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PUMP CLINIC 11

SPECIFYING AND PURCHASING PUMPS

Pump Purchasing Sequence

The sequence involved in obtaining a pumping system, following the initial decision that pumping equipment is required for a system, and culminating with the purchase of the equipment, can be divided into the following general steps:

- Engineering of system requirements
- Selection of pump and driver
- Specification of pump
- Bidding and negotiation
- Evaluation of bids
- Purchasing of selected pump

In the process of specifying pumping equipment, the engineer is required to determine system requirements, select the pump type, write the pump specification, and develop all information and data necessary to define the required equipment for the supplier.

Having completed this phase of work, the engineer is then ready to take the necessary steps to purchase the equipment. These steps include issuance of the specifications for bids or negotiations, evaluation of pump bids, analysis of purchasing conditions, selection of supplier, and release of all data necessary for purchase order issuance.

It is imperative that a pragmatic approach be taken when specifying requirements. Too often, purchasers provide the same degree of specification, whether a pumpset is valued at $5000 or $500,000. It is possible that documentation and testing requirements can be greater than the cost of the equipment. The message is, 'resist using a sledgehammer to crack a walnut.'

Engineering of System Requirements

The first decision the engineer must make is to determine the requirements and conditions under which the equipment will operate.

Fluid Type
One of the initial steps in the defining of the pumping equipment is the development of physical and chemical data on the fluid handled, such as viscosity, corrosiveness, lubricating properties, chemical stability, volatility and amount of suspended particles.

Depending upon the process and the system, some or all of these properties may have an important influence on pump and system design. For example, the degree of corrosiveness of the fluid will influence the engineer's choice of materials of construction. If the fluid contains solids in suspension suitable types of pump seal designs and abrasion-resistant pump construction materials may have to be considered.

Fluid physical and chemical data of interest to the engineer should cover the entire expected operating range of the pumping equipment. The influence of such parameters as temperature, pressure and time upon the fluid properties, should also be considered.

System-Head Curves
The engineer should have a clear concept of the system in which the pumping equipment is to operate. A preliminary design of the system should be made and include an equipment layout and a piping and instrumentation diagram (or other suitable diagram), showing the various flow paths, their preliminary size and length, elevation of system components and all valves, equipment, piping specialties etc. which establish the system-head losses.

System Head Curves (Cont.)
The engineer should then determine the flow paths, flow rates, pressures and temperatures for various system operating conditions and calculate line, and estimate pipe runs.

With this information, the engineer can develop system-head curves which show the graphic relationship between flow and hydraulic losses in a pipe system. In calculating the hydraulic losses, the engineer may need to include adequate allowances for corrosion and scale deposits etc. in the system over the life of the plant.

Since hydraulic losses are a function of flow rate, piping sizes, and layout, each flow path in a system will have its own characteristic curve. Care must be taken when specifying pump characteristics to take into account the characteristic curve of each possible flow path served by the equipment.

In specifying pump equipment, it is convenient to add the effect of static pressure and elevation differences to the system-head curve to form a combined system-head curve. The resultant curve shows the total head required of the pumping equipment to overcome system resistance. The pump head must be at, or above, the combined system curve at all expected operating points, and for all flow paths the pumping equipment is expected to serve.

Alternate Modes of Operation
The various modes of operation of the system are important considerations when specifying pumping equipment:

- Is operation of the pumping equipment to be continuous or intermittent?
- Is the flow head to be fluctuating or constant?
- Will there be a great difference in flow and head requirements for different flow paths?

These and other questions arising from different modes of operation greatly influence such decisions as to the number of pumps, their capacities, and whether booster pumps are needed in some flow paths.

The engineer should also consider the continuity of service expected of the pumping system. This factor will influence the decision on number, type and capacity of installed spares and the quality expected of the equipment.

Frequently, reliability considerations will dictate the use of multiple pumps, such as 2 full-size pumps and 3 half-size pumps, or, where continuity is more important than full capacity, 2 half-size pumps. Where 2 half-size, 3 third-size etc. pumps are used, loss of 1 pump will cause the others to run-out on their system-head curves.

This run-out case should be evaluated when engineering the system and specifying the pump characteristics. This loss of a pump can occur no only by pump malfunction, but by motor failure, external damage, loss of power supply, loss of control power etc. The likelihood of these causes should be evaluated as part of the pump selection process.

Margins
Pumps are frequently specified with margins over and above the normal rating. Over any long period of time, it is possible that a system can operate at transient conditions, such as may be caused by changes in modes of operation, malfunction in system components, or electric system disturbances.

