FIELD PUMP TESTING
METHODS AND EQUIPMENT

Field pump tests, often referred to as Index Tests, are for the purpose of establishing field or actual condition and operating characteristics. These tests differ from pump laboratory tests in several important ways.

Laboratory tests are conducted in a controlled environment with prescribed hydraulic, mechanical and electrical equipment. The tests are carefully controlled and all test equipment meets prescribed standards. Normally, only the bowl assembly of a turbine type pump is tested for operating characteristics. (Hydraulic Institute (H.I.) 2.6.5.5, 4a.) All other conditions such as column losses and motor efficiencies are calculated. The results of the tests are normally plotted and presented as a head/capacity curve with additional curves for brake horsepower (BHP), pump efficiency and net positive suction head (NPSH) requirements.

Field tests are conducted with the same care but under conditions present in the field. The test technician is faced with the limitations of the installed equipment configuration. This may include the lack of unobstructed flow measuring locations of the prescribed length; poorly placed pressure measuring ports; cascading water in wells; gasses in the discharge flow; vortexing at the pump inlet; and difficulties in obtaining a suitable location to measure power input. Even with these difficulties present, a field test can be made with suitable accuracy by an experienced test technician.

The differences to keep in mind between laboratory and field tests are the limitations of both. A laboratory test certifies the performance of the pump bowls as assembled for a specific condition. The efficiency shown is pump efficiency which normally excludes the driver and any other influence above the pump discharge head.

A field test considers the entire pump installation including the driver and the water delivery system to the pump. It should be understood that the overall plant efficiency will always be lower than pump efficiency. Field tests should be conducted in accordance with H.I Test Procedures, Section 1.6, 2.6 and 11.6 to the fullest extent possible.

PROCEDURES

The following is a brief outline of the procedures and methods that should be used to conduct a field pump test. Its purpose is to first establish pump and/or well performance and then track that performance over time, usually with annual or biennial tests. A second and equally important purpose of the test is to enable the
pumper to obtain and maintain the highest operation efficiency possible. The first test should be conducted soon after the new pump is installed. Tests should also be conducted at interim times whenever an unusual condition develops or is suspected.

A field test has three basic measurements. They are capacity, total head and power requirement. These are all determined by actual measurement. All three measurements are equally important in determining overall plant efficiency. In addition, pump speed is measured on all but submersible pumps. In some instances sufficient data can be obtained for problem solving when one of the basic measurements is missing. The test instruments and methods are described below.

CAPACITY
The Hall Flowmeter is the most common and widely accepted pitot tube and manometer combination in Southern California. The Prandtl or Collins type single orifice pitot tube is the common and widely accepted pitot tube in Northern California.

Ten diameters of straight pipe are required for measurement and flow rates between three and seven feet per second provide maximum accuracy. In the hands of a skilled test technician, very good readings can be obtained with less than the recommended length of straight pipe and greater or lesser water velocities. In shorter runs of pipe, a ratio of about four to one should be maintained with the pitot tube installed about 80 percent of the distance down stream from any bend or disturbance. In the hands of a skilled test technician, the pitot tube is a very accurate field instrument for measuring capacity. An accuracy of plus or minus one and one half percent can normally be expected.

TOTAL HEAD
The total head of a well pump is the pumping water level (head below datum) plus the additional lift above datum expressed in feet. The total head of a booster pump is the suction head or lift subtracted from or added to the pump discharge pressure and expressed in feet. The centerline of the pump discharge pipe is normally the datum point. Pressures should be measured with calibrated, ½ percent accuracy pressure gauges. When possible, these pressure measurements are taken at the standard H.I. specified locations. Water levels in wells are measured with an electric sounder or airline.

A standard field test does not include any head losses within the pump assembly. There is often no accurate or practical means of verifying specific equipment installed in a well. The variables would be column length, suction pipe length, column or shaft sizes, bearing configuration, strainer, foot valve and its condition, etc. Even with exact equipment and engineering data, the passage of time and use makes any calculation merely an estimate.
POWER INPUT
Electric power input is measured in kilowatts and then converted to input horsepower. The kilowatt input can be measured through the utility billing meter or a portable power analyzer or kilowatt meter. In no case should an attempt be made to obtain kilowatts by the use of a volt and amp meter only. The stated accuracy of the electric utility billing meter is plus or minus two percent as allowed by the public utilities commission. In actuality, the accuracy is usually more like plus or minus one percent according to the utility company’s test departments. The accuracy of a good portable kW meter is 1½-2.0 percent.

From the above measurements the overall plan efficiency and energy required to produce a given quantity of water is calculated. From this information recommendations can be made for pump and system improvements and energy and operating cost reductions.