ITT

PUMPLINES

Innovation ... Technology ... Leadership

A newsletter for users of pumps, controls, monitoring and maintenance services

Fall 2007

Geothermal Power

ITT Goulds pumps bring Earth's heat to the surface

Tourists watching Old Faithful at Yellowstone National Park quickly learn about the power of geothermal energy. It's a sight to behold, and the science behind it tells a fascinating story about the Earth beneath our feet.

Chambers of magma at temperatures of up to 2,700 degrees Fahrenheit (1482 C°) reside in the Earth's crust and heat the rock

layer above. When aquifers come into contact with the superheated rock, hot springs can occur, but when that heated water and steam encounter a constricted access to the surface—just like a fire hose nozzle—those showy geysers can form. Old Faithful, the most famous geyser, sprays its water and steam up to 200 feet (61m) in the air, but Steamboat geyser, also at Yellowstone, has been known to erupt at heights up to 400 feet (122m). That's a massive display of geothermal power.

It's no surprise, then, that man has attempted to harness the power of geothermal energy. For centuries, people around the world have used hot springs to clean, cook, and heat. The first electric generator using geothermal energy was built in Italy in 1904. It simply used the steam erupting from a geyser to drive an electric turbine.

Efforts to use geothermal energy in the United States began in 1922, at The Geysers steam field in Northern California. The plant's operators quickly found out that the particles carried by natural steam and hot water are corrosive to the pipes and turbines that were in use. That early effort failed, but in 1960, a small hydrothermal plant opened in the area, and today, 28 plants are operating there.

Because geothermal energy is renewable—using only water and the continually replenished heat from the Earth's core—it is celebrated by environmentalists. There are few if any byproducts from the resulting steam, so the process is clean, and many sources of geothermal energy are very reliable in terms of producing continually high levels of the heat needed to produce powerful plumes of steam. Perhaps best of

What's Inside

Feature

Geothermal Power Continued...

all, geothermal energy is homegrown. In fact, it's not an energy source that can be exported. It must be used at its sources.

Using geothermal energy sources

Most of those sources in the U.S. are found in the western states, and in Alaska and Hawaii. These are the domestic areas where magma is close enough to the surface to heat rock and, in turn, the groundwater that often finds a path to the surface in the forms of hot water and steam. Today, harnessing geothermal power takes a number of forms. For the most part, ITT Goulds Pumps geothermal products are used by organizations that employ geothermal sources to drive commercial power plants. Three types of plants are in commercial use.

- **Dry steam plants.** These are very efficient vapor-dominated reservoirs that result from a drilled well 7,000 to 10,000 feet (2134m to 3048m) deep. From these exceeding rare wells, natural steam comes to the surface to power turbine generators. The depleted steam becomes condensed water and can be used in the plant's cooling system, then injected back into the well to keep the process going. The Geysers in California is an example of a dry steam plant.
- **Flash steam plants.** Steam is created in a different way in these facilities. Water is sent through an injection well to the geothermal source, where it is heated to above 360 degrees F (182 C°). A production well carries the hot water to the surface, where it is sprayed into a tank, causing some of the water to rapidly vaporize, or "flash." The vapor drives a turbine, which powers a generator that creates electricity. Excess liquid in the first tank can be flashed in a second tank to recover further energy in the same cycle. The resulting water then is sent back down into the injection well to repeat the process.

Downhole pumps such as the ones made by ITT Goulds Pumps sometimes are used in conjunction with flash plants, but their most common use is in binary plants.

- **Binary-cycle plants.** These plants are called "binary" because they use both hot water from their geothermal sources and a fluid that has a much lower boiling point than water. This allows operators to bring the water—which is not hot enough to flash on its own—up from the geothermal source from 600 to 2,000 feet (183m – 610m) under the surface, then use it to heat the tank containing the secondary fluid, which flashes and drives the plant's turbine. By containing the hot water in a closed system that doesn't flash, binary plants avoid the problems that flashing can bring—including calcium carbonate scaling and metal corrosion that result from impurities carried in the geothermal brine. Experts believe that most of the geothermal plants of the future will be binary-cycle plants.

One of the world's foremost experts on geothermal power, and downhole geothermal pumps in particular, is Jack Frost, principal of Frost Consulting Group. With industry experience dating to 1972, Frost designed the first commercially successful geothermal pump in the early 1980's, and today serves as a consultant and authorized global representative for ITT Goulds Pumps Vertical Pumps Operation, which manufactures the company's geothermal products, and with ITT Goulds Los Angeles PRO Services® Center. Both divisions are located in City of Industry, Calif., in Los

Angeles County.