It is necessary for the engineer specifying the pumping equipment to examine the probability and duration of such transients and to specify adequate margins to allow the equipment to undergo such transients without damaging effects.

Margins (Cont.)
This also involves an evaluation of the combined effects of equipment cost, degree of criticality of the system, inconvenience due to unavailability of the equipment and other economic and technological factors.

Some transients often considered in design are pressure and temperature fluctuations, electric voltage and frequency dips. If the maintenance of continuous flow is important, then adequate margins must be allowed in the pump rating. For example, margins are added to the pump head and capacity to allow the pumping equipment to maintain rated flow in case of small electric frequency dips.

In addition, certain design features may be included to allow the pumps to operate without damage through such transients as suction pressure dips which can cause cavitation. Pumps should not be purchased for capacities greatly in excess of requirements. An over-sized pump could operate at capacities less than those recommended by the manufacturer which could present mechanical and hydraulic problems.

Wear
Wear is an ever-present factor in equipment and system design. No material that is handling fluids or used in contacting moving surfaces is free from wear. Thus, operating characteristics of both the pumping equipment and the system can be expected to change due to wear as time goes by. The engineer should assess the extent of such wear over the life of the plant and provide adequate margins in the system parameters so that the pumps can provide the expected flow, even at the end of equipment life.

Where abrasive or suspended materials are handled, pumps with replaceable liners are frequently specified. These liners are usually made of either resilient material such as rubber compounds, or extremely hard alloys of cast iron. In addition, plastic linings (including impellers) are also frequently chosen for these types of services.

In some applications, especially in power plants, the expected pump life is specified as the same as plant life. However, the design life of a pump is a decision based on an evaluation of economic factors. The wear margin to be added is a function of such factors as mode of operation (continuous or intermittent) and fluid properties (abrasiveness, corrosiveness).

Future System Changes
A final factor to be considered in the engineering system requirements for pumping equipment is the possibility of providing for future system changes. If the system changes can be predicted with any degree of certainty, then the system can be designed to enable the changes to be effected with minimum disturbance to operation.

Thus it is important to review the possibilities and effects of such future system changes as well as provide pumping equipment to satisfy the immediate system requirements.

The engineer should attempt to present future requirements based on projection of available data and then evaluate the possibility and desirability of designing the equipment to allow for the changes (such as providing extra flow or head margins or specifying a pump with impeller less than the maximum for a given casing size) versus the desirability of modifying the whole system, including the pumps, when the changes are made in the future.

In any event, it must always be kept in mind that the equipment must operate satisfactorily in the *present* system and this should be a factor in whatever evaluation is being made.

Selection of Pump and Driver

The selection of the pump class and type for a particular application is influenced by such factors as system requirements, system layout, fluid characteristics, intended life, energy cost, code requirements and materials of construction.

Basically, a pump is expected to fulfil the following functions:

- Pump a given capacity in a given length of time
- Overcome the resistance in the form of head or pressure imposed by the systems while providing the required capacity

The behaviour of the system has a very important bearing on the choice of pump:

- What are the required heads and capacities at different loads?
- Does the required head increase or decrease with changes in capacity?
- Does the required head remain substantially constant?

These are some of the questions the engineer must answer.

Pump Characteristics
Constant-speed reciprocating pumps are suitable for applications where the required capacity is expected to be constant over a wide range of system head variations. This type of pump is available in a wide range of design pressures, from low to the highest produced. However, the capacity is relatively small for the size of the equipment required.

That the output from a reciprocating pump will be pulsating is a factor to be considered. Where this is objectionable, rotary pumps may be required. However, the application of rotary pumps is limited to low to medium-pressure ranges.

Centrifugal pumps are often used in variable-head, variable-capacity applications. Straight centrifugal pumps are generally used in low to medium, to high-pressure applications, while low-head, high-flow conditions suggest that an axial-flow pump may be more suitable. Mixed-flow impellers are used in intermediate situations.

It should be noted that some reciprocating and rotary pumps may be self-priming, but centrifugal pumps, unless specifically designed as such, are not. This may be an important consideration in certain applications.

In some cases, the system layout can influence the decision on the choice of pump type. In general, centrifugal pumps will require less floor space than reciprocating pumps, and vertical pumps less floor space than horizontal pumps. However, more head room may be required for handling the vertical pumps during maintenance and installation.

