TORISHIMA

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TC－P 99708／2E
'90. 7. 2000 (K)

SNK Screw Pump

Max. actual head up to 10m
Capacity up to 18000m³/h
Screw nominal diameter 400 ~ 3500mm

TORISHIMA PUMP MFG. CO., LTD.

Introduction

Screw pumps based on the Archimedian principle are known to have been used for irrigation as early as the third century B.C. Recently, this same type of pump has come into use for sewerage and water treatment purposes.
Torishima screw pumps are based on our own extensive research and development efforts.
Our advanced technology in screw blade production and concrete casing construction, has been fully utilized to produce this standardized line of pumps. As a result, our screw pumps are extensively used for sewerage system, irrigation and other purposes.

When inquiring, please specify the following data

1. The expected normal delivery capacity and the maximum delivery Capacity (m^3/min)
2. The distance from the standard influent water level to the effluent water (m)
3. The number of pump units, the place of installation and the angle of installation:
   - place of installation
   - number of units
   - angle of installation (α = 30°, 35°, 38°, etc.)
4. The application and condition of liquid:
   - application
   - condition of liquid
     (1) rain water, sewage or sludge
     (2) digested or activated sludge, if mixed, please state size (max. mm)
5. The drive-unit
   - Motor: Electric motor, Diesel engine, Jeared motor
   - Reduction: Reduction gear, Angular bevel reduction gear, V-belt drive
6. The operation time
   - continuous
   - intermittent (regular, irregular)
7. Electric power supply:
   - Hz
   - Volt

