DAYLIFF

DS/DSP

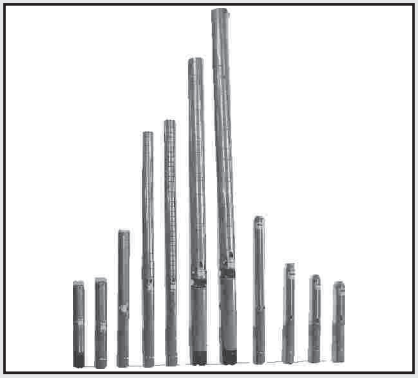
Submersible Borehole Pumps

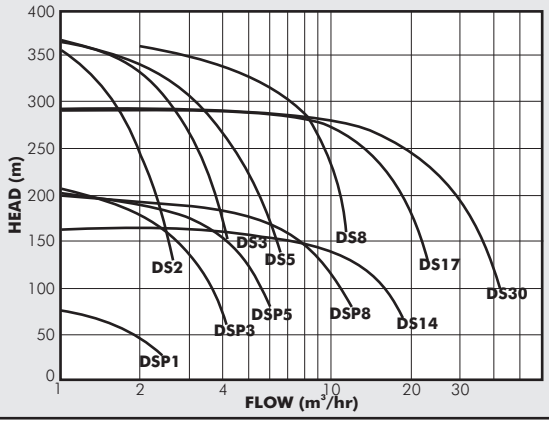
Installation & Operating Manual

INDEX

Thank you for choosing a DAYLIFF DS/DSP pump. The pump has been manufactured to the highest standards and if installed and operated correctly should give many years of efficient and trouble free service. Careful reading of this instruction manual is therefore extremely important and if there are any queries they should be referred to the pump retailer.

1. PUMP SPECIFICATION





i) Pump

DAYLIFF DS and **DSP** submersible multistage centrifugal pumps are specially designed for water supply from boreholes. DS pumps feature stainless steel construction throughout while DSP pumps use engineering plastics for the hydraulic components and feature a floating type impeller that gives superior sand handling capabilities. Both pumps are made from quality materials providing high efficiency operation and long life. Performance characteristics and other data of the model selected should be checked on the specific data sheet, which will be supplied with the pump.

Max. Water Temp: 30^{0}C ***Max. Sand Content:*** 50g/m^{3}

ii) Motor

All pumps are fitted with sealed liquid cooled oil filled 2-pole asynchronous squirrel-cage motors constructed principally of stainless steel. Single phase motors require purpose designed control boxes while three phase motors require a remote starter. DAYLIFF 'Drytek' Electronic Pump Controllers are recommended for total motor protection.

Enclosure Class: IP68 ***Insulation Class:*** F ***Speed:*** 2900rpm

2. DELIVERY & STORAGE

i) Delivery

DAYLIFF DS/DSP pumps are supplied from the factory in proper packing in which they should remain until they are to be installed. During unpacking and prior to installation, care must be taken when handling the pump to ensure that misalignment does not occur due to bending.

ii) Storage and Handling

The pump should not be exposed to direct sunlight. If the pump has been unpacked, it can be stored either horizontally if adequately supported as shown in Fig 1. or vertically to prevent misalignment of the pump. Ensure that the pump does not roll or fall over.

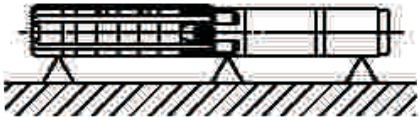


Fig. 1 Pump position during storage

3. PUMP ACCESSORIES

i) Drop Cable

Any leakage on the pump tail cable or drop cable will lead to motor failure

Suitable drop cable selection and attachment is vital to ensure proper pump operation. The following should be noted:-

- Only proper submersible cable of either PVC or rubber type must be used that is specified for permanent water submersion. Other cable types will lead to water ingress and motor failure.
- For single phase pumps 3-core cable is suitable. For three phase pumps 3-core can be used with steel pipes installation using the drop pipe for earthing. 4-core must be used for plastic pipe installations.
- It is important that the correct cable size is selected which is related to motor size and total length. Voltage drop should not exceed 5% from the supply point. The pump supplier should be consulted for the correct cable size.

