrought super-duplex stainless steels.**

Steel Grade		Typical Chemical Composition, wt%						
UNS	Trade name	Producer	Cr	Ni	Mo	Cu	N	W
S31260	DP3	1	25	7.0	3.0	0.5	0.18	0.4
S32550	Ferralium 255	2	25	6.0	3.0	2.5	0.18	
	Alloy 381	3	25	7.0	3.9		0.15	
S31200	UR 47N	4	25	7.0	3.0		0.18	
S32550	UR 52N	4	25	7.0	3.0	1.5	0.18	
S32760	Zeron 100	5	25	7.0	3.5	0.7	0.25	0.7
S32750	SAF 2507	6	25	7.0	4.0		0.30	
	Ferrel	2	27	8.5	3.1	1.0	0.23	
	Atlas 958	7	25	7.0	4.5		0.18	
S32520 (1.4469)	DPS 28	1	27	7.5	3.8	0.3	0.30	
	UR 52N+	4	25	6.5	3.4	1.5	0.24	
	Marker G-4469	8	26	7.5	4.7		0.27	
S39274	DP3W	1	25	7.0	3.0		0.30	2.0
S39277 (1.4501)	DTS 25.7 NWCu A911	9 10	25 25	7.5 7.0	3.9 4.0	1.7 0.6	0.28 0.23	1.0 0.7

Steel producers:

1 Sumitomo Metal	5 Weir Materials	9 CSM
2 Langley Alloys	6 Sandvik Steel	10 Bohler Edelstahl
3 Climax Molybdenum	7 Atlas Foundry	
4 Creusot Loire	8 Schmidt & Clemens	

**Table 2.
Cast super-duplex stainless steels.**

Steel Grade		Typical Chemical Composition, wt%							
UNS	ASTM A890 Grade/Type	Wrought Equiv.	Goulds Code	Cr	Ni	Mo	Cu	N	W
J93373	1C	Alloy SD40	1384	24.0-	5.6-	2.9-	1.4-	0.22-	
	CD3MCuN			26.7	6.7	3.8	1.9	0.33	
J93404	5A	Alloy 2507	1361	24.0-	6.0-	4.0-		0.10-	
	CE3MN			26.0	8.0	5.0		0.30	
J93380	6A	Zeron 100	N/A	24.0-	6.5-	3.0-	0.5-	0.20-	0.5-
	CD3MWCuN			26.0	8.5	4.0	1.0	0.30	1.0
N/A	1B modified	N/A	1338	24.5-	4.7-	3.0-	2.7-	0.10-	
	CD4MCuN			26.5	6.0	4.0	3.3	0.25	

corrosion in seawater. The austenite phase generally is less resistant to localized corrosion than the ferrite phase. This is because the chromium and molybdenum are more concentrated in the ferrite phase; while the nickel and nitrogen are more concentrated in the austenite phase. This is known as alloy partitioning, and one of the drawbacks of dual phase or duplex alloy systems.

Nitrogen enhancement is beneficial to increase localized corrosion resistance of the austenite where it is mainly concentrated, and it also reduces the partitioning of chromium and molybdenum between the two phases. The only way to make the austenite phase as resistant as the ferrite phase in a duplex

stainless is to alloy the material with high amounts of nitrogen. I spoke of this in greater detail in the Spring 2000 issue of PumpLines⁽³⁾. Since nitrogen helps to maintain higher levels of chromium and molybdenum in the austenite, it improves its corrosion resistance. Therefore, duplex stainless steel enhancement due to nitrogen is mainly due to the improved corrosion resistance of the austenite.

In low-nickel duplex stainless steels, the diffusion of nitrogen into austenite is possible due to its large diffusion coefficient, but molybdenum and chromium (small diffusion coefficients) cannot be significantly redistributed, so they are unevenly distributed (higher in ferrite) between the ferrite and austenite phases. The main role of nickel is

Material Matters

to control the ferrite/austenite phase ratio and the partitioning of the alloying elements between the two phases.

An optimum range of nickel content is about 4 to 8% in a 25% Chromium duplex stainless steel. Increasing nickel content above this optimum increases the austenite ratio in such a way that the dilution of nitrogen in larger volumes of austenite would be detrimental and lowers its resistance to pitting and crevice corrosion.

Increasing the chromium content raises the pitting potential, and is beneficial in both phases. The trend in materials development seems to be towards moving from the 25% to 27% Chromium duplex alloys for increased corrosion resistance.

Molybdenum content well in excess of 3% is needed within a 25% Cr nitrogen enhanced duplex to be fully resistant to pitting and crevice corrosion in seawater. Molybdenum content cannot be increased indefinitely because of severe problems with intermetallic phase precipitation, and it rarely exceeds 4.5 to 5.0% in even the highest alloyed duplex stainless steels.