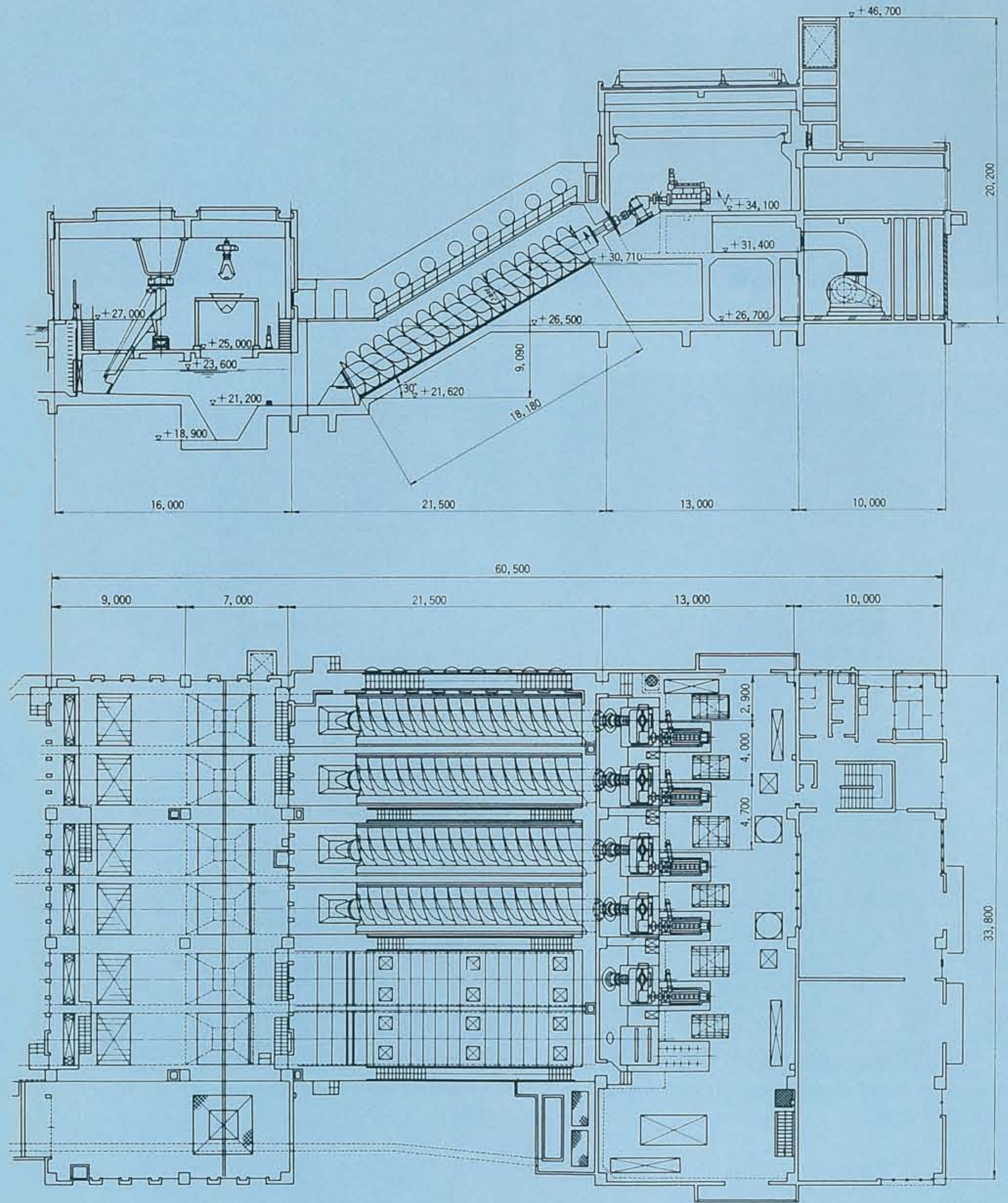
Accessories

Standard
Flexible coupling, Coupling guard, Grease pump, Splash bars, Return stop device, Foundation bolts

Optional
Water gauge, Screw, Stool for reduction gear, etc.

Installation Lay-Out

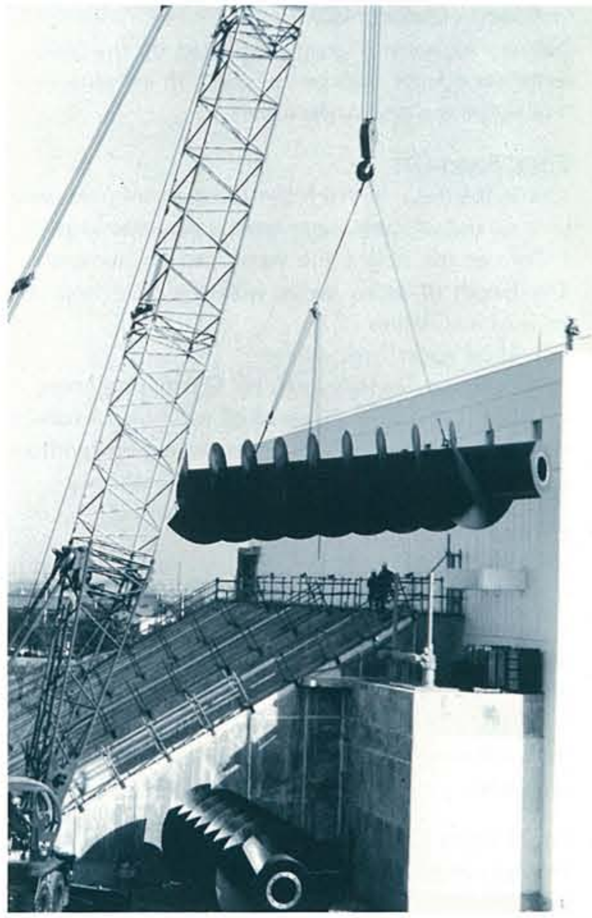
Arakawa Pumping Station, Kumagaya-city, Saitama-pref.