- The drop cable must be attached to the pump tail cable using a certified cable joint. Leakage at this joint will cause motor failure.
- Care must be taken when fitting the motor tail cable to the motor. The connection between the tail cable and the motor should be lubricated with a non-conducting petroleum jelly and a secure fit made with the securing screws fully tightened.

ii) Riser Pipe

Suitable selection and installation of the riser pipe is essential to avoid the risk of pipe fracture and pump dislodging. This will then require expensive pump removal or possibly borehole loss. The following should be noted:-

- Either MS galvanised steel pipe in 6m or 3m sections or DAYLIFF PVC borehole piping in 3m section should be used for all installations below 50m. For shallow well installations up to 50m single length Polypipe can be used.
- For MS steel pipe ensure that all threads are properly cut and that the connecting sockets are fully threaded. For deep boreholes (deeper than 100m) high tensile 'Crane' type sockets are recommended. Steel pipes are recommended for all 6" pump installations.
- For reasons of reduced friction, ease of installation and economy 'DAYLIFF' PVC borehole pipe are recommended for all 4" pump installations up to 200m depth. Standard PVC piping must never be used.

iii) Wellhead

A robust sealed wellhead plate should be fitted on the borehole top to prevent borehole contamination, a DAYLIFF wellhead assembly being recommended. The assembly includes a delivery outlet with isolating valve and test tee as well as drop cable entry and optional provision for low-level electrode cables and an airline to measure borehole water depth.

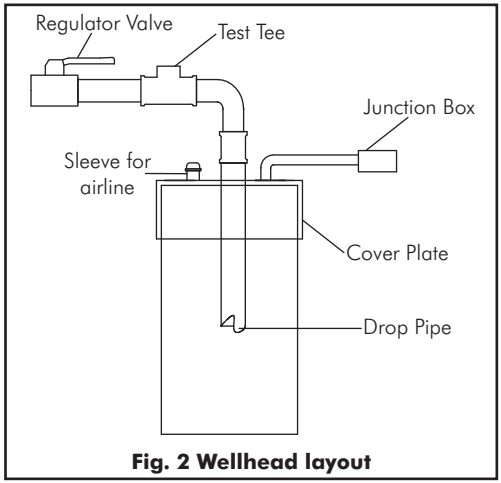


Fig. 2 Wellhead layout

4. ELECTRICAL CONNECTIONS

i) General Information

Before starting work on the pump, make sure that the electricity supply has been switched off and that it cannot be accidentally switched on.

The electrical connection should be carried out by an authorised electrician in accordance with local regulations.

Correct earthing for all borehole pump installations is essential for safety and pump motor protection. Consult a licensed electrician for advice on requirements.

- The rated maximum current, supply voltage and cos∅ are given on a loose data plate supplied with the pumps which must be fitted close to the installation site.
- The required voltage quality for DAYLIFF DS motors measured at the motor terminals is -10%/+10% of the nominal rated voltage during continuous operation including variations in the supply voltage and cable losses.
- All motors must be fitted with a mains isolator and coarse current protection in the form of an MCB or fuse. Coarse current rating should be approx 3X maximum rated motor current.
- For all three phase motors and single phase motors above 1.1kW a DOL starter is required. Note that starting current is between 4X and 6X the rated motor current which due to the low inertia of a submersible pump is reached in about 0.1 seconds. DOL starting is therefore recommended for motor starting up to 30kW motor sizes as the total system load is less than with a Star Delta alternative. For alternative starting arrangements options of a soft starter or auto transformer starter should be used.
- It is essential to provide motor protection from high/low current conditions outside the limits of +10%, -10% of the rated full load running current, high current protection being provided by a DOL starter overload relay. Also recommended for 3-phase motors is protection against phase loss, phase

asymmetry and high/low voltage variations (<+10%, >-10%) of nomimal supply voltage which can be provided by a multi-function relay.