Frost is a character with a well-known reputation in the geothermal power industry. For 30 years, he has traveled the world working with geothermal power organizations and siting pumps, but with most of his time dedicated to the well fields in the western United States where geothermal development leads the world.

Frost is "the world's expert on geothermal production well pumps and their applications," said Bob Verity, resource engineer for Ormat Nevada Inc., owner and operator of geothermal and recovered energy power plants. Verity calls Frost "the prime mover in the development of pumps for our industry."

ITT Goulds pumps geothermal products

By producing geothermal pump products that perform well under punishing conditions—such as in deep wells or where the brine is hot or abrasive—ITT Goulds Pumps has captured 80 percent of the electricity-producing market. One of the latest projects for the company and Frost Consulting is the Raft River binary-cycle geothermal power plant in southeastern Idaho. When it's completed this year, phase one of the plant, a project of U.S. Geothermal Inc., will generate 13 megawatts of electricity.

The plant's builder selected the ITT Goulds Pumps VPO product, said Kevin Kitz of U.S. Geothermal, because of its "record of reliability and after-sales service of Goulds Los Angeles PRO Services Center. The geothermal industry recognizes the reliability of the Goulds design and has replaced many pumps manufactured by other companies with the Goulds equivalent," Kitz stated.

What makes ITT Goulds pumps right for the rigors of geothermal work is their design and construction. "They're made with extremely robust, extremely thick, very hard alloys," said Frost. "Goulds geothermal pumps are unlike anything else in the industry," he continued. "On these pumps, the laterals are four and five-eighths inches thick, versus what you might have on an industrial type of pump like a cooling pump, where the thickness is only a half inch or less."

The Raft River pumps "went together perfectly," Frost asserted. "I really have to hand it to both VPO and PRO. These guys put together a top-notch product with incredible quality." He explained that a typical vertical industrial turbine pump uses five stages at most, but the typical downhole geothermal pump is built with 28 to 36 stages. Assembly of these pumps is labor-intensive and exacting, but the Goulds professionals who do the work are excited about it.

"I go and talk to the guys in assembly, and they're disappointed if there are only 18 stages in a pump," said Frost. "They take great pride in their work, and they would rather assemble 36 stages than anything less."

Performance monitoring on each custom-manufactured Goulds geothermal pump is done right on the job. Several instruments provide information that indicates how well the pump and well are working. Discharge pressure, flow rate, temperature, well bore pressure, water level, amperage, voltage, oil lubrication, cooling water pressure, motor bearing, and winding temperatures are measured and recorded every three to six hours, to ensure that the pump is running properly.

In the event of a pump failure, it's necessary to remove it from the well with an oil-field workover rig. If the rig is close by, a typical removal time is three days, during which time ITT Goulds Pumps can have a new replacement bowl assembly on the ground and ready to be installed in the well. If time allows, a rebuilt unit from customer stock can be on site within 10 days. On-hand inventory, standardization, and continual

Feature

Geothermal Power Continued...

product re-design are three of ITT Goulds Pumps keys to serving customers well. ITT Goulds geothermal pumps today are serving about 150 producing wells around the world. Pumps endure for varying periods on the job, largely depending on the sand content and temperature of the geothermal brine. Some pumps may last only two years before a failure or drop in performance, and others have been in place for more than 15 years. It wasn't always that way. Before ITT Goulds entered the business, early geothermal pumps—mostly adaptations of pumps used in agricultural water wells—lasted only about 30 days each. Jack Frost's first design increased the longevity of one of these geothermal pumps to 420 days.

As with nearly every industrial application, safety is an important consideration when working around geothermal wells. There are reasons why the U.S. Park Service keeps curious tourists away from erupting geysers at Yellowstone, and the same safety concerns apply for geothermal well workers. Similar to oil-well fires, geothermal wells can create geysers of hot water and steam if something goes wrong at the site. These dangerous geysers are much larger than Old Faithful, and can kill people in their paths. The most dangerous period during geothermal well construction is just before the pump is being installed in the well, because the well is not fully controlled at that point. Once the pump is in place, it becomes a much safer environment for the workers.

A hot future for geothermal energy

The future of geothermal power depends on a combination of economics and technology. Californians get six percent of their electrical power from geothermal energy—more than any other state. In Nevada, where the whole state rates highly for potential geothermal resources, governments and power utilities both see the possibilities and are moving to build more geothermal power facilities. With the cost to produce geothermal energy rivaling that of traditional power sources such as coal plants, more utilities and other companies are finding ways to take advantage of geothermal resources.

