

# Calculating Pump Efficiency

**R**emember those first word problems in math that stumped the entire class? They typically involved two trains starting out from different locations heading toward the same destination. The trains travelled different routes at different speeds and it was your job to find out which one would reach its destination first. The killer question came, however, when the teacher asked you to figure out what speeds both trains should travel to reach the destination at the same time.

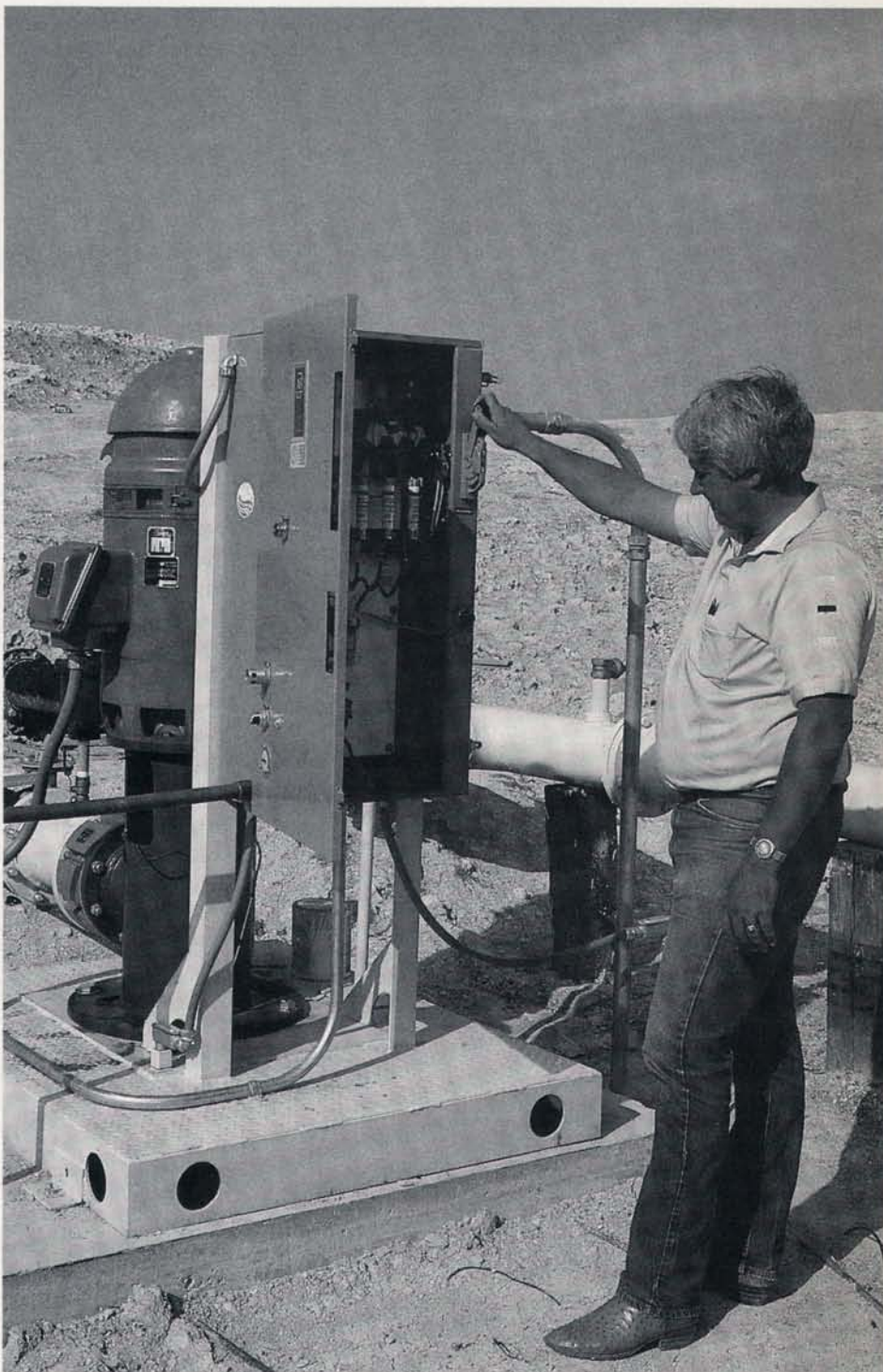
For the first time you were faced with balancing speed, time and distance together. If any one of these things changed, the other two also had to change for you to come up with the right answer. Most of us remember those math questions because they seemed so difficult at the time. We just hoped that we wouldn't be faced with questions like these later in life.

