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Indian Standard

GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

PART 10 HYDRO-ELECTRIC POWER STATION INCLUDING WATER CONDUCTOR SYSTEM

(First Revision)

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GLOSSARY OF TERMS RELATING TO RIVER VALLEY PROJECTS

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0. FOREWORD

0.1 This Indian Standard (Part 10) (First Revision) was adopted by the Bureau of Indian Standards on 20 September 1988, after the draft finalized by the Terminology Relating to River Valley Projects Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 A number of Indian Standards have already been published covering various aspects of river valley projects and a large number of similar standards are in the process of formulation. These standards include technical terms and precise definitions for the terms which are required to avoid ambiguity in their interpretation.

0.3 This standard was first published in 1969. The revision of this standard has been taken up in the light of experience gained during the last few years in the use of this standard. Some of the terms have been added in this revision.

0.4 In the formulation of this standard due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practice in the field in this country. This has been met by deriving considerable assistance from 'Multilingual technical dictionary on irrigation and drainage' published by the International Commission on Irrigation and Drainage (ICID), and other sources. All the definitions taken from 'Multilingual technical dictionary on irrigation and drainage' are marked with asterisk.

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1. SCOPE

1.1 This standard (Part 10) covers definitions of terms relating to hydro-electric power station including water conductor system.

1.2 This standard does not contain terms relating to dams, gates and valves.

2. GENERAL TERMS AND TERMS RELATING TO TYPES OF HYDRO-ELECTRIC POWER STATIONS

2.1 Base Load Power Station — A power station operating continuously at a constant or nearly constant power and which operates at relatively high load factors. It caters to power demand at base of the load curve.

2.2 Dam Power Station — A power station located at the toe of a dam thus using relatively small length of water conductor system.

2.3 High Head Power Station — A power station operating under heads above 300 m (*see* Note under **2.7**).

2.4 Indoor Power Station — A power station where the machinery, namely, turbine, generator and control equipment, is housed in a permanent building with superstructure of conventional type.

2.5 Installed Capacity — The total capacity of all the generating units installed in a power station.

2.6 Low Head Power Station — A power station operating under heads less than 30 m (*see* Note under **2.7**).

2.7 Medium Head Power Station — A power station operating under heads from 30 to 300 m.

NOTE — The limits are not exactly defined and sometimes the upper limit for medium head power station may be taken as 200 to 250 m.

2.8 Outdoor Power Station — A power station where the superstructure is eliminated and the generating equipment is protected against the weather by a suitable covering.

2.9 Peak Load Power Station — A power station primarily designed for the purpose of operating to supply the peak load of a power system. Also called 'Peaking Station'.

2.10 Pumped Storage Power Station — A power station which, during periods of high demand for

energy, generates power from water stored in the upper reservoir; and which pumps the water from a lower reservoir back into the upper reservoir during periods of low demand utilizing low value energy from the system. Usually such stations follow the diurnal cycles but some may follow seasonal cycles.

2.11 Run-of-the River Power Station — A power station utilizing the run-of-the river flows for generation of power with sufficient pondage for supplying water for meeting diurnal or weekly fluctuations of demand. In such stations, the normal course of the river is not materially altered.

2.12 Semi-outdoor Power Station — A power station with a low superstructures over the machine hall with hatches in the roof for handling the generating equipment.

2.13 Surface Power Station or Overground Power Station — A power station which is constructed over the ground with necessary open excavation for foundations.

2.14 Underground Power Station —A power station located in a cavity in the ground with no part of the structure exposed to outside.

2.15 Semi-Underground Power Station — A power station located partly below the ground level and followed by a tail race tunnel.

3. TERMS RELATING TO COMPONENTS OF POWER STATIONS

3.1 Access Tunnel — The underground approach for the power station.

3.2 Auxiliary Rooms or Auxiliary Bays — Portion of the power station annexe to the machine hall where the control and auxiliary station service equipment like cooling water supply, compressed air pumps, etc, are positioned.

3.3 Cable Racks — Racks or trays supported by brackets or frames fixed in the walls, floors or ceiling for carrying the cables.

3.4 Control Room — A room located near the units either just on the downstream or the upstream side of the unit blocks or at one end of the machine hall which houses the control panels.

3.5 Crane Beam — Beams over which the overhead crane traverses on the rails placed over the beam in the power station for carrying the loads.

3.6 Dewatering Sump — A pit provided in the power house for collecting the water to be pumped out from the turbine for evacuating it for inspection and maintenance.