Today's worldwide output of geothermal power is equivalent to the output of 10 to 15 coal or nuclear power plants, and

provides power for about 30 million people. In the United States alone, utilities produce about 2,300 megawatts of geothermal electricity, and serve nearly 4 million Americans.

In other parts of the world, geothermal resources also are available and are beginning to be harnessed. Indonesia, Mexico, and the Philippines all largely operate flash steam plants from high-temperature resources. However, because some locations did not re-inject the geothermal brine back into the wells—instead letting the water flow out onto the adjacent ground—the result was mounds of unneeded salt and depleted geothermal resources.

Today, with more understanding of what it takes to operate a sustainable geothermal power plant, political and corporate leaders around the world are learning to appreciate that geothermal energy is one of the environmentally friendliest ways to generate electrical power. In fact, geothermal energy is ideally suited to provide new, clean power sources in developing countries.

However, geothermal energy has had its environmental challenges in the past. Because geothermal steam and hot water

contain traces of hydrogen sulfide and other gases and chemicals, flash steam plants can release those compounds into the atmosphere. For that reason, operators use scrubber systems to minimize environmental releases. Today's plants emit less than four percent of the carbon dioxide that coal- and oil-fired plants produce, and sometimes the gases can be converted into marketable products such as liquid fertilizer. Properly designed binary-cycle plants, because geothermal fluids travel through them in a closed system, release nothing to the atmosphere.

In a complementary re-use scheme, The Geysers power plant in California pumps in wastewater from surrounding communities to replenish the water that is brought up from its geothermal wells.

Climate is not a barrier for geothermal power plants. They operate around the world in areas as diverse as deserts, fertile farmlands, and in mountainous forests. Of course, geothermal features that have become national treasures, such as those in Yellowstone, are protected by law and will not be developed as power sources. Other federal lands have been used for geothermal plants, in part because they do not significantly harm the environment.

Advances in alternative energy such as geothermal resources already are helping to lower the world's dependence on fossil fuels. ITT Goulds Pumps is doing its part by producing highly effective and dependable pumps for the geothermal energy industry.

Material Matters

Vertical Turbine Pumps In Seawater Service – Materials of Construction Options

by
Stephen J. Morrow, Global Manager of Materials Technology
Jose Gutierrez, Marketing and Engineering Manager, Vertical Product Operation
Richard O'Donnell, Technical Service Manager, Vertical Product Operation

The location of industrial plants on the coast, along with the continuing search for offshore oil and gas, has led to an increase in the number of vertical turbine pumps handling seawater applications due to their ability to be adapted to most system designs.

The flexibility of design of vertical turbine pumps lies in the ability to meet any system design by multistaging. The ease of changing the staging on the pumps is also an advantage if it becomes necessary to change the hydraulic characteristics of the system. Stages can be added to the same pump if changes in the system head curve result from an increase in pipe friction due to corrosion. This condition is quite common in seawater systems.

Corrosion in vertical turbine pumps can be minimized, and in many cases, completely prevented by proper material selection. However, high initial cost may prevent the use of those alloys which would eliminate the corrosion problem. Corrosive conditions, such as seawater, require more consideration because initial low cost materials are not likely to result in the lowest ultimate cost. When pumps are in critical service, periodic shutdowns for parts replacement add to the total cost; therefore,

ITT

Material Matters

Vertical Turbine Pumps In Seawater Service Continued...

in these applications it is wise to select more corrosion-resistant and expensive materials. This article examines some popular combinations of materials for seawater service – from low-cost, limited service life, to high-cost, long service life.

Since seawater is a highly conductive environment, galvanic considerations normally dictate material combinations. An understanding of the galvanic series of metals is essential to proper material selection. A few suggestions to combat galvanic corrosion in vertical turbine pumps are:

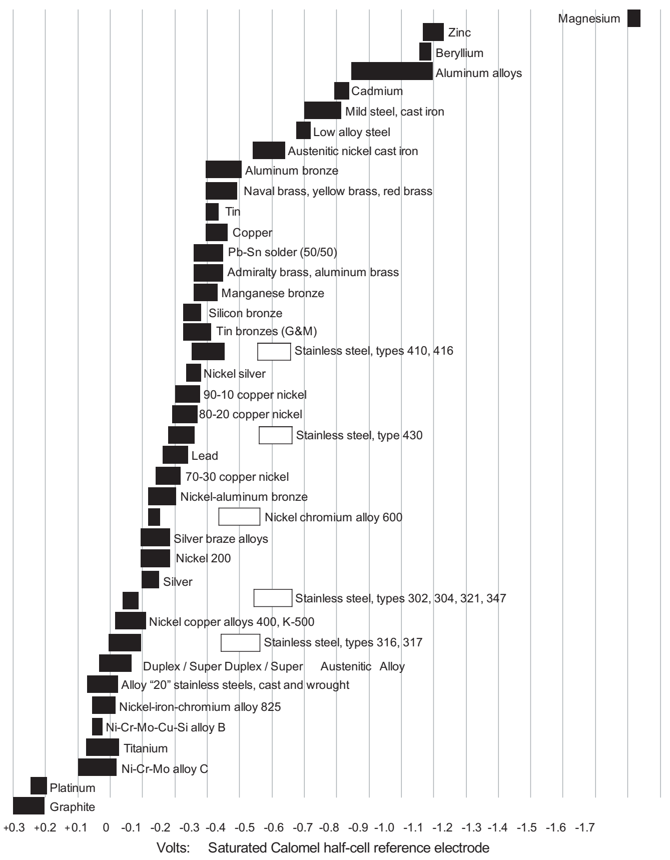
- Selection combinations of metals as close together as possible in the galvanic series with less than 0.25 v potential difference desired.
- Avoid the combination of a small anode and a large cathode.
- Use insulating washers on bolting and insulating gaskets on mating flanges.
- Use protective coatings on less expensive materials.
- Locate sacrificial zinc or aluminum alloy anodes on the column assembly.

Additionally, marine fouling can be a severe problem. Marine growth build up can be solved by selecting materials with good resistance to marine bio-fouling, treating the sump with chlorine, and using an electrolytic water treatment.

Fig. 1 shows the corrosion potential of materials in the flowing seawater. The application and service conditions will also affect the rate of corrosion. A pump that sits idle for long periods of time, such as a vertical fire pump on an offshore installation, will experience a different rate of corrosion than a pump constructed of the same materials operating continuously. Many materials are regarded as corrosion resistant in fast flowing seawater, but under stagnant conditions they are susceptible to pitting and crevice corrosion attack. This reversal in the resistance of metals due to velocity change is due to the depolarization of the hydrogen film which protects the material. This mechanical depolarization (loss of protective film) is an important aspect of pump design and material selection. Stainless steels and nickel-base materials remain passive at high velocities, but they corrode due to pitting in stagnant water. The copper base alloys are very corrosion-resistant in quiet, unpolluted, sulfide-free water; but as water velocities increase, the corrosion barrier can be stripped away.

Thus, a proper material combination is highly dependent on specific application considerations. All material options presented in the tables included here have been utilized in seawater service. They are listed in increasing initial cost. This comparison is based on a typical offshore fire pump installation. This bowl assembly is an 18-in., 3 stages with 50 ft of 14-in.

Potentials in flowing sea water* ***Fig. 1***

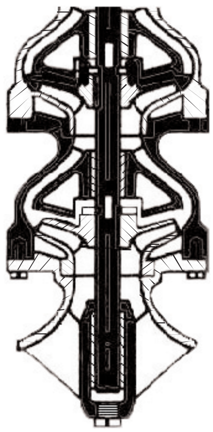


*(8 to 13 ft/sec, temp. range 50-80°F)

Alloys are listed in the order of the potential they exhibit in flowing sea wate r. Certain alloys indicated by the symbol in low-velocity or poorly aerated wate r, and at shielded areas, may become active and exhibit a potential near -0.5 volts.