Questions such as these, like it or not, are a vital part of managing turf and landscape irrigation systems. Fortunately, today sports turf managers can rely on computers and irrigation consultants to handle many of the calculations necessary to balance water volume, pressure and time. Without math, it would be impossible to apply the correct amount of water to the proper locations at the right time. You need to know the pressure, the flow rate, and the distribution of water at each sprinkler head to set the right amount of time for each head or zone on the controller. But, most importantly, the irrigation system must have the ability to prevent all of these factors from changing during operation.

Irrigation manufacturers have been diligently developing products that take the guesswork out of controlling water application. They have refined their products to the point that irrigation specialists can design systems which deliver the exact amount of water as needed day in and day out. Those refinements begin at the pump station, continue to the valves, heads and fittings, and culminate with the controller and various devices that result in changes in water needs. But no matter what improvements are made, no irrigation system can attain maximum efficiency without a properly designed and functioning pump system.

Just 25 years ago turf irrigation was far from precise. Greens and tees were frequently watered by hand while fairways,

*continued on page 40*



**Prefabricated pump stations containing pumps, valves, hydropneumatic tank and electronic controls, are used for more than 75 percent of new installations. Photo courtesy: Pumping Systems, Inc.**

## Calculating Pump Efficiency

continued from page 38

roughs, parks and athletic fields were irrigated with quick couplers or other types of manual systems. The amount of water applied was based upon the experience of the irrigation manager and the appearance of the turf rather than knowing how much was really needed.

In those days, sprinkler heads operated at the pressure of the public water supply or of a simple pump system drawing water from a well or lake. This pressure could vary widely at times causing the amount of water applied during a specific amount of time to change. When a turf irrigation system is delivering thousands of gallons of water each day, a change in pressure can result in serious over- or underapplication leading either to waste or drought stress.

"Prior to the mid-'60s, all pump systems were different," recalls Gary Harbour, vice president of Carroll Childers Co., a manufacturer of prefabricated irrigation pump systems in Houston, TX. "About the only thing they had in common was a pump. Most were built on site by local contractors or superintendents according to their individual ideas and expertise. It was not uncommon to find a pump, with a suction line feeding directly out of a water supply, controlled only by a manual on/off switch."

The superintendent or irrigation specialist would simply put a pump on some kind of motor, describes Emil Gram, president of



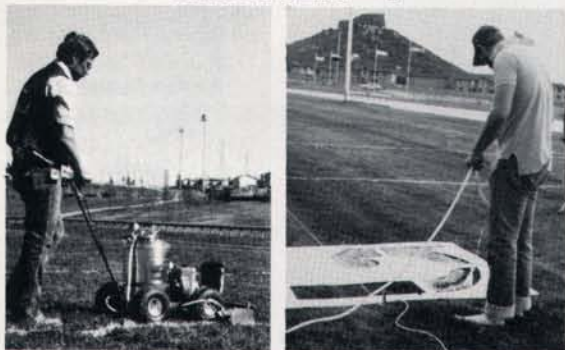
This pump, unprotected from weather and lacking pressure controls, is typical of older systems with poor energy efficiency.

Pumping Systems, Inc. (PSI), Dallas, TX. He would start up the system and then check to see what the end pressure was and how many gallons per minute (gpm) the pump system produced. If it wasn't sufficient for the requirements of the largest or highest zone, he would add another pump and another motor.