Where the available NPSH is limited, such as when a saturated liquid is being handled, and the application calls for a centrifugal pump, the engineer may have to investigate the use of a vertical canned-suction centrifugal pump to gain adequate NPSH. In other cases, the design may call for the installation of a pump immersed in the liquid handled, and here a vertical turbine pump may be advantageous.

Code Requirements
The construction ratings and testing of most pumps normally used in industry are governed by codes such as the ISO, ANSI, API or the Standards of the Hydraulic Institute. However, other codes of regulatory bodies may impose additional requirements which can affect both pump rating and construction. For example, the Boiler and Pressure Vessel Code requires feed pumps to be capable of feeding the boiler when the highest set safety valves are discharging.

Fluid Characteristics
Fluid characteristics such as viscosity, density, volatility, chemical stability and solids content are also important factors for consideration. Sometimes, exceptionally severe service may rule out some classes of pumps at once. For example, the handling of fluids having solids content will exclude the use of reciprocating piston pumps, or pumps with close clearances.

Rotary pumps are suitable for use with viscous fluids, such as oil or grease, whereas centrifugal pumps can be used for both clean, clear fluids, and fluids with high solids content. On the other hand, if it is undesirable for the process liquid to come into contact with the moving parts, diaphragm pumps may have to be used.

Pump Materials
Materials are affected by both the pumped fluid and the environment. Resistance to corrosion and wear are two of the more important material properties in this regard, and the engineer should evaluate materials to determine which are most suitable and economical for the purpose intended. Often this becomes an evaluation for the desirability of specifying expensive long-life materials versus specifying cheaper materials which must be frequently replaced.

Operating factors, such as type of service (continuous or intermittent, critical or non-critical), running speed preferences (high or low) and intended life, will also influence the engineer’s decision. For example, equipment used in continuous and/or critical service will generally demand heavier duty design and construction than equipment for intermittent and/or non-critical service. High-speed operation, if allowed, will permit the use of smaller, usually less expensive equipment.

The life of the equipment cannot be predicted with certainty. For a given life expectancy, the engineer must evaluate the effects of materials of construction, design, severity of service etc. before making a choice.

Driver Type
The choice of driver type for the pumping equipment is as important as choosing the pump, for frequently the driver can cost more than the pump. Depending on the available energy sources, pumps may be driven by electric motors, steam turbines, steam engines, gas turbines, or internal combustion engines. Also, pumps may be driven at constant speed or at variable speed. Variable speed can enable centrifugal pumps to operate along the system-characteristic curve and thus save on power for part-load operations.

Electric motor drives are usually used in constant-speed service unless a hydraulic coupling or other speed-varying device is introduced into the system. Internal combustion engine drives are usually chosen because of location (no electric power available), portability, or redundancy (loss of power back-up) requirements.

They can operate as either constant-speed for variable-speed drivers. Steam turbines, eddy-current couplings, adjustable-speed motors, fluid couplings, and gears and belts are frequently used where variable-speed operation is required.

In large, complex installations where the equipment is to be operated continuously, the decision as to type of driver and variability of pump speed should be based on a comparison to the total operating and capital costs for the pump system over the intended plant life for the several alternatives.

Variable-speed operation would usually result in lower operating costs. However, the total first cost of the driving equipment to accomplish this would frequently be higher than for constant-speed equipment. The first cost should include cost of equipment, building space etc and the operating cost should include such factors as energy costs, maintenance, and replacement costs. This comparison usually results in the choosing of a pumping unit that provides the lowest cost per gallon pumped over the useful life of the plant.

Driver Type (Cont.)
It should be recognised that these are general guidelines and that there may be overriding non-technical and non-economic factors, such as prior satisfactory experience or excellent technical or service assistance which may dictate the final choice of pumping equipment.

Pump Specifications

Specification Types
When selecting a pump, the first decision to be made is whether the procurement will be based upon a formal specification, or whether some abbreviated form of requirements will be suitable. For relatively simple or inexpensive pumps, or for replacement pumps where duplication is desired, a specification is frequently not used.

For inexpensive pumps, the time and cost required to write a specification and obtain and analyse competitive bids, frequently exceed the potential cost-savings. In this case, and where the pump supplier is already established (replacement/duplication), a direct quotation is frequently requested from the supplier. It is important, when requesting this quotation, to have the principal requirements well defined and known to the supplier so that they can be properly included in the technical, and priced, offering.

Thus, while a formal specification may not be appropriate, the purchaser should have the requirements well established.

Attached are four (4) data sheets that can be utilised for enquiry purposes. As a minimum, details under Operating Conditions and the Quantity required are to be defined by the purchaser.