Bowl Assembly Options

Fig. 2



Materials Selection for Seawater Service

	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
COMPONENT	LOWEST COST	MEDIUM COST	MEDIUM COST	HIGHER COST	HIGHEST COST	HIGHEST COST
	(Minimum Useful Life Expected) 316 SS / carbon steel construction	(Good Service Life) 315SS construction	(Good Service Life) AL-BRZ/NI-AL-BRZ construction	(Very Good Service Life) Duplex: 2205/ CD4MCuN construction	(Excellent Service Life) Super Duplex	(Excellent Service Life) Super Austenitic
BOWLS	CF-8M 316 SS	CF-8M 316 SS	AL-BRZ CA958	Duplex Alloy CD4MCuN ASTM A890 Grade 1B	Alloy 2507 ASTM A890 Grade 5A	Alloy 6% Moly
IMPELLERS	CF-8M 316 SS	CF-8M 316 SS	NI-AL-BRZ CA958	Duplex Alloy CD4MCuN ASTM A890 Grade 1B	Alloy 2507 ASTM A890 Grade 5A	Alloy 6% Moly
COLUMN/ DISCH. HEAD	Coated Carbon Steel/ 316SS flanges	316 SS	AL-BRZ w/Nickel	Duplex Alloy 2205	2507	Alloy 6% Moly
SHAFTING	316 SS	316 SS or Nitronic 50	Nitronic 50 * Monel K500	Duplex Alloy 2205	2507	Duplex Alloy 2205
BEARINGS	Bronze or Rubber	Bronze or Rubber	Bronze or Rubber	Bronze, Rubber or Hardfacing on metal shell	Bronze, Rubber or Hardfacing on metal shell	Bronze, Rubber or Hardfacing on metal shell
BOLTING	316SS	316SS	Monel	Duplex Alloy 2205	2507 4% Moly	Alloy
KEYS/ COLLETS	316SS	316SS	Monel * or Nitronic	Duplex Alloy 2205	2507	Alloy 6% Moly

When quoting these different material constructions, the following items should be taken into consideration:

1. Temperature and Abrasives: the maximum temperature limits and PPM of abrasives for the various constructions will generally depend on the bearing materials:

Bearing Type	Degrees F	Abrasives Maximum PPM of TSS	Comments
a. Rubber Bearings	32 to 150	5000	Above 100 PPM Hardface Shaft
b. Bronze Bearings	-50 to 180	50	
c. Hardfacing Coating	-100 to 300	5000	Shaft must also be Coated
d. Carbon	-380 to 700	10	Alterantive Bearing Material

2. 316SS materials are susceptible to localized corrosion (pitting) when the sea water is not moving along the material surface. This can occur when the pump is in still water and/or the unit is not in operation (intermittent service).

* Factory Choice

column. The unit cost ratio may vary slightly among pump manufacturers.

The design of the vertical turbine pump consists of three basic components assembled into a single unit. These are the bowl assembly, column and shaft assembly, and discharge head assembly.

If the service condition is known, the proper mix of materials will determine the ultimate lowest cost by providing good service life.

Bowl assembly

The pumping element of a vertical turbine pump is the bowl assembly. It is comprised of the suction bell, one or more intermediate bowls, the bowl shaft, and the impellers.

The many components of the bowl assembly create the major concern in material selection. An improper galvanic coupling can create a dry cell effect (electron flow between dissimilar metals in contact in a conductive electrolyte solution); where metal ions move from the corroding more anodic metal being oxidized into the solution pumped, and electrons flow towards the cathodic metal regions where reduction reactions occur inside the pump.

The bowl assembly should be mechanically constructed so that field maintenance is easy. Some basic design criteria are:

- Bowls should be flanged construction, not threaded.
- Bolting material should be cathodic to bowl material, but as close to it as possible to prevent accelerated corrosion.
- Impellers should be keyed for easy removal.
- Impellers should be of the same enclosed type to allow the

Material Matters

Vertical Turbine Pumps In Seawater Service Continued...

use of wear rings which permit re-establishing the initial running clearances when replaced.

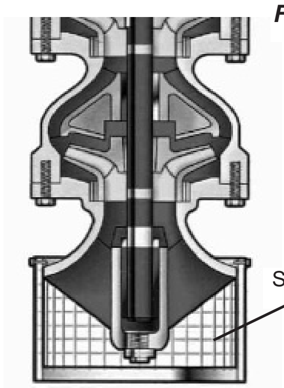
Fig. 2 lists the following material options:

Option 1 is listed as a basis for cost comparison. Although this combination has been used in seawater, service life is limited and repairs are predictable. This combination of castings in 316SS/CF8M and columns in coated carbon steel with 316SS flanges is the lowest cost material offered for seawater service.

In *Option 2*, Medium Cost, changing column and discharge head materials to 316ss and with Nitronic 50 shafting will increase the shaft strength and pump life. However, in both Options 1 and 2 the 316ss material is subject to pitting in stagnant conditions unless cathodic protection is provided and has relative good characteristics in flowing applications.

In *Option 3* or Medium Cost, Al-Bronze / Ni-Al-Bronze castings are considered to provide good corrosion resistance when handling flowing seawater. It does not have a tendency to pit in stagnant waters and is not as susceptible to marine fouling. CF8M/316ss impellers have a higher resistance to erosion due to flow velocity than does Ni-Al-Bronze, and should be considered for higher velocity applications over 90 ft/sec.

Fig. 3



Bronzes, however, can be damaged in seawaters with hydrogen sulfides so the seawater must be unpolluted and free of hydrogen sulfide.