Gradually, sports turf managers added pressure relief valves and hydro-pneumat-

ic tanks between the pump and the irrigation main. These devices assured that the pressure in the lines remained at a constant, controllable level during operation. With pressure fixed at the pump station, the irrigation manager eliminated one major variable in determining water supply in the field. Then he realized that he could add a second or third pump in parallel with the main pump to match pumps more efficiently to

## IS YOUR FIELD A "WINNER"?



NEWSTRIPE can supply the products to make your sports surfaces the most attractive in your conference. Our line markers and stencils are being used by major universities, school districts and soccer clubs for field maintenance.

### Check these possibilities:

- Football
- Basketball
- Soccer
- Playgrounds
- LaCrosse
- Shuffleboard
- Baseball

**NEWSTRIPE** Inc.

P.O. Box 440881  
Aurora, CO 80044

CALL  
1-800-624-6706  
For Details

## FERTIGATION. . .



WITH:

## TURF N' JECTOR™

A METERING PUMP FOR INJECTING FERTILIZERS  
AND CHEMICALS IN YOUR SPRINKLER SYSTEM

SAVE LABOR AND FUEL COSTS

A PROVEN TURFGRASS MANAGEMENT TOOL

FOR FURTHER INFORMATION OR FREE BROCHURE, CONTACT:

**INJECT-O-METER MFG. CO., INC.**

820 Thornton Clovis, New Mexico 88101

(505) 763-4461  
1-800-545-4440

FAX 505-762-2497  
TELEX 9102502594

zones with higher or lower pressure or flow requirements.

Still the vast difference between pump systems made controlling the built-on-site units difficult. "Superintendents wanted more control over their pump systems, but because the proper equipment wasn't selected initially, controls were costly and cumbersome. We had to match the characteristics of certain pumps to the needs of the irrigation system," explains Harbour, "and provide the major control components ourselves so that the superintendent could have what he wanted. In short, we had to select and provide all the pumping equipment, not just the controls." Eventually the special needs of golf courses and other sports areas led to the selection of various components found on "prefabricated" pump systems today.

Prefabricated doesn't mean a manufacturer builds one type of pump station at his plant and ships it to all customers. Each system is designed for the particular customer to match the needs of his particular irrigation system. The system is then built to these specifications under controlled conditions at the company's plant and shipped to the site for installation. It is estimated that 75 percent of all pump stations built today are prefabricated.

The irrigation designer or pump system specialist selects a pump or combination of pumps as determined by the needs of the particular irrigation system—needs based on the irrigation programming and



Prefabricated pump station being lowered on to pad at golf course. Photo courtesy: Carroll Childers.

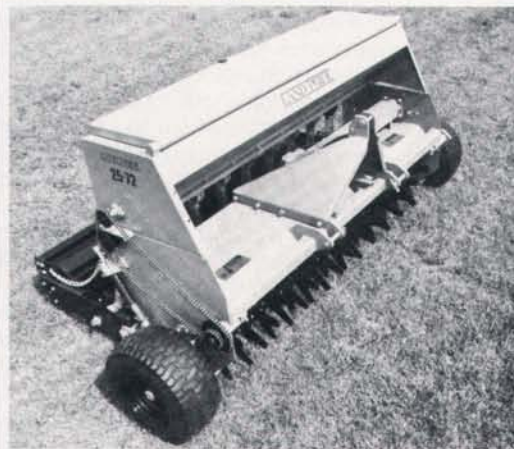
the sprinklers and other equipment being utilized.

The workhorse of turf irrigation is the centrifugal pump. There are two versions—the horizontal centrifugal pump and the vertical turbine. The horizontal centrifugal pump can be located above or below the water level and draws water from its source into the system. If located above water level, suction lift is provided by the impeller with blades

which spins around the axis of a shaft in a confined cavity. Once the suction line has been primed, water entering the pump at the center or eye of the spinning impeller is accelerated and thrown to the outer edge of the blades. This creates an increase in pressure. The water then escapes at higher pressure through a discharge nozzle located on the outer edge of the cavity.