Summary and Recommendations

In summary, for seawater services the duplex alloy selected should have a balanced nitrogen enhanced composition to provide for a PREN greater than 38 or higher to ensure freedom from localized corrosion. Those duplex alloys that offer PREN values of 40 or more are ideal for pumps

and highly recommended for use in seawater.

An excellent way to specify any duplex alloy intended for seawater service would be to request that the chemical composition be balanced to provide a PREN greater than or equal to 40 as a minimum using the pitting resistance equivalent expression given above. This will ensure that the alloy selected has the optimum chemistry control to provide adequate localized corrosion resistance in the seawater environment.

Highly alloyed 25% Chromium duplex stainless alloys such as Goulds Code 1338 (Modified Cast Alloy CD4MCuN with 3% molybdenum), Goulds Code 1384 (ASTM A890 Grade 1C - CD3MCuN), or Goulds Code 1361 (ASTM A890 Grade 5A - CE3MN) are logical choices for sea water services. ■

References:

- (1) Bengt Walle'n, "Corrosion of Duplex Stainless Steels In Seawater," Avest Sheffield AB, Research and Development, acom 1-1998, SE-77480 Avesta, Sweden
- (2) ASTM A890, "Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion - Resistant, Duplex (Austenitic-Ferritic) for General Application," Annual Book of ASTM Standards 2002, Volume 01.02.
- (3) Stephen Morrow, "Duplex Stainless Steels - Several Generations In The Making," PUMPLINES - Spring 2000 issue, ITT Industries- Industrial Products Group, Seneca Falls, NY

Sealless Vertical Sump Pump Provides Cost Efficient Operation

Looking for an alternative to maintenance intensive conventionally sealed sump pumps? Whether it's submersible, self priming, or foot valve equipped end suction pumps, they can be maintenance headaches.

The Goulds Model 3171 sealless vertical sump and process pump is capable of handling a multitude of industrial applications including process fluids, sump drainage, tank unloading, and chemical waste control. The sealless construction of the 3171 eliminates stuffing box problems, including expensive and maintenance intensive mechanical seals. Designed with a rugged, double-row thrust bearing, a heavy-duty one piece shaft that eliminates misalignment and provides for longer bearing life, the 3171 features an open impeller design which allows for external

impeller adjustment for maximum efficiency. Available in 17 sizes with a wide range of alloys, the 3171 offers capacities to 3180 GPM (722m³/h), heads to 344 feet (105m) and temperatures to 450° F (232°C). The 3171 handles lifts from 2 to 20 feet.

For additional information on the Model 3171 visit www.gouldspumps.com or call your local Goulds Sales Office. ■



Service Solutions

Innovation Reduces Refinery Costs

Leonard Cadena, P.E., Manager,
Project Engineering PRO Services

Problem:

A major Oil Refinery on the Gulf Coast was spending several hundred thousand dollars per year to strip their tank farm vessels. The refinery was renting pumping systems on a regular basis to strip their tanks. The issue was the continual annual rental costs. They performed a complete assessment and found the costs of solvents and other cleaning fluids to be recurring with no corrective action available at this time. The cumulative cost of renting the systems was compared to the cost of owning a single system that would accommodate the needs of the tank farm with reasonable maintenance costs. It was assessed that the cost of a new system would be paid for in less than a year and the annual maintenance costs would be a small fraction of the rental costs.

Solution:

Through a continuous effort to reduce costs in their operations they found this opportunity and worked with ITT PRO Services Project Engineering Group to resolve the large annual expenditure issue. Utilizing CAD generated conceptual drawings the initial idea began to evolve. Through several meetings with the customer and PRO Services representatives, we were able to take the basic idea of a pump on a trailer with a driver and piping to a completely automated and self-contained system.