Where a formal specification is indicated, the type to be written is of fundamental importance. In most cases, the specification will be of the performance type rather than the construction type. The performance specification basically establishes the performance which the pump must achieve and does not attempt to dictate pump design or construction methods, although certain details of construction are frequently established, particularly where choices may exist.

For example, where either leak-off or mechanical shaft seals may be offered, the performance specification usually states a preference. The performance specification, however, basically establishes 'what' not 'how'.

The construction specification establishes in some detail the type of design, construction, and methods to be employed in designing the pump and certain other features which, if the performance specification is utilised, are left to the manufacturer's discretion. From the standpoint of legal responsibility, if a construction specification is used, manufacturers may respond and advise that since the purchaser has established certain design features of the pump, the manufacturer cannot be responsible for the performance.

It is therefore, important that care be taken when writing a construction specification not to relieve the manufacturer of responsibility for applicability, suitability, and performance and that care also be exercised by the purchaser to avoid any unnecessary assumption of responsibility for the proper performance of the pump.

In short, unless there are unusual circumstances, it is far more appropriate to specify the pump on the basis of performance required, rather than construction, unless the purchaser has a high degree of assurance that the requirements called out in the specification can be met and that the pump supplier will not be relieved of responsibility.

Codes and Standards
When specifying a pump, the codes and standards that apply are of major importance. Standards relating to quality of materials should be referenced ANSI, ISO, API or other industrial standards which establish such factors as metallurgy, dimensions, tolerances, and flange facing and drilling should be referenced where appropriate. Similarly, if a pump is to meet certain critical service requirements, there are, in many cases, industrial codes which apply to design, construction and application.

An example of this is the ASME Boiler and Pressure Vessel Code, Section III. These codes, in some cases, are extremely detailed in specifying pump construction and are a rather well-defined specification in themselves. It is, of course, essential to establish the dimensional standards which apply, such as SI or English, the codes which may apply to the construction and fittings of the pump and the industrial codes that apply to the application of the pump for the service intended.

In all cases however, the engineer must review each reference to ensure that it does not introduce conflict. Some codes and standards include alternate choices of material or inspection methods requiring selection by the engineer. Others may include cross references to additional codes which the engineer may wish to exclude.

Alternates
It is extremely difficult for a specification to cover all possible pumps offered by various manufacturers. Coupled with that is the problem faced by a potential user in remaining up-to-date with the changing state-of-the-art, and the development work being performed by manufacturers.

It is good practice to allow manufacturers to offer alternatives. This gives them an opportunity to present their best offer and also gives the buyer the advantage of obtaining potentially attractive, alternate offerings. However, the choice of whether or not to accept the alternates is fully up to the purchaser who may choose to reject any, and all bids, including alternates.

Bidding Documents
The bidding documents for pumps normally consist of two major parts:

1. Technical specifications
2. Commercial terms

The technical specification establishes the performance requirements, materials of construction and major technical features. The commercial terms include the contract language and cover such items as the location of the work, requirements for guarantees/warranties, shipping method, time of delivery, method of payment, normal inspection and expediting requirements.

Frequently, the commercial terms and conditions are relegated to second place, especially when standard inexpensive pumps are being bought, but in many cases, the commercial terms can assume more significance than many of the performance requirements.

Technical Specification
The technical specification should consist of a series of carefully defined and distinct sections. The more complete and specific the specification, the more competitive will be the bid prices. A typical specification might contain the following:

1. <u>Scope of work</u>: Pump, baseplate, driver (if included), interconnecting piping, lubricating oil pump and piping, spare parts, instrumentation (pump-mounted), erection supervision.
2. <u>Work not included</u>: Foundations, installation labour, anchor bolts, external piping, external wiring, motor starter

3. Rating and service conditions: Fluid pumped, chemical composition, temperature, flow, head, speed range, preference, load conditions, overpressure, run-out, off-standard operating requirements, transients.
4. Design and construction: *Care should be taken to provide latitude in this section, as this borders on dictating construction requirements.* Codes, standards, materials, type of casing, stage arrangement, balancing, nozzle, orientation, special requirements for nozzle forces and movement (if known), weld-end standards, supports, vents and drains, bearing type, shaft seals, baseplates, interconnecting piping, resistance temperature detectors, instruments, insulation.
5. Lubricating oil system (if applicable): System type, components, piping, mode of operation, interlocks, instrumentation.
6. Driver: Motor voltage standards, power supply and regulation, local panel requirements, wiring standards, terminal boxes, electric devices. For internal combustion drivers, fuel type preferred (or required), number of cylinders, cooling system, speed governing, self-starting or manual, couplings or clutches, exhaust muffler.
7. Cleaning: Cleaning, painting, preparation for shipment, allowable primers and finish coats, flange and nozzle protection, integral piping protection, storage requirements.
8. Performance testing: Satisfactory for service, smooth-running, free of cavitation and vibration, shop tests for pump and spare rotating elements, hydrostatic tests, test curves, field testing.
9. Drawing and data: Drawings and data to be furnished, outline, speed versus torque curves, WK^2 data, instruction manuals, completed data sheets, recommended spare parts.
10. Tools: One set of any special tools.
11. Evaluation basis: Power, efficiency, proven design.