*continued on page 42*

## Reseeding, Interseeding, and Overseeding With Accuracy And Durability... Only From Land Pride



The Land Pride Solid Stand Seeder features the precision and dependability synonymous with the Land Pride line. Proven fluted seed cups precisely meter grass seed for either slit or broadcast pattern.



Adjustable tickler tines help promote soil-to-seed contact. A smooth steel roller or solid cast iron packer wheels firmly pack the seed for proper germination. For a high output, user-accessible

overseeder with durability, see the Land Pride Solid Stand Seeder and your Land Pride dealer.

# LAND PRIDE

A DIVISION OF GREAT PLAINS MFG. INC.

BOX 218 / ASSARIA, KANSAS 67416  
TELEPHONE (913) 667-4755

**The fine family of landscaping equipment from Land Pride**



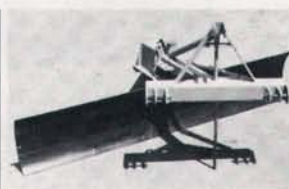
GROOMING MOWER



ROTARY TILLER



HYDRAULIC RETRACTABLE BOX SCRAPER



REAR BLADE



WALK-BEHIND AERATOR

**Calculating Pump Efficiency**  
continued from page 41

The centrifugal is a very versatile pump. By varying the diameter and pitch (tilt) of the impeller and the speed at which it turns, a pump can be made to provide a wide range of pressures and flow rates.

However, a plain centrifugal pump does not have the capability to lift water a great distance and cannot handle air in its suction line. Anyone with an old centrifugal well pump knows it has to be primed before it will start working. Should it lose prime during operation, repair costs can be extreme. To

*On a golf course or park, a booster pump may be used to provide enough pressure for heads in elevated areas.*

overcome this characteristic, centrifugal pumps are quite often installed below water level.

Vertical turbine pumps were first developed for deep-well service. They are normally suspended down into the water source and use multiple impeller and bowl sets called stages to develop the required pressure. As with the horizontal centrifugal pumps, water is propelled by an impeller from the center to the outside of a cavity. But the cavity or bowl of the vertical turbine is shaped to direct the flow of water upward to the next stage so it can create additional pressure. The efficiency of these units is better than most other pumps and they can produce higher pressures.

One thing to remember, says Harbour, is that these pumps often operate at different speeds. In order to develop the pressure needed, horizontal centrifugal pumps may operate at 3,600 revolutions per minute (rpm) whereas vertical turbines generally operate at 1,800 rpm. Lower operating speed can result in lower maintenance/repair costs and longer life.

A third type of pump being utilized in a growing number of pumphouses is a diaphragm pump. It operates on a back-and-forth or up-and-down stroke. One stroke fills a cavity on one side of the diaphragm with a liquid fertilizer or chemical. The next stroke forces the liquid into the irrigation line. This process is called fertigation or chemigation. The diaphragm pump injects a small, precise amount of liquid into the irrigation water for distribution on the turf.

Having the injector pumps in the pump house or near fertilizer storage tanks can present some problems with corrosion of the metal on the irrigation pump station. For this reason, AquaTurf of Jacksonville, FL, galvanizes the exposed components of their stations and protects control panels in stainless steel cabinets. "You have to protect the pump station from any hostile condition that might eventually affect its operation," explains Kent Curley, president of AquaTurf. "Once we have assembled all the components for a pump station, we take it apart and dip all the exposed metal before final assembly at the site."

Centrifugal pumps can also be used as "booster pumps." If water is supplied by a municipal water system, a booster pump may be used to increase the pressure of the municipal system to match the requirements of the sprinkler heads. On a golf course or park, a booster pump may be used to provide enough pressure for heads located in elevated areas. "It takes an additional 25 psi to raise water up to a zone 60 feet higher than the rest of the course," explains Harbour. "A booster pump located at the base of the elevated area can eliminate the need for a larger pump at the pump station."