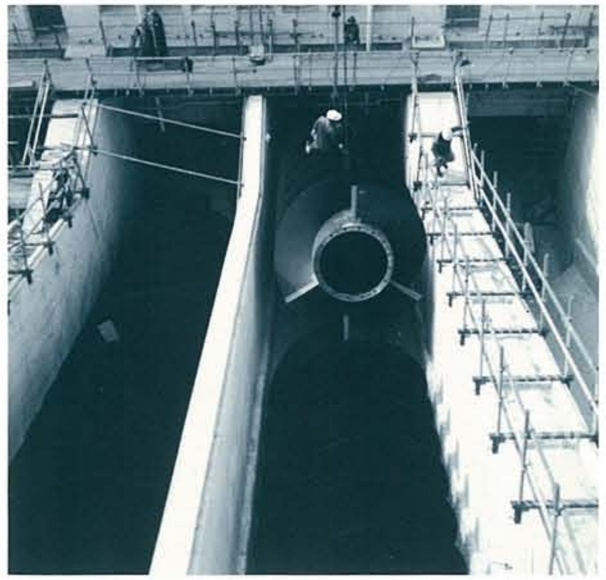


Features

1. Liquids containing small stones, other suspended solids or rags, pieces of wood or ropes, digested or activated sludge etc., can be easily handled.
2. The simple, rugged construction and the open screw trough facilitate maintenance and inspection.
3. There is no danger of clogging within the pump as in centrifugal pumps, therefore only a coarse screen is required at the intake level.
4. Advantages of slow speed operation (approx. 20-100 rpm) are:
   – very slight wear
   – excellent durability
   – trouble free operation
5. No need of priming device or valve. Automatic operation is easily and yet positively accomplished.
6. There are no sliding parts, even at idling speed. Hence troubles like jamming will not occur.
7. Contrary to vertical pump installations, there is no need for deep sumps. Therefore installation space and cost of civil engineering work is greatly reduced.
8. A lower intake water level automatically reduces the delivery capacity. Hence it is not necessary to adjust the capacity by means of valves as in other pumps.

Note: For maximum performance, align the pump carefully in order to obtain the proper clearance between blades and trough.





Applications

1. **Pumping of sewage and waste water**
   At booster pump stations, setting basins are not required.
2. **Sewerage**
   Screens or setting basins can be set on the discharge side. When installed as return pump for digested or activated sludge pumping can be performed without destroying the flakes.
3. **Delivery of digested or activated sludge.**
4. **Irrigation and drainage**
5. **Delivery of liquids containing various solid matters**
   Ideal for pumping liquids with sand or other solid matters, since there is no danger of clogging.

Performance

1. Delivery capacity (Q)

Delivery capacity is greatly affected by the influent water level, and will be reduced, if influent water level is lower than standard level.

2. Total head (H)

This is the distance from the standard influent water level to the effluent water level (screw discharge level + Δh), or the height the water can be pumped up. The length of screw varies with the total head and angle of inclination (α).

3. Speed of rotation

Rated delivery capacity can be adjusted by changing speed of revolution. If speed of rotation is excessive high, however, water being lifted will rotate with the screw, reducing efficiency and delivery capacity.

4. Efficiency

Maximum value will be obtained when operating at the standard influent water level; the efficiency will be reduced when the influent water level is reduced. However, even if the delivery capacity is only one third of the rated delivery capacity, efficiency is kept at approx. 80% of maximum value. High efficiency is obtained in a wide range of delivery capacities.

5. Drive shaft power requirements (SP)

The maximum design input power is required under the operation at standard influent level. Power consumption will be reduced at lower or higher water levels.

The efficiency factor of the gear reducer must also be considered when design power requirement is calculated.

6. Suction water level

To keep screw's lifting efficiency in a high level, operate the pump near to the standard influent water level.

Specifications

1. Maximum delivery capacity

About 300 m^3/min (based on nominal screw diameter of 3,500 mm, and varies according to installation angle)

2. Maximum actual head

Total head limit per a pump is approx. 10m, although it changes according to installation angle. A higher head is possible by using several pumps in series.

3. Angle of inclination

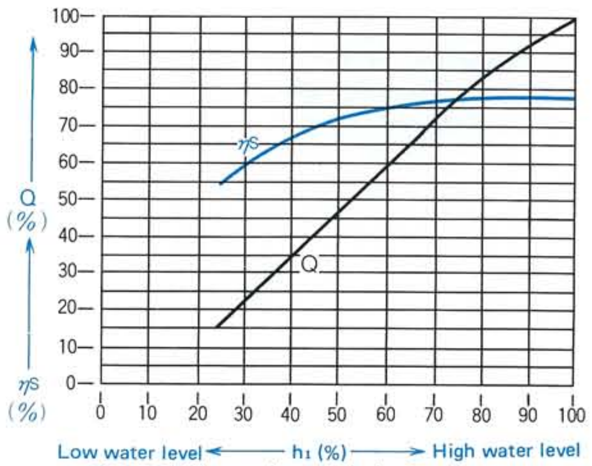
Standard installation angle is 30°, but pumps with 22°~38° installation angle are available on request.