Supplementing these may be technical specifications relating to other requirements of the order, such as specifications for the electric motor, steam turbine, or other type of driver, a specification on marking for shipment, a specification on painting, and requirements for any supplementary quality control testing.

In addition, it is important that any unusual requirements be listed in the technical specification so that the manufacturers are aware of them. Examples of these are special requirements for repair of defects in pump castings, a sketch of the intake arrangement for wet-pit applications and special requirements regarding unique testing, for example, metallurgical testings which may be required during manufacture, apart from performance testing.

It is helpful to the pump supplier to provide system-head curves, sketches of the piping system (dimensioned if this is significant), listing of piping and accessories required etc.

Pump data sheets are extremely useful in providing a summary of information to the bidder and also in allowing the ready comparison of bids by various manufacturers. As can be noted, by inspecting these sheets, some of the items are filled in by the purchaser and the balance by the bidder to provide a complete summary of the characteristics of the pump, the materials to be furnished, accessories, weight etc. The data sheets should be included with the technical specification.

Commercial Terms
The commercial terms included with the bidding documents should cover the following information:

1. General: Name of buyer, place to which proposals are to be sent, information on ownership of documents, time allowed to bid, governing laws and regulations.
2. Location of plant site: This establishes the geographic area in which the equipment is to perform and in a broad way the scope of the work. It should also state maximum temperatures, humidity, storage provisions (indoor or outdoor), and altitude (so that the motor drivers can be selected for the proper cooling).

3. Proposal: This establishes the format of the proposal, number of copies, owner's right to accept or reject any bids, status of alternates.

4. Schedule: Including requirements for all drawings and design data submittals, manufacturing schedule, and equipment delivery.

5. Acceptable terms of payment, retention, liquidated damages

6. Transportation: Transportation to and from point of use (or installation) is frequently a consideration, since with very large equipment, it may not be possible to ship by truck and it may be necessary to either barge, rail or ship the material. In addition, it is important to establish the method of shipment which may be used so that the bidder can include the proper allowance for freight and to establish responsibility for the risk of loss.

   Thus a bid could either include a freight allowance, that is, be FOB manufacturer's plant WFA (with freight allowed) to point of use, or be FOB point of use, in which case freight is included. In either case, the risk of loss remaining with the seller and that assumed by the purchaser should be clearly stated.

Special Considerations

Performance Testing
An important part of any specification is the requirement for testing. Normally, small commercial pumps that are routinely produced by a manufacturer, up to about 6in (150mm) are tested on a sample selection, quality control basis and from that, standardised curves of pump performance are available. Thus for pumps of this size, it is not necessary to require certified tests unless the pumps are to be used in critical service, such as fire protection or boiler feed.

However, for larger pumps or pumps with more critical service requirements, a certified performance test should be required. This test requires the manufacturer to test the pump at several points on its performance curve to establish its exact head curve. Since it is necessary to assure the pump driver is of the proper size, power curve must be furnished with the head curve.

Occasionally, pumps for special services or extremely large pumps cannot be tested in the manufacturer's shop. Examples of this are very large low-head pumps for circulating water service, low-lift irrigation pumps and pumps for liquid-metal service. The actual performance testing in this case takes place following installation of the pump.

It is important that the purchaser and the supplier agree upon a proper (field) test method in some detail. This method should include the number of points at which the head curve will be determined, the applicable code, the specific method of traversing the pump discharge characteristics across the cross-section of the discharge pipe, and the manner in which the head will be varied.

Care should be taken in establishing this procedure to set forth the characteristics of the fluid and other variables which can affect the performance test. The specification should establish the performance testing requirements for the pump and whether or not it is necessary the testing of the pump be witnessed.

Witnessing and furnishing of certified test data (including the test work done) are frequently priced separately and if not specified, can be a source of dispute between purchaser and supplier.