3.7 Draft Tube Deck — A slab over the draft tube openings supported on draft tube pier above maximum tail water level for gantry cranes operating the draft tube gates.

3.8 Drainage and Inspection Galleries — Suitable galleries in the substructure of power station to facilitate drainage and inspection.

3.9 Drainage Sump — A pit provided in the machine hall for collecting and pumping out the water from inside the power station.

3.10 Fire Protection Wall — Protection walls provided in between equipments for protection against spread of fire.

3.10.1 *Generator Floor* — The floor in the power house from where inspection, repairs and maintenance of the generator are carried out.

3.10.2 *Gantry Column* — Columns (RCC/steel) which support the crane beams.

3.11 Intermediate Structure — The portion of power station extending from the top of the draft tube top slab to the generator floor consisting of speed ring and its support, the generator supporting barrel, and the concrete around the scroll case and various floors.

3.12 Outdoor Switch Yard — The area where outdoor switching and associated equipment are installed.

3.13 Power House — Power house is the structure housing the generating and control equipments and service bay.

3.14 Power Station — Power station denotes the entire complex including power house, ancillary structure and switchyard.

3.15 Service Bay — Area of the power house in continuation of the machine hall where the assembly and maintenance of equipment may be carried out. This may also refer to the maintenance and repair area provided separately for transformers.

3.16 Stages of Concreting — Stages of concreting in the concrete monolith of power house to facilitate installation of embedded parts of equipments. Normally there are five stages of concreting:

a) *Base Course/Zero Stage Concreting* — Concreting for filling the irregularities in foundation and to make the surface uniform for placement of reinforcement and other embedments.

b) *First Stage Concreting* — Concreting of foundation and main columns leaving the block-out for draft tube liners and other equipments.

c) *Second Stage Concreting* — Concreting around draft tube liners and formation of scroll case supports.

d) *Third Stage Concreting* — Concreting around scroll case and formation of generator foundation.

e) *Fourth Stage Concreting* — Concreting of generator barrel and floor in the machine hall.

3.17 Substructure — The substructure of power house housing the reaction turbine is that portion of the structure which is below the top level of the draft tube top slab; and in the case of a power house having impulse wheel, it is that portion of the structure which is below the distributor pipe.

3.18 Superstructure — The portion of power house extending from generator floor right up to the top including gantry columns, roofs, walls, etc.

3.19 Transformer Deck — The draft tube deck over which the transformer is positioned.

3.20 Transformer Yard — The area where transformers are positioned.

3.21 Turbine Floor — The floor from where there is access to the turbine pit for inspection and regular maintenance.

4. TERMS RELATING TO WATER CONDUCTOR SYSTEM

4.1 Adit — It is an underground opening from hill face either for facilitating underground construction (construction adit) or for exploration/instrumentation (exploratory adit).

4.2 Balancing Reservoir — A reservoir created upstream of the forebay to cater for the diurnal or weekly fluctuations in water demand due to variations in power generation.

4.3 Bypass Channel (or Bypass Tunnel) — The channel (or tunnel) bypassing power station to permit direct flow of water from head race or surge tank to the tail race.

4.4 Chute — Pipe, flume or open channel on relatively steep slopes carrying a free surface flow.

4.5 Cut and Cover Conduit — A conduit usually of concrete/RC construction placed in a cut and covered with backfill to the required extent.

4.6 Draft Tube — A passage of gradually expanding area from runner to tail race which enables retrieval of the considerable velocity head at runner outlet.

4.7 Flume — An artificial water channel of wood, metal, concrete or masonry usually supported above the surfaces of the ground.

4.8 Forebay — A small balancing storage upstream of the power house to absorb the short interval variations of intakes of water into the turbines in accordance with the fluctuating loads.

4.9 Free-Flow Conduit — Channel, pipe or other enclosed structure carrying water partially full; the flow conditions are similar to those in open channel. Also called 'Open Conduit' or 'Free-Flow Tunnel'.

4.10 Head Race Tunnel/Channel — A channel or a free-flow tunnel leading water to the forebay or a pressure tunnel leading the water to the surge tank.

4.11 Penstock — A closed conduit for supplying water under pressure to a water turbine.

4.12 Power Channel — A channel constructed to carry water for power generation.

4.13 Pressure Conduit — A closed conduit which entirely confines and guides the movement of water under pressure.

4.14 Reservoir — It is a water storage created by putting an obstruction across a stream or river.

4.14.1 *Lower Reservoir (Pumped Storage)* — A reservoir downstream of the draft tube usually created for pumped storage schemes (*see* **2.10**)

4.14.2 *Upper Reservoir (Pumped Storage)* — High elevation reservoir serving as head reservoir for pumped storage schemes for storage of water.