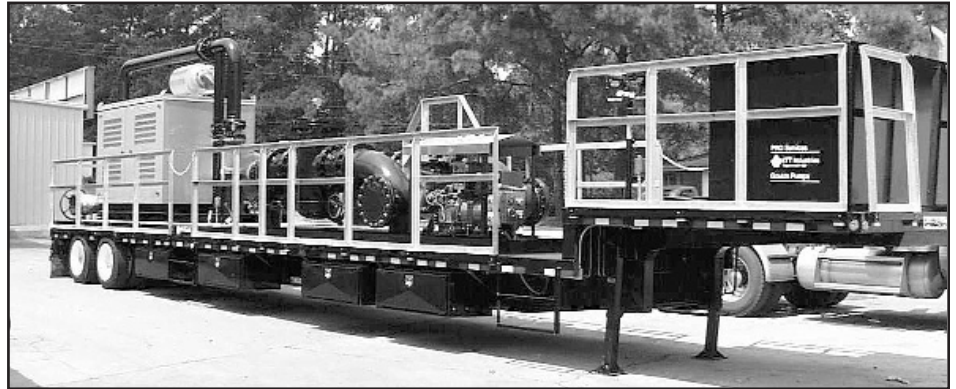
The system consists of a process pump capable of 2000 GPM, a 625 HP Diesel Engine driver, and a specially designed skid to completely isolate the pump system from the trailer for long term eventless operation due to alignment and torsional issues. The engine alone was a task as diesel engines are not made for CCW rotation. They are manufactured in CW rotation so an inverter was required to operate the pump in a CCW rotation. All the torsional loading on the skid and trailer had to be reviewed and designed for. The piping was designed using the latest piping design software and empirical information. Though this was an API application, we utilized stainless expansion joints to reduce the potential for pipe strain. The piping was supported throughout with

Service Solutions

Innovation...

continued from page 7

massive brackets tied directly to the deck of the trailer. The suction system incorporated dual 16" piping to allow for massive strainers to be cleaned without interrupting the functionality of the system. The diesel engine was able to run continuously for 24 hours with the 1000 gallon fuel tank which was incorporated in the front of the trailer. The fuel system was completely automated as was the control of the complete system through an electrical control center designed to allow the operator to stand in one location on the side of the trailer and operate all the separate systems as required. The entire trailer was lit by a separate diesel generator system that also received fuel from the 1000 gallon diesel tank.



The final testing of the system was done at our PRO Shop utilizing flexible piping and a 20,000 gallon portable water tank. After a successful witness of the performance test the customer accepted delivery of this great system. If you

would like to know more about this project or how you can lower your plant operation costs, please contact your local PRO Services Account Manager or PRO Service Center. ■

ITT ProCast Offers Pump Parts On-Line

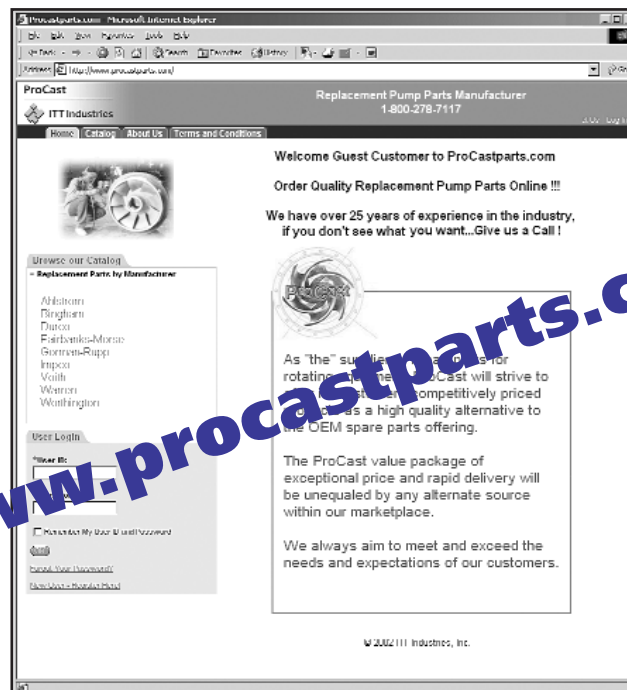
ProCast, an ITT Industrial Products Group Company which manufactures OEM quality replacement parts for pumps and other industrial equipment, has developed a website simplifying the parts purchasing process. www.procastparts.com allows customers to search, identify, and order parts on the internet, anywhere, anytime! The new website features user-friendly navigation and simple shopping cart functionality. An extensive search catalog of all major pump manufacturers enables you to locate your part quickly. Additionally, procastparts.com allows credit card purchasing, online order status, and e-mail order confirmation.

ProCast has been supplying parts to industry for a quarter century. It has the resources, the technology, the personnel, and the proven experience to quickly and economically manufacture quality replacement parts for virtually any industrial rotating equipment.

ProCast has earned a reputation for providing high quality design, foundry and machining services, employing the very latest in technology. ProCast parts meet or exceed manufacturers' standards. Located in Zachary,

Louisiana, ProCast assures you the fastest possible response to your parts needs.

For more information visit our Website at www.procastparts.com ■



Send your comments or suggestions to:

John Beca - ITT Industrial Products Group, 240 Fall Street, Seneca Falls, NY 13148 or email: jbeca@fluids.ittind.com

View the latest in pumping technology at: www.gouldspumps.com