Pump Drivers
Pump drivers (motors, turbines, engines etc) can be purchased either with the pumps or separately. With small pumps, pumps using 'monobloc' construction (where the pump is mounted on, and supported by, the motor) and pumps built to special codes, such as 'Underwriters' engine-powered fire pumps, there is not usually any cost-advantage to buying the driver separately.

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Pump Drivers (Cont.)
Where the driver is excluded from the pump scope of supply, the specification should require the pump supplier to determine the proper characteristics of the driver. This includes establishing the proper motor speed, sizing the driver for both accelerating and running loads, assuring end-float compatibility and/or thrust-bearing loadings (including direction), and selecting and fitting the couplings.

If the driver is purchased separately and can be economically and conveniently shipped to the pump supplier's plant, the pump supplier should be required to mount the driver half of the coupling, as well as align and mount the driver (for common baseplate installations). For very large drivers, or where it is costly or impractical to ship the driver to the pump supplier, it will be necessary to perform this work at the point of installation. To assure compatibility with the other drivers in the plant, it is important to specify the driver enclosure type, insulation standards, and special features required, such as heaters and oversize junction boxes.

For steam turbine drivers, speed range, throttle pressure, steam quality, exhaust pressure and control method should also be specified.

Intake
Vertical wet-pit pumps are sensitive to the geometry of their suction pit. Factors to consider include clearance beneath the bottom of the suction bell and the floor of the pit, spacing between pumps or between the pump and the pit walls (both side and rear), the approach angle of the floor of the pit (including surging and surcharge), submergence and lack of uniform approach flow.

The standards of the Hydraulic Institute include recommendations on the geometry of the intakes. These, as well as the recommendations of the pump manufacturer, should be carefully reviewed. Suction piping, where complex or unusual, should be treated in a similar manner

When specifying vertical wet-pit pumps, a layout of the installation should be furnished to the bidders for their information and comment. In many cases, if the geometry of the installation is not fixed, bidders can recommend small changes to improve pump performance. Where the geometry is fixed, it may be necessary to add anti-vortexing baffles, surge walls, or flow-directing vanes (or walls) to avoid pump operating problems.

For moderate or large installations where any design question exists, model testing may be considered. Several pump manufacturers offer this as a service, as do a number of universities and commercial testing laboratories. Responsibility for proper pump performance will rarely be assumed by the bidder when the intake pit is of non-optimum size or shape. The use of model testing is usually resorted to in these cases also.

Drawing and Date Requirement Forms
The purchase should define the type of drawings and data required both for preliminary design purposes and for final information, that is, the as-built dimensions and the certifications which demonstrate that the pump meets the specified requirements.

Attached: 4 x Data Sheets
1. Positive Displacement Pump
2. Seal/less Centrifugal Pump
3. Centrifugal Pump
4. Vertical Extended Spindle Pump

KELAIR PUMPS AUSTRALIA

Positive Displacement Pump

Data Sheet No.	
Issue No:	
Prepared by:	
Checked by:	

Client:	Date:
Service:	Quotation No:
Site/Plant:	Contract No:
Item No:	Job No:
Quantity:	Serial No:
Pump Mfr:	Client Order No:
Model:	Date Req'd:

OPERATING CONDITIONS

Fluid Pumped:	
Solid Content % by Wt:	
Solid Size:	(mm)
Temperature:	(Deg)
Specific Gravity at Temp.:	
Viscosity at Temp.:	(cst)
Discharge Pressure:	(kPag)
Suction Pressure:	(kPag)
Differential Pressure:	(kPa)
Differential Head:	(m)
Flow Rate:	(L/s)
NSPH Available:	(m)
pH Value:	

PERFORMANCE

Speed:	(RPM)
Efficiency:	(%)
Power Design:	(kw)
NPSH Required:	(m)
No. of Stages:	
Curve No:	

MATERIALS

Casing:
Rotor/Screw:
Shaft:
Stator:
Internal Bearings:
Seal Plate:
Jackets:
Relief Valve:

SEALING AND FLUSHING

Seal Type:	
Seal Mfr:	
Seal Model:	
Seal Flushing Plan:	
Flushing Pressure:	(kPag)

REMARKS

Form KF006 (5/92)

CONSTRUCTION

Pump Type:
No. of Stages:

Nozzles	Size(mm)	Rating	Facing	Location
Suction				
Discharge				

Radial Bearing Type:
Thrust Bearing Type:
Lubrication:
Relief Valve:
Jackets:

BASEFRAME AND PAINTING

Base Type:
Material:
Size:
Surface Preparation:
Paint Specification:
Guard Type/Material:

TESTING

Performance:	Witnessed / Certified / N.A.
Hydrostatic:	Witnessed / Certified / N.A.
N P S H:	Witnessed / Certified / N.A.
Test Pressure : Case:	(kPag)
Jacket:	(kPag)

DRIVER

Driver Type:		
Mfr:		
Model/Frame Size:		
Enclosure:		
Power:	kw	RPM
Power Supply:		

TRANSMISSION

Coupling Type:	
Coupling Size:	Vee Belt Size:
Pump Shaft:	Pump Pulley:
Drive Shaft:	Drive Pulley:
Manufacturer:	

PRICING

Pump (each net):	A$
Driver (each net):	
Extras:	

Exchange Rate Variation:
Delivery:
Delivery Basis:

KELAIR PUMPS AUSTRALIA

Seal/less Centrifugal Pump

Data Sheet No.	
Issue No:	
Prepared by:	
Checked by:	

Client:	Date:
Service:	Quotation No:
Site/Plant:	Contract No:
Item No:	Job No:
Quantity:	Serial No:
Pump Mfr:	Client Order No:
Model:	Date Req'd:

OPERATING CONDITIONS

Fluid Pumped:	
Solid Content % by Wt:	
Solid Size:	(mm)
Temperature:	(Deg)
Specific Gravity at Temp.:	
Viscosity at Temp.:	(cst)
Discharge Pressure:	(kPag)
Suction Pressure:	(kPag)
Differential Pressure:	(kPa)
Differential Head:	(m)
Flow Rate:	(L/s)
NSPH Available:	(m)
pH Value:	

PERFORMANCE

Speed:	(RPM)
Efficiency:	(%)
Power Design:	(kw)
Power Max:	(kw)
Impeller Design:	(mm)
Impeller Min/Max:	(mm)
NPSH Required:	(m)
No. of Stages:	
Min. Continuous Flow:	(L/s)
Curve No:	

MATERIALS

Casing:

Impeller:

Shaft:

Shroud:

Casing Wear Ring:

Impeller Wear Ring:

Internal Bearing:

Torque Ring:

Elastomers/Gaskets:

ANCILLIARIES

Jackets:

Thermocouple:

P.P. Switch:

Flow Switch:

Inline Filter:

REMARKS

CONSTRUCTION

Pump Type:

Case Mounting:

Nozzles	Size(mm)	Rating	Facing	Location
Suction				
Discharge				

External Thrust Bearing Type:

External Radial Bearing Type:

Lubrication:

Impeller Type:

Jackets:

BASEFRAME AND PAINTING

Base Type:

Material:

Size:

Surface Preparation:

Paint Specification:

Guard Type/Material:

TESTING

Performance:	Witnessed / Certified / N.A.
Hydrostatic:	Witnessed / Certified / N.A.
N P S H:	Witnessed / Certified / N.A.
Test Pressure : Case:	(kPag)
Jacket:	(kPag)

DRIVER

Driver Type:

Mfr:

Model/Frame Size:

Enclosure:

Power: kw RPM

Power Supply:

TRANSMISSION

Coupling Type:	
Coupling Size:	Vee Belt Size:
Pump Shaft:	Pump Pulley:
Drive Shaft:	Drive Pulley:
Manufacturer:	

PRICING

Pump (each net): A$	
Driver (each net):	
Extras:	

Exchange Rate Variation:

Delivery:

Delivery Basis:

KELAIR PUMPS AUSTRALIA

Centrifugal Pump

Data Sheet No.	
Issue No:	
Prepared by:	
Checked by:	

Client:	Date:
Service:	Quotation No:
Site/Plant:	Contract No:
Item No:	Job No:
Quantity:	Serial No:
Pump Mfr:	Client Order No:
Model:	Date Req'd:

OPERATING CONDITIONS

Fluid Pumped:	
Solid Content % by Wt:	
Solid Size:	(mm)
Temperature:	(Deg)
Specific Gravity at Temp.:	
Viscosity at Temp.:	(cst)
Discharge Pressure:	(kPag)
Suction Pressure:	(kPag)
Differential Pressure:	(kPa)
Differential Head:	(m)
Flow Rate:	(L/s)
NSPH Available:	(m)
pH Value:	

PERFORMANCE

Speed:	(RPM)
Efficiency:	(%)
Power Design:	(kw)
Power Max:	(kw)
Impeller Design:	(mm)
Impeller Min/Max:	(mm)
NPSH Required:	(m)
No. of Stages:	
Min. Continuous Flow:	(L/s)
Curve No:	