4.15 Shafts — Vertical or inclined bores in rock or in over burden.

4.16 Tunnel — An underground passage constructed for conveyance of water, equipment, materials and movement of traffic.

4.16.1 *Approach* — Approach tunnel is a permanent underground passage to the underground structure.

4.16.2 *Goose Neck* — A relatively short length of tunnel connecting a high level intake and a low level tunnel which is usually a diversion tunnel.

4.16.3 *Head Race* — A power tunnel between the intake and surge tank/forebay is called a head race tunnel.

4.16.4 *Hydraulic Tunnel* — A tunnel to carry water under free-flow or pressure.

4.16.5 *Tunnel Lining* — Protective treatment in the form of plain or reinforced concrete, steel, etc, given to reduce frictional resistance to prevent the loss of water to the surrounding rock and to provide support to the excavated rocks in poor reaches.

4.16.6 *Power Tunnel* — A tunnel to carry water for generation of hydro-electric power.

4.16.7 *Pressure Tunnel* — Tunnel operating under pressure.

4.16.8 *Tail Race* — A tunnel/channel carrying water downstream of the power house to the connecting stream.

4.16.9 *Tunnel Support* — Supports provided to the rock around the tunnel.

4.17 Water Conductor System — It consists of one or any combination, of the means of conveyance of water from the reservoir or diversion structure to the turbine and thence to the exit of the tail race.

5. TERMS RELATING TO INTAKES

5.1 Air-Vent or Air-Vent Pipe — Vent or pipe provided downstream of gate groove for entry of air into the conduit to prevent formation of negative pressures in the conduit and cavitation, and also to prevent possible collapse of the conduit when the conduit is drained with the gate closed.

5.2 Bell-Mouth Transition — Bell shaped transition provided at the entry of the penstock or a tunnel to ensure smooth inflow and minimize entry losses.

5.3 Ice Removal System — An arrangement for removal of different types of ice formation in case of intakes located in very cold climates so as to prevent the blocking of the intake opening and also to prevent pieces of ice reaching the turbine runner.

5.4 Intake Gates — The gates regulating the entry of flow into the power channel, tunnels or penstocks.

5.5 Intake Ports — The openings of the intake well (tower) which admit water into the tower.

5.6 Intake or Intake Structure — A structure to withdraw water from a surface water source to feed a power house.

5.7 Intake Tower — Intake structure constructed in the form of a tower in the reservoir with entry of flow at one level or at more than one levels, when there is wide variation of water level in the reservoir. This can be a submerged structure also.

6. TERMS RELATING TO TRASH RACKS

6.1 Raking — Raking is a manual/electrical operation to clean the trash rack.

6.2 Trash Rack — A grill or screen cover at intake openings for preventing the entry of suspended or floating material into the water conductor system. Trash racks may have fine/coarse openings depending upon the nature of debris to be excluded.

7. TERMS RELATING TO SURGE TANKS

7.1 Downsurge — Fall of water level in the surge tank/shaft below the static water level due to load acceptance.

7.2 Expansion Gallery/Expansion Chamber — It is a gallery or chamber attached to the surge tank to provide additional storage capacity.

7.3 Mass Oscillation — Oscillation of relatively low frequency in the closed water conductor system caused by changes in the flow conditions.

7.4 Pressure Drop — Decrease in the pressure head due to sudden increase of flow in the pipe.

7.5 Pressure Rise — Increase above normal condition in the pressure head due to sudden decrease of flow in the pipe.

7.6 Stability of Surge Tank — Condition for damping the mass oscillations caused by the change in the steady flow condition of system due to the governor action.

7.7 Surge Tank/Chamber — A surge chamber/tank is a device introduced in the system near the power plant and in a long pressure conduit to provide the required force of retardation in case of sudden load rejection and force of acceleration during the load acceptance.

7.7.1 *Air Cushioned* — It is a closed surge tank having a provision of air cushion to absorb change in pressure in the water conductor system (*see* Fig. 1).

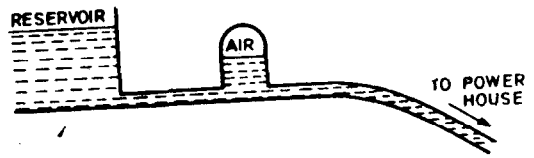

FIG. 1 AIR CUSHIONED SURGE TANK

7.7.2 *Differential* — A type of surge tank with a main chamber and central riser with port holes (*see* Fig. 2).