4. Speed of rotation

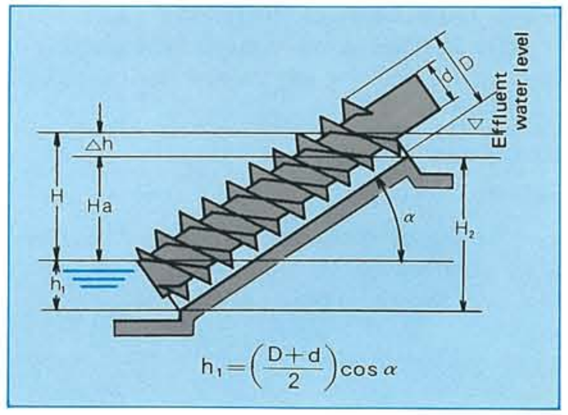
Revolution depends on nominal screw diameter: About 100 rpm with small quantities of water and about 20 rpm with greater quantities of water.

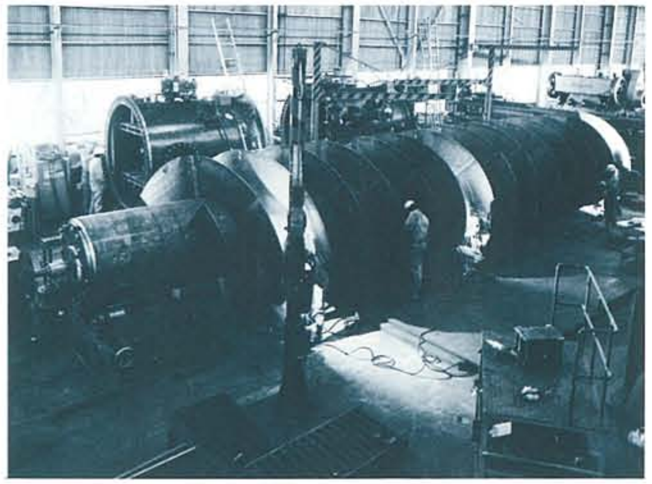
5. Screw efficiency

Differs with installation angle, speed or delivery capacity: under a standard operation condition, about 60% in small pump and about 80% in large pump.

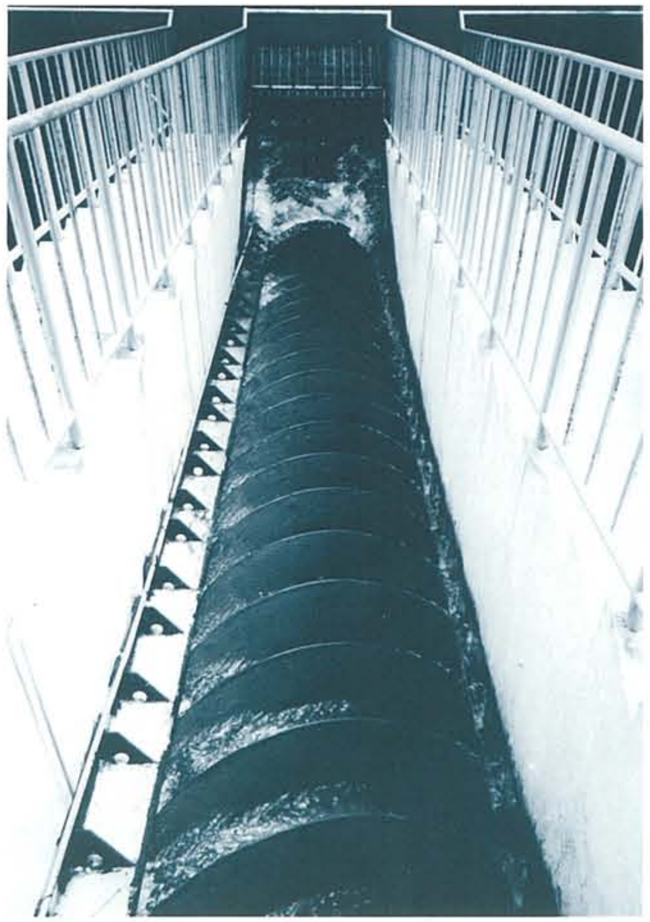


Notes:
* Shows when revolution is constant.
* Delivery capacity (Q) and influent water line (h_1) show 100% when they reach at standard influent water level.
* Efficiency is represented by absolute value.