MATERIALS

Casing:
Impeller:
Shaft:
Shaft Sleeve:
Casing Wear Ring:
Impeller Wear Ring:
Seal Plate:
Wear Plate:
Elastomers/Gaskets:
Jackets:

SEALING AND FLUSHING

Seal Type:
Seal Mfr:
Seal Model:
Seal Flushing Plan:

Flushing Pressure: (kPag)

REMARKS

Form KF004 (5/92)

CONSTRUCTION

Pump Type:
Case Mounting:

Nozzles	Size(mm)	Rating	Facing	Location
Suction				
Discharge				

Radial Bearing Type:
Thrust Bearing Type:
Lubrication:
Impeller Type:
Jackets:

BASEFRAME AND PAINTING

Base Type:
Material:
Size:
Surface Preparation:

Paint Specification:

Guard Type/Material:

TESTING

Performance:	Witnessed / Certified / N.A.
Hydrostatic:	Witnessed / Certified / N.A.
N P S H:	Witnessed / Certified / N.A.
Test Pressure : Case:	(kPag)
Jacket:	(kPag)

DRIVER

Driver Type:
Mfr:
Model/Frame Size:
Enclosure:
Power: kw RPM
Power Supply:

TRANSMISSION

Coupling Type:	
Coupling Size:	Vee Belt Size:
Pump Shaft:	Pump Pulley:
Drive Shaft:	Drive Pulley:
Manufacturer:	

PRICING

Pump (each net): A$	
Driver (each net):	
Extras:	

Exchange Rate Variation:
Delivery:
Delivery Basis:

KELAIR PUMPS AUSTRALIA

Vertical Extended Spindle Pump

Data Sheet No.	
Issue No:	
Prepared by:	
Checked by:	

Client:	Date:
Service:	Quotation No:
Site/Plant:	Contract No:
tem No:	Job No:
Quantity:	Serial No:
Pump Mfr:	Client Order No:
Model:	Date Req'd:

OPERATING CONDITIONS

Fluid Pumped:	
Solid Content % by Wt:	
Solid Size:	(mm)
Temperature:	(Deg)
Specific Gravity at Temp.:	
Viscosity at Temp.:	(cst)
Discharge Pressure:	(kPag)
Suction Pressure:	(kPag)
Differential Pressure:	(kPa)
ifferential Head:	(m)
ow Rate:	(L/s)
NSPH Available:	(m)
pH Value:	
Pump Length: (from underside of mounting plate to bottom of strainer)	(m)

PERFORMANCE

Speed:	(RPM)
fficiency:	(%)
ower Design:	(kw)
Power Max:	(kw)
Impeller Design:	(mm)
Impeller Min/Max:	(mm)
NPSH Required:	(m)
No. of Stages:	
Min. Continuous Flow:	(L/s)
Curve No:	

MATERIALS

Casing:
Impeller:
Shaft:
Shaft Sleeve:
Casing Wear Ring:
Impeller Wear Ring:
Seal Plate:
Wear Plate:
Elastomers/Gaskets:
Column Bearings:
Column/Riser Pipe:
Strainer:

SEALING

eal Type:
Seal Mfr:
Seal Model:

REMARKS

CONSTRUCTION

Pump Type:

Case Mounting:

Nozzles	Size(mm)	Rating	Facing	Location
Suction				
Discharge				

Radial Bearing Type:
Thrust Bearing Type:
Lubrication:
Impeller Type:
Jackets:

BASEFRAME AND PAINTING

Base Type:
Material:
Size:
Surface Preparation:
Paint Specification:
Guard Type/Material:

TESTING

Performance:	Witnessed / Certified / N.A.	
Hydrostatic:	Witnessed / Certified / N.A.	
N P S H:	Witnessed / Certified / N.A.	
Test Pressure : Case:		(kPag)
Jacket:		(kPag)

DRIVER

Driver Type:		
Mfr:		
Model/Frame Size:		
Enclosure:		
Power:	kw	RPM
Power Supply:		

TRANSMISSION

Coupling Type:	
Coupling Size:	Vee Belt Size:
Pump Shaft:	Pump Pulley:
Drive Shaft:	Drive Pulley:
Manufacturer:	

PRICING

Pump (each net):	A$
Driver (each net):	
Extras:	

Exchange Rate Variation:

Delivery:

Delivery Basis:

Form KF007 (5/92)