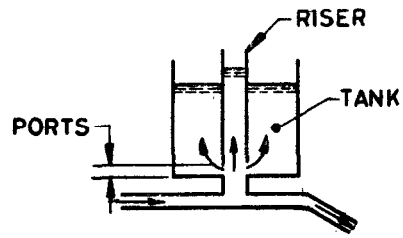

FIG. 2 DIFFERENTIAL SURGE TANK

7.7.3 *Multiple* — The water conductor system having two or more shafts with free surface upstream of power station (*see* Fig. 3).

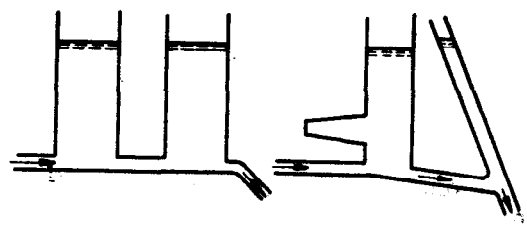

FIG. 3 MULTIPLE SURGE TANK

7.7.4 *Restricted Orifice* — A tank having an orifice at its base with a restricted area.

7.7.5 *Simple* — A shaft, vertical or inclined, at a suitable point along the water conduit intended to absorb surges.

7.7.6 *Tail Race* — A tank provided after the draft tube in the tail race tunnel/conduit.

7.8 Up Surge — Rise of the water level in the surge shaft above static water level due to load rejection.

7.9 Water Hammer — The pressure wave set up due to change of kinetic energy to elastic strain energy caused by any change in the flow condition in a closed conduit.

8. TERMS RELATING TO PENSTOCK AND ITS APPURTENANT STRUCTURE

8.1 Anchorage - Anchor Block or Anchor Pier — A structure built to hold down penstocks in position at the points where the direction or inclination of the axis changes and also at some regular intervals.

8.1.1 *Close Type* — In this type of anchor, the penstock is embedded in concrete.

8.1.2 *Open Type* — In this type of anchor, the penstock is anchored to the concrete by rings.

8.1.3 *Umbrella Type* — In this type, the bend pipe is anchored to the rock with umbrella type reinforcement as shown in Fig. 4.

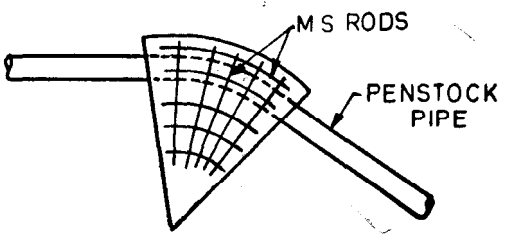

FIG. 4 UMBRELLA TYPE ANCHOR BLOCK

8.2 Banded Pipe or Rimmed Pipe — Pipe provided with forged steel hoops called bands or rims so as to induce pre-stress in the relatively thin pipe shell, thus enabling the shell to withstand more internal pressure.

8.3 Bifurcation Piece — A separate piece of the pipe where the main pipe is to be divided into two separate pipes. Also known as 'Wye Piece'.

8.4 Burried Pipe — Pipe laid burried underground.

8.5 Circumferential Joint — Joint by which two ferrules are joined circumferentially. This may be welded or riveted.

8.6 Compound Bend — A bend having change in the direction of the axis or centre line of the penstock in more than one plane.

8.7 Concrete Saddle Supports — Type of intermediate supports with concrete base shapped to suit the bottom of the pipe. A well lubricated steel plate, rolled to suit the shape of the pipe shell in contact, is provided in between the concrete surface and the pipe to facilitate smooth movement of the pipe over the saddles.

8.8 Economic Diameter — The optimum size of the penstock for which the total annual cost or the power loss due to friction and the fixed annual charges of the penstock is minimum.

8.9 Expansion Joint — Device provided for taking care of expansion or contraction of the penstocks due to variation in the temperature or unequal settlement of the foundation or both.

8.10 Ferrule — Single unit of pipe length.

8.11 Friction Loss — Loss of head of water due to friction during flow.

8.12 Horizontal Bend — Change in the direction of the penstock alignment in horizontal plane.

8.13 Hydrostatic Test — This is the test conducted on fabricated pipe shell at such a pressure so as to prove the adequacy of the strength of the material of the shell and the joints with required margin of safety.