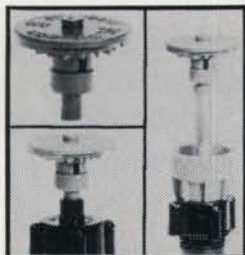
Rather than fighting gravity, a pump system should utilize it to maximum advantage. An elevated lake can serve a pumping system

continued on page 44

**EFCO, INC.**  
*Specialists in Irrigation*  
**"The Total Irrigation Concept"**



EIN-DOR, Adjusts From 6' to 50' in Diameter

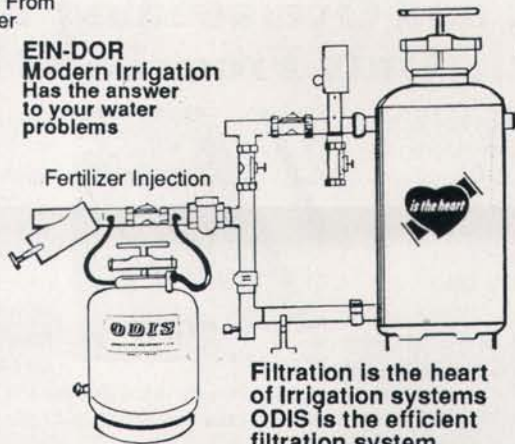


Pop up to 24"



New PopUp Low Volume 6" to 24" Rise

**EIN-DOR Modern Irrigation Has the answer to your water problems**



Mister Produces Fine Mist



Low Volume Bubble



Screen Water Filters



Automatic Water Circulating Filters



Sand Separator

**P.O. 3247, North Hollywood, California 91609**  
**(818) 763-2203 TELEX 5101013093 EFCO**

## Calculating Pump Efficiency

continued from page 42

tem just as municipal water towers do. For each foot of elevation a water source is located above a pump, nearly one-half pound of pressure per square inch is gained. The less pressure needed from the pump the more energy is saved. In some instances, it may be more efficient to pump water up to a holding reservoir than to develop all the necessary pressure with the pump system for a few hours of peak demand.

The cost of water today is based primarily on the cost of energy. As energy costs have risen, so has the cost of irrigation. Anything that reduces the amount of energy consumed by the pump system, increases the cost efficiency of irrigation.

Pump manufacturers work with sports turf managers to provide the greatest energy efficiency for the pump station while meeting all the various irrigation needs of the site. Today, an irrigation system at a golf course, park or stadium may include a wide range of flow and pressure requirements. Advanced controllers can link together the water needs of turf, plant beds and water features. They also provide the flexibility to adjust water application according to weather, soil types, sun or shade, slope, traffic levels and types of turfgrasses.

There is also a trend toward lower pressure sprinkler heads, says Larry Keesen, an irrigation consultant in Denver, CO.



Variable frequency pumps change speed to provide a range of pressure requirements. Photo courtesy: Western Pumping Systems.

"Heads that used to require 100 or more psi are being replaced with new heads that only need 60 to 80 psi." As a result, pressure from the pump station needs to be reduced.

All manufacturers agree that energy is wasted when the pressure from a pump has to be reduced by a valve. The ideal situa-

tion is to select pumps that closely match the pressure requirements of the various portions of the system so they require minimal pressure reduction. The sports turf manager has a great influence on the efficiency of the pumps as well. By scheduling the zones with the same pressure re-

continued on page 46

## GROOM AN INFIELD IN LESS THAN 20 MINUTES.



Easy Rider A.F.C. turns total baseball infield maintenance into a one man operation. Twenty minutes is all it takes.

The scarifier chops the crust and the free-floating rear rake adds the finishing touches. The grading blade may be used to fill and level the surface around the bases. For extra-fine finishing, a drag mat may be attached. 8 hp engine, mechanical drive.

Super A.F.C. with 3-wheel hydraulic drive also available.

# SMITHCO

WAYNE, PENNSYLVANIA 19087

## DISCOVER THE



PAT. U.S. #4383580  
CAN. #1773286/84



### Low energy aerifier

The AER-WAY turf aerifier is a low maintenance, low energy aerifier designed especially for hard compacted traffic and playing areas and sod establishment. It can be used for golf course fairways, parks, sports fields, cemeteries, school grounds, estates and wherever appearances are important.