Option 4 or Higher Cost, higher chromium duplex types 2205 or CD4MCuN construction is superior to Option 3 due to improved corrosion and erosion resistance in seawater at high velocity. Under stagnant conditions, localized pitting resistance is improved by these higher alloyed duplex stainless alloys, but bio-fouling organisms can collect on the surface causing limited crevice corrosion damage under deposits. These Duplex grades will perform well in normal 7 – 8 pH seawater with chlorides up to 25,000 ppm or even higher.

With a higher cost *Option 5*, the Super Duplex alloys having PREN values over 40 (where PREN = %Cr + [3.3 x %Mo] + [16 x %N]) offers corrosion resistance advantages over Al-Bronzes and Ni-Al-Bronzes. The super duplex alloys resist polluted waters with sulfides as well as localized pitting and crevice corrosion under stagnant or idle conditions, and offers good cavitation and erosion-corrosion protection. Additionally, in normal 7-8 pH ambient seawater, Super Duplex will perform well with up to 50,000 ppm of chlorides or more.

The last *Option 6,* the Highest Cost in the selection chart, utilizes the 6% molybdenum super-austenitic stainless steels such as the ASTM A743/A744 Grades CK3MCuN/ 254SMO and/or CN3MN/AL6XN. These super-austenitic stainless alloys provide excellent corrosion resistance that allows operation in ambient seawater at normal 7-8 pH and up to 100,000 ppm of chlorides and higher. These grades provide excellent cavitation resistance, superior localized pitting and crevice corrosion resistance and excellent flow velocity erosion resistance properties. As with all stainless steels, fouling organisms can collect on their surfaces unless treated with biocides.

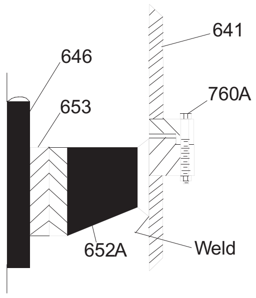
Regardless of which bowl assembly option is selected, pumps installed in seawater service should always be fitted with a strainer on the suction bell (Fig. 3). A basket-type strainer constructed of 316ss for the 316ss/CF8M bowl assembly combinations, or Al-Bronze for the Al-Bronze/Ni-Al-Bronze bowl assembly, will provide the required protection to the pump internals. For higher alloy ferrous bowl assembly material combinations, a compatible strainer material should be selected.

Column assembly

The column and shaft assembly is designed to connect the bowl assembly to the discharge head assembly. The column serves two purposes: it carries the weight of the bowl assembly and provides a means of conducting the fluid vertically from the pumping element to the discharge head. Threaded column assemblies are not suitable for seawater applications and should not be used.

Fig. 4 illustrates a typical Column assembly construction. Column sections are normally provided with flanged ends incorporating registered fits for alignment accuracy. This construction also facilitates disassembly where corrosion can be a

Column assembly construction ***Fig. 4***



Item no.	Description
641	Column pipe
646	Lineshaft
652A	Bearing retainer
653	Lineshaft bearing
760A	Column bolting

Integral bearing retainer

problem. For all column sizes the standard design has the bearing retainer welded into the column section to ensure concentricity between components while machining a single integral piece.

The column assembly materials should provide galvanic compatibility with the bowl assembly materials. See Fig. 1 and material selection chart combination shown in Fig. 2 for compatibility. An electrochemical potential difference between materials of 0.25 volts, from Fig. 1, indicates a galvanic problem exists.

In the material selection chart (Fig. 2), the least expensive Option 1 is coated steel column (interior and exterior) with 316SS flanges. The coating should be extended over the 316SS flanges to prevent corrosion from starting underneath the coating and to prevent coating "peel off" when subjected to high liquid velocities.

All coatings should undergo a spark test (holiday test) to ensure that no pinholes are present in the coating. The coating normally consists of an inorganic zinc primer followed by a multi-layered epoxy, applied 20-25 mils thick. The coating must be applied carefully, and certain design criteria for coating over weld joints must be followed to assure corrosion-free operation.

All the shafting material (as well as bowl and column) is selected based on horse-power carrying capability and resistance to corrosion. ANSI/AWWA E101 provides basic guidelines for proper shaft sizing. It states, "The maximum combined shear stress shall not exceed 30% of the elastic limit in tension or be more than 18% of the ultimate tensile strength of the shafting material used." In higher-horsepower applications, it is wise to use 10% of the ultimate tensile strength. This conservative over-sizing of the shaft costs very little and the result is a more robust and reliable unit. Three excellent pump shaft materials used in seawater service are 316SS, Monel K-500, and Nitronic 50. All provide good seawater corrosion resistance and are readily available materials. For duplex, super-duplex, and super-austenitic pump selections, these materials are also available.