- Also generally recommended unless water availability is assured is low level protection to prevent the pump running dry. Conventionally this is provided by a relay connected by cable to sensors in the borehole water, though wireless electronic protection is also available.
- DS & DSP motors can be used with inverters for power by DC sources, particularly solar modules and also variable speed operation. Further information can be obtained from the pump supplier if there is a particular installation requirement.

ii) Single Phase Motors

Correct connection of terminals and identification of the start, run and common windings is essential or else the motor will burn out. Extra care must therefore be taken when connecting and if in doubt the pump supplier should be consulted.

All single phase motors are supplied with control units including capacitors and a switch. PSC motors are fitted with one combined start/run capacitor while CS/CR motors are fitted with separate start and run capacitors with a change-over relay. Specifications are as follows:-

Motor Size	Type	Start Capacitor	Run Capacitor
0.37kW	PSC	-	16
0.75kW	PSC	-	25
1.1kW	PSC	-	35
1.5kW	CS/CR	200-250	40
2.2kW	CS/CR	200-250	60

Small single phase motors (up to 1.1kW) are fitted with inbuilt thermal overload protection though for added motor security it is advisable to fit a voltage protection unit such as a Sollatek AVS. For motors larger than 1.1kW a DOL starter is required and this can be provided by a separate DOL contactor and overload unit or alternatively by a DAYLIFF Drytek controller which includes over/under current protection plus multi-function power input protection and wireless low level protection by cosØ monitoring. Digital indications of operating parameters are also provided including current, voltage and cosØ. For full motor protection a Drytek controller is recommended.

iii) Three Phase Motors

All three phase motors require DOL starting and overload protection. Drytek controllers as detailed for single phase motors are recommended for enhanced protection and prolonged life.

5. INSTALLATION

i) Pump Application

- A wide range of pump models are available and the pump selected must be matched to the borehole output to provide optimal operating performance. This should be done with reference to the borehole drillers report in consultation with a borehole installation specialist. As a rule pump output should not exceed 65% of maximum tested borehole yield.
- Minimum Borehole Diameter 4"pumps-110mm, 6"pumps-160mm, DS30-200mm.
- Maximum Pump Immersion Depth - 200m for DSP, 250m for DS.
- Pumped liquid should be clean, thin and non-explosive containing no solid particles or fibres. Sand content should not exceed 50gm/m^3 or else pump life will be reduced and any warranties will be invalidated .
- Liquid temperature should not exceed 40^{0}C in order to preserve rubber components. Also for high temperatures one motor size larger should be fitted to prolong motor life due to high operating temperatures.
- Pumps can be installed either vertically or horizontally, though if installed horizontally the discharge outlet should never fall below the horizontal plane. For all horizontal installations a flow sleeve should be used and also there should be a minimum of 0.5m water depth above the pump to prevent the formation of a vortex.

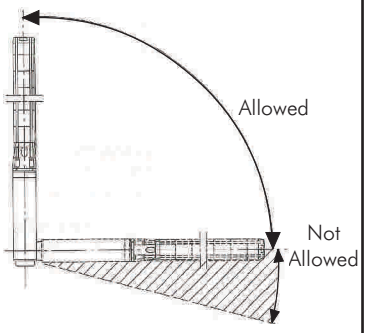


Fig. 3 Pump Axis Limits

ii) Pump Position

Borehole Measurement Parameters

L1. Minimum installation depth below dynamic water level
L2. Depth to dynamic water level (DWL)
L3. Depth to static water level (SWL)
L4. Draw down. This is the difference between the dynamic and the static water levels
L5. Installation depth
L6. Distance of pump from well bottom