There are several model sizes available to handle jobs large and small. The tines are available in either a 4 1/2 or 6 1/2 in. length.

The unique patented design fractures the soil between the tines enhancing the soil profile and its natural capillary action. This eliminates ponding and allows air, moisture and fertilizer to get to the root system maximizing growth and greener turf.

The tufts of grass produced by the aeration disappear with the first cutting. The "AER-WAY" now comes standard with a full width weight box, tow bar and parking stands, and optional passive or precision overseeders.

Contact your nearest Holland office or Aerway dealer for a demonstration.

## ADVANTAGE

FAST,  
EFFICIENT,  
LOW COST,  
LOW MAINTENANCE  
WAY TO  
TURFGRASS  
AERATION



Holland Equipment Limited, P.O. Box 339, 20 Phoebe St.,  
Norwich, Ontario N0J 1P0 Telephone (519) 863-3414  
Holland Hitch Western, Ltd., Cloverdale, B.C. V3S 5K1  
Telephone (604) 574-7491  
Holland Hitch of Texas, Inc., Wylie, Texas 75098  
Telephone (214) 442-3556

## Calculating Pump Efficiency

continued from page 44

requirements to run consecutively, the pumps do not have to expend energy to meet changing pressure needs.

There are two schools of thought on pump efficiency. The first is that certain pump/motor combinations are most efficient at certain speeds, flows and pressures. "Maximum efficiency is achieved by running a pump at its most efficient output," says Harbour. "The pump motors use the most energy when they are starting or speeding up." Running them at their most efficient level for as long as possible reduces energy waste.

Electric motors are matched to the rpm and flow characteristics of each pump to create the highest energy efficiency. This is one reason to incorporate more than one pump in a pump system. The "jockey pump" is the result of this type of energy saving. The small jockey pump can keep the irrigation system pressurized and allow for syringing or single-station operation without turning on a higher pressure, higher horsepower pump.

"The main purpose of everything we do in building our prefabricated stations is to maintain a constant downstream pressure, regardless of how the flow requirements may vary," explains Rick Allenstein, marketing manager for Carroll Childers.

The second school of thought is it is more

## A major source of energy savings has been running pumps at off-peak hours.

efficient to eliminate the waste caused by pressure reducing valves and to change the speed of the motor to maintain the proper pressure and flow requirements. There are some energy losses with "variable-frequency drive" pumps," explains Bob Whalen of Western Pumping Systems, Chandler, AZ, "but they are minimal and pumping efficiency is markedly improved." By using one pump for a range of outputs, fewer pumps are required.

There is also a second school of thought on pump pressure and flow. "Rather than using pressure to indirectly gauge flow," says Norm Bartlett with Data Industrial Corp., "we encourage superintendents to use devices that measure flow directly." Bartlett says that a small drop in pressure may cause a second or third stage pump to kick on, when the flow rate is still adequate. By controlling the pumps by flow instead of pressure, pumps may not have to cycle on or off as frequently, saving energy. Data Industrial's

flow measuring system can be linked with Motorola's MIR-5000 irrigation computer system. "Other manufacturers are considering flow rate control," Bartlett adds.

A major source of energy savings to sports complexes has been running pump systems at off-peak hours. Electricity rates can fall 20 to 35 percent in some areas from late evening to early morning. By scheduling irrigation during this period, thousands of dollars can be saved. Cramming all irrigation into this period may be impractical for large facilities. But, at the very least, zones requiring the highest pressure and output can be scheduled then. Sports turf managers and irrigation manufacturers are developing heads and controllers which speed up irrigation where possible. Repeat cycles are replacing long cycles to match water application to soil infiltration rates. Lower pressure heads and higher output heads can also speed up irrigation and lower pressure demand.

"Our job is to keep up with the changes made by the sports turf manager," states Harbour. "He changes programming regularly in response to the turf's changing irrigation needs and may make major changes in the equipment every few years. All these things affect the efficiency of the pump station. We have to provide them with both flexibility and efficiency."