Screw pump under fabrication for the Monzen Pumping Station, Iwate pref.
Screw dia: 2,400mm.

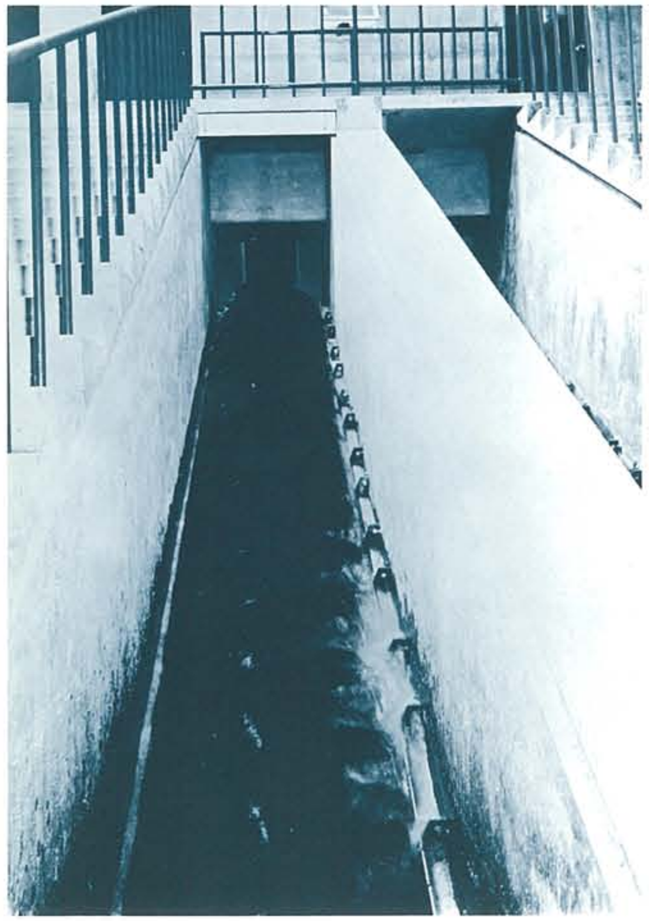


Delivered to the Hiro Pumping Station, Hiroshima pref.
Screw dia: 1,300mm.

For industrial waste water treatment
Screw dia: 1,400mm.

Screw Pumps Under Fabrication and In Operation

Delivered to the Arakawa 3rd Rain Water Drainage Station (Constructed by Japan Sewerage Agency), Kumagaya-city, Saitama-pref.
Screw dia: 3,000mm, Screw length: 18.18m.



Delivered to the Onozaki Pumping Station, Ibaragi-pref.
Screw dia: 1,200mm.

Screw Pump (screw dia: 3,000mm) under fabrication for the Arakawa 3rd Rain Water Drainge Station.

Construction and Installation

1. The screw
Screw is made of mild carbon steel pipe around which sections of steel plate are welded in spiral form. Special surface treatment guarantees long durability.

2. The bearings
The upper roller bearing supports screw weight and shaft thrust.
The lower plain bearing only supports screw weights. (Roller bearing is used optionally.)
Both are of hermetically sealed construction protected against damage by digested or activated sludge. They are greased by an automatic lubrication system (grease pump).

3. The trough
Concrete or steel troughs guarantee most exact clearance between the screw pump and the wall of the trough, i.e. smooth operation, minimum of leakage and high efficiency.

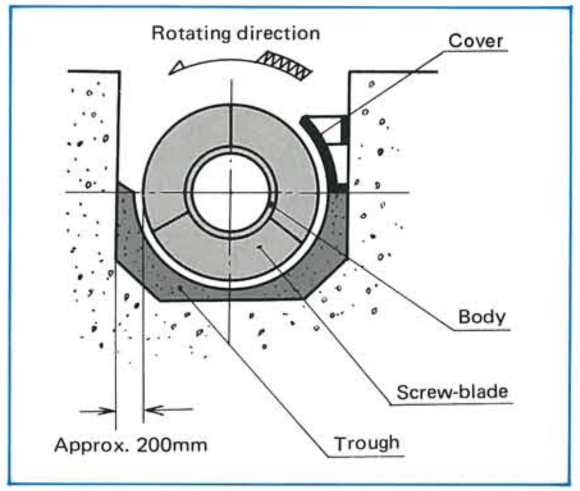
4. The sill
The sill level should be set higher than the discharge level to prevent reverse flow of water during stoppages.
The discharge water level is the total of the water level of a river where lifted water is discharged and the loss head through the culvert.