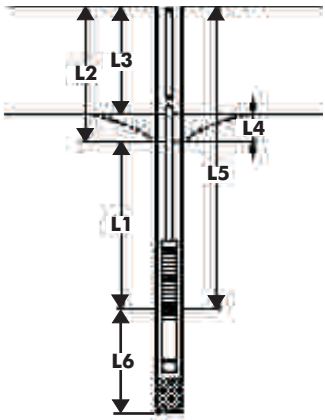


Fig. 4 Borehole Measurements

- When positioning the pump it is important to ensure adequate motor cooling through water flow past the motor. This will be achieved by installing the pump suction above the borehole main aquifer or well screen and if not possible or in cases of open water installation a cooling sleeve must be used. Recommended minimum flow rate past the motor is 0.2m/sec.
- It is recommended that the complete pump is submerged at least 3m below the dynamic water level and if possible the pump should be installed at least 3m from the bottom of the borehole to prevent silting damage. As a rule the pump should be positioned mid-way between the bottom of the borehole and the dynamic water level assuming that the main aquifer is below this level. If in doubt consult the pump supplier.

iii) Pump Lowering

It is recommended that a fully equipped borehole service vehicle be used for pump lowering and removal in order to minimize risk of pump dislodging. However, for shallow boreholes (less than 50m) a manual tripod arrangement can be used. When moving the pump the following procedures should be followed:-

- Before starting pump lowering it is important to check the borehole depth and straightness to ensure it is as expected and there is unobstructed passage. The pump should be carefully lowered into the borehole and if an obstruction is encountered the pump should be removed and the cause investigated to avoid pump or cable damage.
- Fit the first starter pipe into the pump outlet and ensure a tight leak free joint while the pump is on the surface. The thread on the starter pipe should not be longer than the threads in the pump outlet or it will interfere with operation of the non-return valve.
- Screw the starter pipe into a robust adaptor hook attached to the winch or tripod cable and lower the pump and pipe section into the borehole. When fully lowered hold the pipe below the socket with a clamp, disconnect the lifting hook and attach to the next pipe length ensuring a water tight connection. Ensure the pipe joint is fully home and repeat until all pipes are lowered.
- While the pipes are being lowered bind the drop cable, low level cable (if fitted), and airline (if fitted) to the drop pipes with a PVC cable clip at 2m centres.

6. PUMP OPERATION

When the pump has been connected correctly and is submerged in water proceed as follows:-

- First check the direction of rotation by starting the pump and observing a normal water flow. If low or uneven change the direction of rotation by switching two phase connections.
- The pump should then be run with the discharge valve restricted to approximately 1/3 of its maximum volume of water. Observe if there are impurities in the water and then gradually open the valve until the water is observed to be clear. If the water continues to be silted the pump is installed too low in the borehole and it should be raised until it is in a position of clear water availability. Alternatively a borehole problem is indicated and a driller should be consulted.

- As the valve is being opened, the water output should be monitored to ensure that the pump output does not exceed the borehole capacity as indicated by the pump starting and stopping on the low level relay (if fitted) or uneven water flow at the outlet. If this occurs the pump should either be changed to one of suitable specification or throttled on the outlet valve to a sustainable output. Note that the dynamic water level should always be above the suction interconnector of the pump.
- After the water flow settles the pump overload relay should be set. This is carried out by reducing the overload setting to the cutout condition and then increasing by +10%.
- During regular operation the pump operating current should be regularly monitored and if a substantial change is noted (±10%) it should be investigated by a service technician. Pump output should also be monitored and if the flow rate or consistency changes investigations should be made.
- In order to obtain maximum pump life the number of starts should be controlled and should not exceed 30 per hour. It is also necessary to start the pump at least monthly to prevent seizure.