For example, valve-in-head sprinklers per-

continued on page 48

## Ben Meadows Company Grounds & Lawn Care Catalog

Attention Groundskeepers, Lawn Care Professionals, Arboriculturists, and Horticulturists—

We now have a catalog designed just for you. 80 pages packed with

- ✓ Pruners and Shears.
- ✓ Climbing Equipment.
- ✓ Nursery Supplies.
- ✓ Weed Control Equipment.
- ✓ Clearing and Planting Tools.
- ✓ Protective Clothing and Equipment.
- ✓ Dozens of valuable new products.

Call or write today for your copy of the latest Ben Meadows Company Grounds & Lawn Care Catalog L19.

1-800-241-6401 Outside Georgia  
1-800-241-3136 In Georgia  
(404) 455-0907 In Atlanta



Professionals Serving Professionals!

**Ben Meadows Company**

3589 Broad Street, Atlanta (Chamblee), Georgia 30366  
Telephone 404/455-0907 / Cable Address "Benco"

5205B

## One bad Fall Could change a Child's whole Life

An educational, research, charitable,  
non-profit, tax-exempt organization

An extension of the Musser International  
Turfgrass Foundation collaborating with the  
United States Department of Agriculture

### Membership Application

- Sponsor ..... \$500+
- Corporate ..... \$500
- National Corporation ..... \$250
- Local Commercial ..... \$100
- Donor (not a member) ... Any Amount
- Contributor (Receives Mailings) ... \$25  
to any amount

I (We) wish to support NSTC in the above  
category (check appropriate box)

Name \_\_\_\_\_

Business/organization name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_

Please return this membership application and  
your check to: **National Sports Turf Council**

### Young athletes need your help

Let's look at reality... many, maybe even most, of our sports and playground surfaces are in deplorable condition. Many of these are unsafe and even treacherous. We still tolerate this even though we have the finest agronomic knowledge, turfgrasses and equipment at our disposal. Add this to our collective enthusiasm for physical activity... watching and participating... and we have a powerful force to construct quality fields, maintain them, and/or correct existing sports field turf problems. We believe that lack of vital information and blurred focus of intentions have slowed progress. NSTC will take all of this talent, information and material, focus, then project the essence into an active force for sports and playground safety.

Who do we need to get involved? Support from organizations, institutions and associations is essential, but individual efforts from parents, teachers and coaches is mandatory. We need input... emotional, testimonial, technical, statistical and physical. Then we need funds to fuel the mechanism. We need you.

We need community liaison, people who will grab the ball on a local level and run with it. We need people in the right places who can implement a plan to tackle a problem, devise game plans in the community and make them work. We need people of conscience who realize that falling is a part of physical activity and that getting up and shaking it off is a right, and pain and injury are not acceptable. We need you.

### You can help by joining today!

Become associated in some category with NSTC and with affiliated organizations.

Give financial aid to NSTC to assure continuity of Safer Sports Turf operations. Help implement plans on a local/community level.

Talk to others... get them involved.

Join today.

USDA-ARS-BARC  
Bldg. 001, Room 333  
Beltsville, MD 20705  
301/344-3655



## Calculating Pump Efficiency

continued from page 46

mit a sports turf manager to run one head at a time if he so desires. Short, mid-day syringe cycles are used frequently by golf course superintendents and sports field managers during the summer. Both require low pump output at times when the rest of the system is off. To power up a large pump for these cycles would be wasteful when a small jockey pump could do the job.

With the advent of lower pressure heads, pumps that were once needed to generate 90 psi now operate at just 60 psi. "Pumps that did not fit the high pressure systems before can now be used effectively in pump stations and save the sports facility money," Harbour says. With so many types of pumps and other pumping system components, it is no wonder that Bob Cloud, an irrigation consultant in Los Angeles, CA, warns that picking the right equipment can become confusing. "There are as many pumps as there are sprinkler heads. If not properly selected and used, they can cause more problems than they solve."