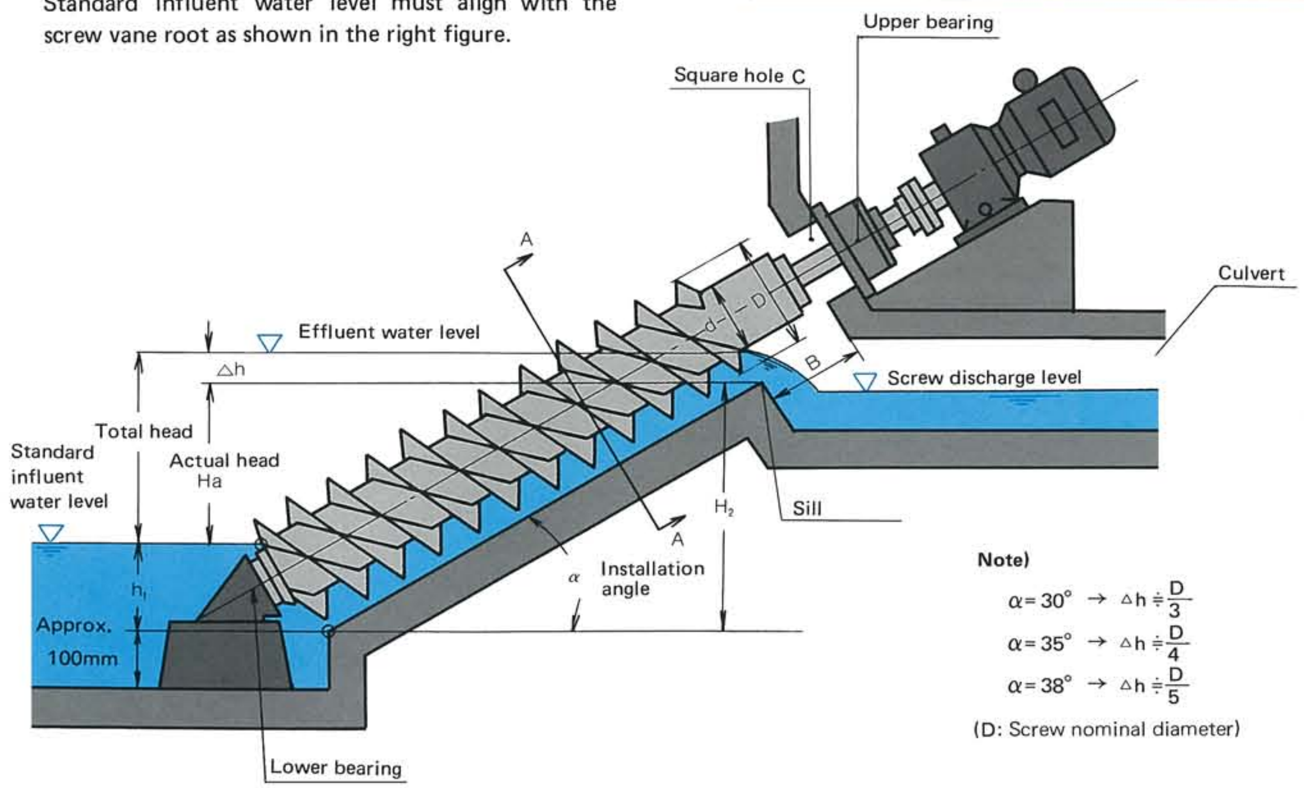
5. Standard influent water level
Standard influent water level must align with the screw vane root as shown in the right figure.

6. The drive
Use an electric motor or a diesel engine in combination with a gear reducer. For diesel engine drive, an automatic centrifugal clutch should be installed for better starting performance.

7. The return-stop device
As an additional safety device, provision to prevent the screw pump from reversing during dewatering is made.