While all vertical pumps consist of the same basic components, there are two distinct variations in the column design. These are open lineshaft construction and enclosed lineshaft construction.

With open lineshaft construction, the bearings are lubricated by passing the pumped fluid around and through the bearings.

The enclosed lineshaft construction involves enclosing the lineshaft with a series of threaded connecting tubes. These tubes separate the pumped fluid from the shaft and also house the shaft support bearings. Lubrication, usually oil, is introduced at the top end of the tubing and drips down through the bearings. A drain port in the lower end of the tubing allows the oil lubricant to flow out. The tube and shaft assembly is supported in the column pipe at intervals by spiders to hold it in the center.

The enclosed lineshaft is commonly used for deep well units. This construction is not recommended on seawater service, as it increases initial cost without increasing reliability. It also compounds disassembly problems should maintenance become necessary. For these reasons, open lineshaft construction, due to its simplicity of design, is recommended for seawater service.

With open lineshaft construction, selection of the bearing material depends on pump setting, and the silt and sand content of the pumped fluid.

On short setting pumps, fluted rubber with phenolic backing is a good selection. These bearings have good wetted frictional characteristics. On long setting pumps, the upper lineshaft bearing could run dry at a start up. In this situation, a bearing with good non-wetted frictional characteristics must be chosen. Zinc-free or low zinc Bronze has proven to be a good choice in this

ITT

Material Matters

Vertical Turbine Pumps In Seawater Service Continued...

service. For fluted rubber bearing, if the setting is over 50 ft, the line shaft bearings must be pre-lubricated prior to starting the pump.

Discharge heads

The discharge head serves several functions. It turns the flow from vertical to horizontal and provides a seal area where the shaft passes through to the atmosphere. It also aligns and supports the driver, and supports the column and bowl assembly.

A typical "L" Discharge Head construction is the most commonly used and is shown in ***Fig. 5.*** Configurations of discharge heads can be varied when fabricated. A "T" type head in which the suction and discharge lines are attached to the same discharge head is commonly used in "can" pumps mostly found in refineries, chemicals and power process applications.

The below ground style head is supplied when an underground piping connection is required.

For seawater service the most commonly used discharge head in seawater services is the "L" style.

Galvanic considerations also dominate the material selection criteria for the discharge head. Coating on steel discharge heads is a less expensive alternative than special metallurgy. If low cost is an important consideration, a combination construction of coated carbon steel and stainless steel parts will provide good service life. On small heads (10 in. and under), it is not possible to physically reach all welded joints to ascertain that no pinholes or crevices are present. Consequently, 10-in. heads and smaller should be furnished in alloy material.

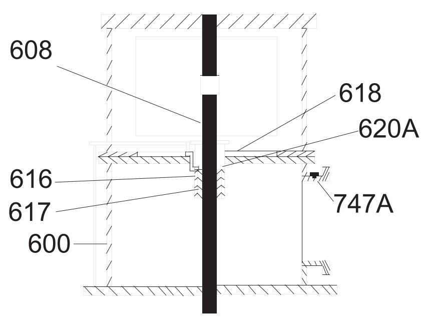
On 12-in. and larger heads, a combination of carbon steel and alloys can be furnished as follows:

1. 316SS RF discharge flanges will be furnished
2. The motor base should be of coated carbon steel, except for the fittings which will be of 316SS material.
3. The 316SS top column flange is bolted to the head baseplate or to the discharge head extension pipe. Since these components have registered fits, the discharge head extension pipe and column flange should be furnished in 316SS material. When the column is bolted directly to the head baseplate, an alternative to a 316SS plate, is a stainless steel weld overlay applied to the wetted exposed surface of a carbon steel coated baseplate.
4. Stuffing boxes, the discharge head stuffing box plate, and the mechanical seal housings should be 316SS material.

In the Al-Bronze alloy construction, the discharge head should be fabricated from Ni-Al-Bronze.

Fig. 5 illustrates and lists typical discharge heads components.

Discharge head construction ***Fig. 5***



Open Lineshaft

Item no.	Description
600	Discharge head
608	Head shaft
616	Stuffing box
617	Throttle bushing
618	Split gland
620A	Packing
747A	Pipe plug

Summary

The proper selection of vertical turbine pumps depends on many factors, including understanding of the service and operating conditions, depth or length of pump, abrasive and corrosive qualities of the seawater, materials availability, and a complete analysis of the seawater that is to be pumped, including biocide treatments and macro-fouling practices.