Cloud believes that pumping systems are too complex a subject for a busy sports turf manager to understand in full—there just isn't time to master all the combinations and calculations. Yet they are highly efficient when properly used.

"I think the most helpful thing I can do when advising someone is to get him to

## Today's pumps enable new irrigation systems to perform better.

respect all the different potentials of pumps," he says. When the sports turf manager appreciates the complexity of the subject, then hopefully he will rely on somebody who is a specialist on pumps. A growing number of sports turf managers are looking to manufacturers of prefabricated pump stations. "They can take various elements and requirements and efficiently provide a unit that will best serve the needs of that particular site, requiring less-skilled people to install, and resulting in a far more reliable unit."

Prefabricated systems allow irrigation contractors to do their thing, which is piping, fittings, wiring, sprinklers and controllers, says Bob Smith, of Triangle Manufacturing and Pump Co., Durham, NC. Smith believes most installers are not pump people. That is his company's line and he'll do whatever it takes to satisfy the customer's needs. That is why his equipment has no model names,

no series names and no trademarks.

The pump system industry has a very bright future, according to PSI's Gram. "There are more and more competitors entering the marketplace on a regular basis. The demand to irrigate parks and recreation areas of all types, as well as industrial areas, is increasing. New products are entering the market. The research and development now being pursued will continue to create highly efficient systems for the future."

"A designer can design an irrigation system to work properly at certain pressures and manufacturers can develop products to work within certain pressures, but neither will be acceptable if proper water pressures are not available," explains Sam Tobey, president of Salco Products Inc., a manufacturer of drip irrigation components. "Sports turf managers can adjust pressures downward for desired water requirements—but if supply-side pressures are continuously changing, these adjustments have no meaning."

A pump is the beating heart of an irrigation system. Today it pumps with a newer, more efficient beat, positioning itself at the leading edge of irrigation technology, thanks to recent improvements in pumping systems. Most importantly, today's pumps enable the newer and more sophisticated irrigation systems to perform better. That, of course, is what it's all about. ☺

## Improve your Athletic Fields with this versatile maintenance tool

Low-Cost  
**FUERST**  
F-L-E-X-I-B-L-E  
TINE  
HARROW®



### IT'S VERSATILE

Use it to keep your ball diamonds, football/soccer fields, cinder tracks and all turf areas in top condition. Dries drags and floats basepaths and skinned infields. *The only maintenance tool approved by Little League Baseball.* A single pass aerates, brings up thatch, crumbles and scatters cores without clogging. Prepares seedbeds without disrupting existing growth when overseeding worn areas. Works in seed and fertilizer. Revitalizes worn spots while it strengthens turf.

### IT'S TROUBLE FREE

Adjusts without tools for deep or light penetration or as a smoothing drag mat. Unique tines hug the turf at 6-8 mph. Never needs maintenance. Rolls up for easy storage. 4 to 42 ft. widths. *We guarantee your satisfaction.*

For FREE literature, testimonials, prices call toll-free 1-800-435-9630 (In IL call 217-784-4266) or write:



**FUERST BROTHERS, INC.**

P.O. Box 427-ST1, Gibson City, IL 60936

## SPRINKLERS REBUILT

  
**THE AMERICAN WAY**



SEND US  
THIS...

**SATISFACTION  
GUARANTEED**



WE'LL RETURN  
THIS...

**NO HASTLES  
IN BETWEEN**

We rebuild: Aqua Dial, Buckner, Rainbird, Royal Coach, Thompson, Weathermatic, Weather-Tec, Rain-O-Mat, & much more...

Large stock of sprinkler parts, valve parts, and a great selection of irrigation supplies. Do yourself a favor, call us today!

WE BUY  
OLD USED  
SPRINKLERS

  
**AMERICAN**

**IRRIGATION REPAIR & SUPPLY CO., INC.**

3270 Seldon Court #3 Fremont, California 94538

**(415) 659-8558**

GUARANTEED WORK  
GUARANTEED TURN-  
AROUND TIME!!!