7. MAINTENANCE

- No regular maintenance is required though periodically, recommended every 3 months, the installation should be inspected to check operating parameters including running current, water output, closed head pump pressure and water quality as well as switchgear condition. Rectification should be carried out as necessary. Interpretations of various operating problems are given in the Fault Finding Guide.
- Also important is a periodic check of motor winding and insulating resistance, especially if there is an abnormal operating current or voltage reading. For three phase motors winding resistance between each pair of phases should not exceed 10%. For insulating resistance a satisfactory reading is >100MOhm and if below this some deterioration in motor winding insulation, cable integrity or cable joint security is indicated. Generally it is satisfactory to keep running the motor until resistance drops to below 0.5MOhm when the equipment should be removed and checked.

- As a rule periodic lifting and checking of borehole installations is not recommended until an operating fault is noted as equipment is designed for continuous operation for an indefinite period.

8. WARRANTY

DAYLIFF pumps are quality products and are warranted against failure through faulty manufacture or materials for a period of two years from the date of purchase provided correct installation procedures are followed, the pump motor is provided with the specified protection and pumped water is of the specified quality.

Claimed pumps should be returned free to the supplier and no claim will be entertained for any site or incidental costs or consequential losses. Pumps will be replaced or repaired at the supplier's discretion.

9. TROUBLE SHOOTING GUIDE

Problem	Possible Cause	Solution
The pump does not run	The fuses are blown	Replace the blown fuses. If the replacements blow too, the electric installation and the submersible drop cable should be checked
	The ELCB or the voltage-operated ELCB has tripped out	Re-set the circuit breaker
	No electricity supply	Contact the power supply provider
	The motor overload has tripped out	Reset the motor starter overload. If it trips again, check the voltage and if normal call service technician
	Motor starter/contactor defective	Repair the motor starter/ contactor
	The control circuit has been interrupted or is defective	Check the electric installation
	The dry running protection has cut out the pump due to low water level	Check the water level. If it is in order check the water level electrodes/level switch
	The pumps submersible drop cable is defective	Repair/replace the pump/ cable
	The protection relay has tripped due to power inconsistencies	Contact the power supply provider

The pump runs but gives no water	The discharged valve is closed	Open the valve
	No water or very low level in borehole	Increase the installation depth of the pump, throttle the pump or replace it with a smaller model to obtain reduced capacity
	The non-return valve is stuck in its shut position	Pull out the pump and clean or replace the valve
	The inlet strainer is choked up	Pull out the pump and clean the strainer
	The pump unit is defective	Replace or repair the pump
	Pipes are leaking	Replace pipes
The pump runs at reduced capacity	The draw down is larger than anticipated	Increase the installation depth of the pump, throttle the pump or replace it by a smaller model to obtain a smaller capacity
	Wrong direction of rotation	Change direction of rotation
	The valves in the discharge pipes are partly closed or blocked	Check and clean or replace the valves and discharge pipe
	The non-return valve of the pump is partly blocked	Pull out the pump and check or replace the valve
	The pump and the riser pipe are partly choked by impurities	Pull out the pump. Check and clean or replace the pump if necessary
	The pump is defective	Repair or replace the pump
	Leakage in the pipework	Check and repair the pipe work

Frequent starts and stops	The water level electrodes or level switches have not been installed correctly	Adjust the intervals of the electrodes to ensure suitable time between the cutting-in and cutting-out of the pump. If the intervals between stop/start cannot be changed automatically, the pump capacity may be reduced by throttling the discharge valve changed
	The non-return valve is leaking or stuck half open	Pull out the pump and clean or replace the non-return valve
	The pump is oversized for borehole	Increase the installation depth of the pump, throttle the pump or replace it with a smaller model to obtain a smaller capacity
Long period until water flow after start	Riser pipe leakage	Check and repair riser pipe
	Pump NRV faulty	Lift pump and rectify NRV
Loud noise in the pipework	Water hammer	Fit a surface non-return valve and a diaphragm tank on the surface delivery piping
Mechanical damage to pump and motor	Pump cavitation due to low system head resulting in operation at insufficient pressure	Throttle the pump or replace it with a lower pressure alternative

DAYLIFF is a brand of **Davis & Shirtliff**

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