A-A Section (viewed from bottom)





Note)
$\alpha = 30° \rightarrow \Delta h \doteqdot \frac{D}{3}$
$\alpha = 35° \rightarrow \Delta h \doteqdot \frac{D}{4}$
$\alpha = 38° \rightarrow \Delta h \doteqdot \frac{D}{5}$
(D: Screw nominal diameter)

Selection Guide

1. Delivery capacity (Q) varies according to number of blades used.

   Three blades: Q
   Two blades: Q_2 =Q x (0.8 ~ 0.83)
   One blade: Q_1 =Q x (0.45 ~ 0.6)

2. The maximum actual head Ha can be slightly higher than the values described by applying special designs (discharge capacity will be changed, however).

3. Screw pump shaft power = $\frac{0.163 \cdot \gamma \cdot Q \cdot H}{\eta_s}$

   H : Total head (m)
   Q : Delivery capacity (m^3/min)
   η_s : Screw pump efficiency
   γ : Specific gravity of liquid

Screw nominal diameter Dø(mm)	One blade	Two blades	Three blades	α=30° Delivery capacity Q(m³/min)	α=30° Maximum actual head (m)	α=35° Delivery capacity Q(m³/min)	α=35° Maximum actual head (m)	α=38° Delivery capacity Q(m³/min)	α=38° Maximum actual head (m)	Common dimensions B mm	Common dimensions Square hole C mm
400	■ Except when α is 38°	■	■	1.82	3.0	1.55	3.6	1.35	3.9	550	550ø
450	■	■	■	2.31	3.2	1.98	3.8	1.72	4.1		
500	■	■	■	3.10	3.4	2.64	4.0	2.31	4.4		
550	■	■	■	3.89	3.5	3.37	4.2	2.97	4.6		
600	■	■	■	4.69	3.7	3.96	4.4	3.50	4.8		
700	■	■	■	6.93	4.0	5.94	4.8	5.22	5.2		
800	■	■	■	9.37	4.3	8.05	5.1	7.06	5.6		
900	■	■	■	12.5	4.5	10.7	5.4	9.37	5.9		
1000	■	■	■	15.8	4.6	13.5	5.5	11.9	6.0	800	700ø
1100	■	■	■	19.3	4.8	16.5	5.8	14.4	6.4		
1200	■	■	■	24.0	5.0	20.6	6.0	18.1	6.6		
1250		■	■	25.7	5.1	21.9	6.2	19.1	6.8		
1300		■	■	28.5	5.2	24.3	6.3	21.3	6.9		
1400		■	■	34.7	5.4	29.7	6.5	26.1	7.1		
1500		■	■	39.8	5.4	34.0	6.5	29.7	7.2	1100	800ø
1600		■	■	47.3	5.6	40.5	6.7	35.5	7.4		
1700		■	■	54.4	5.7	46.5	6.9	40.9	7.6		
1800		■	■	62.7	6.0	53.7	7.2	47.1	7.6		
1900		■	■	71.7	6.1	61.3	7.4	53.8	8.2		
2000		■	■	80.9	6.3	69.3	7.6	60.8	8.4		
2100			■	90.8	6.3	77.7	7.6	68.2	8.4	1350	1000ø
2200			■	101	6.3	86.5	7.7	75.9	8.5		
2300			■	112	6.4	95.5	7.8	83.8	8.7		
2400			■	122	6.6	105	8.0	91.9	8.8		
2500			■	133	6.6	114	8.0	100	8.8		
2600			■	150	6.8	129	8.3	113	9.2	1600	1000ø
2700			■	162	6.9	139	8.5	122	9.4		
2800			■	174	7.0	148	8.6	130	9.5		
2900			■	189	7.0	162	8.6	142	9.5		
3000			■	205	7.0	175	8.6	154	9.5		
3100			■	222	7.2	190	8.7	166	9.6		
3200			■	238	7.2	204	8.7	179	9.7		
3250			■	248	7.4	212	8.9	186	9.8		
3300			■	256	7.4	219	8.9	192	9.9		
3400			■	273	7.5	234	9.0	205	10		
3500			■	292	7.5	250	9.0	219	10		

Drive Systems

The following drive systems are available according to types of engine and gear reducer.