Answers to the following questions will help determine which type of pump construction best meets your needs.

First, how much money do you initially want to invest?

How long will the pumps be in service?

Will the pumps operate continuously or intermittently?

Is the seawater being chemically treated?

Are you willing to invest in more expensive materials initially to reduce the maintenance expenses associated with replacing pumps and parts?

Answers to these questions will tell you whether you need the protection afforded by the more expensive materials or coatings on less expensive materials.

2007 Industrial Process Engineering and Marketing Meeting

A combined Engineering and Marketing meeting was held in Seoul, Korea on September 18-21. There were over 40 engineering and marketing attendees from IP facilities around the world. The theme of the meeting was "Globally Aligned for Growth." Strategic plans, growth initiatives, and product development plans were reviewed to insure everyone was aligned with IP future growth objectives. Break out sessions were held for the API lite product, slurry pump product, and the IC product line to identify action plans for these three key product initiatives. A visit was also made to the Goulds Korea facility where a plant tour and presentation were given by I.K. Kim and his staff.

International President, Richard White, discusses the importance of global cooperation and communication with the engineering, marketing, and sales representatives at the kickoff dinner.

IP President Ken Napolitano delivers keynote address at the IP Engineering and Marketing dinner.

ITT IP engineers and marketing attendees from IP facilities around the world.

ITT Employee Donates Sculpture to Community

No, it's not the newest Arnold Schwarzenegger *Terminator* film creature. Audrey Iwanicki, an ITT Goulds Auburn Operations employee, created this sculpture from scrapped pump parts to honor "past, present, and future ITT Goulds employees." The unveiling of the sculpture took place Saturday, 10/20/07, at the 1.75-mile Frank J. Ludovico Sculpture Trail. The trail is home to numerous sculptures inspired by the women's rights movement and created primarily by women sculptors. Audrey incorporated pump components such as impellers and casings. She sculpted this lasting tribute that will fascinate visitors as they walk the Sculpture Trail for generations to come.

Sangiacomo Receives ITT and Goulds Scholarships

Marissa Sangiacomo Receives Two Honors

Marissa Sangicomo (with proud father Carl in attendance) receives her ITT Scholarship certificate from Ken Napolitano, President of ITT Industrial Process (left).

Marissa Sangiacomo recieved one of nine Goulds scholarships presented to select recipients based upon achievements including scholastic grades, class rank, test scores, and community service. The Norman J. and Anna B. Gould Scholarship was instituted in 1964 upon the death of Mr. Gould, former President of Goulds Pumps, Inc., who believed deeply in education.

Marissa is also the recipient of an ITT scholarship. She is one of 25 sons and daughters of ITT Corporation employees selected to receive the company scholarship this year. Winners, selected on the basis of outstanding academic achievement and personal accomplishments, were chosen from a group of 170 applicants from the families of approximately 20,000 U.S.–based ITT Corporation employees.

"We are proud to recognize these outstanding students, and to assist them in pursuing a higher education. We expect that they will follow in the footsteps of many past ITT scholarship winners who have gone on to promising careers in many fields," said Steve Loranger, Chairman, President and Chief Executive Officer of ITT Corporation. Since 1980 when this program was established, 1,620 scholarships have been awarded.

Marissa, daughter of Carl and Alisia Sangiacomo, graduated from Mynderse Academy in Seneca Falls. Carl Sangiacomo is Contract Administrator in Industrial Customer Support at ITT Goulds in Seneca Falls, NY.

Marissa, who maintained high honor roll all four years of high school, was a member of the National Honor Society and Myndersian yearbook staff. She participated in Jazz Band, Marching Band, Parade Band, Jazz Rock Ensemble, and Cheerleading throughout her four years of high school. Marissa was Yearbook Editor, received the Daughters of the American Revolution Award, Kodak Young Leaders Award, Junior Rotarian, and the Russel Sage College Book Award. She received acknowledgments in Character Education, All County Band, and NYSSMA Duet. Her participation in community activities included Relay for Life, Volunteering at Petro and Canal Fest. Marissa will major in Mass Communications and Journalism at St. Bonaventure University.

Send your comments or suggestions to:
John Beca, ITT Industrial Process
240 Fall Street, Seneca Falls, NY 13148
or e-mail: john.beca@itt.com
View the latest in equipment monitoring, maintenance services, fluid control, and pumping at: www.ittindustrialproducts.com