8.14 Intermediate Support — Support provided for the pipe line in between two anchor blocks, over which the pipe can slide while expanding or contracting.

8.15 Joint Efficiency — Actual strength of the joint riveted or welded expressed as a percentage of the strength of the full pipe.

8.16 Longitudinal Joint — Joints provided longitudinally to fabricate circular sections or the ferrule from the plates. These may be welded or riveted.

8.17 Manhole — Opening for entry into the penstock provided for the purpose of inspection and repairs.

8.18 Manifold — The portion beyond the main penstock which feeds the branches for the individual units, when two or more units are fed from a penstock (*see* Fig. 5).

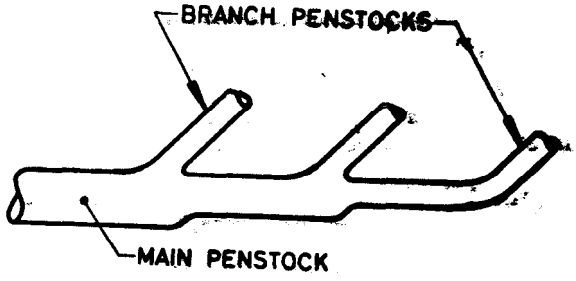

FIG. 5 MANIFOLD

8.19 Open Ground Pipe — Pipe laid over the surface of the ground with anchor blocks and intermediate supports with provision for the expansion or contraction due to temperature changes.

8.20 Penstock Piers, Penstock Supports or Support Piers — Intermediate supports for penstocks installed above the ground or in open tunnels between the anchorages.

8.21 Radiographic Test — A method of test using X-rays or gamma rays employed to detect any defect in the welded joints and castings of the shell.

8.22 Reducer Bend — A fitting or device provided in a pipeline for gradual reduction in the diameter as well as the change in direction of flow.

8.23 Rocker — A casting or fabricated construction used in supports which allows for expansion or contraction by a rocking motion.

8.24 Rocker Support — Rocker supported at the bottom on concrete piers and attached at the top to ring girders or stiffener rings around the pipe.

8.24.1 *Rigid Type Support* — When penstock pipe is rigidly connected to anchorage at the two ends and there is a flexible joint in the pipeline.

8.24.2 *Semi-Rigid Type* — When the penstock is divided in the long segments which are connected by any expansion joint or by flexible coupling.

8.25 Simple Bend — Change in the direction of the alignment of the penstock only in one plane.

8.26 Stress Relieving of the Joints — The process of heating to a specified temperature and controlled cooling by which the residual stresses in the joint welds are reduced to a minimum.

8.27 Terminal Anchors — Anchors built at the terminal ends of the penstocks.

8.28 Thrust Blocks — Supports build on either side of branch connections to resists unbalanced forces at the penstock connection and thus to maintain alignment of outlet headers.

8.29 Ultrasonic Test — A method of test employed to detect any defects in the welded joints of the shell, wherein principle of propagation of high frequency sound waves through homogeneous material is used.

8.30 Valve House — A structure housing the regulating valves, control mechanisms for operation of valves, equipment required to remove parts for repair, etc. Also called 'Valve Chamber'.

8.31 Vertical Bend — Change in the direction of the penstock alignment in vertical plane.

8.32 Yoke Girder — Structural member provided as a reinforcement around the contact of the two bifurcating pipes for strengthening.

9. TERMS RELATING TO TURBINE AND ITS RELATED COMPONENTS

9.1 Discharge Diameter — Parameter describing the size of the runner of a turbine.

9.2 Draft Tube — A passage of gradually expanding area which enables the utilization of the considerable velocity head, still remaining in the water after it has gone through a reaction turbine.

9.3 Design Head — The head at which the turbine is designed to give its maximum efficiency.

9.4 Generator — A machine that transforms mechanical energy into electrical energy.

9.5 Guide Vanes — Moveable gates controlling the discharge from the scroll case into the turbine runner. Also called 'Wicket Gates'.

9.5.1 *Gross Head* — Difference in elevation of the head water level and tail water level when no water is flowing.

9.5.2 *Net Head* — Effective head available for power generation which is gross head less all the losses in the water conductor system including penstocks.

9.5.3 *Rated Head* — The head at which the turbine produces the rated output at specified gate opening.

9.5.4 *Weighted Average Head* — It is the net head determined from reservoir operational calculation which will produce the same amount of energy in kilowatt hours between that head and maximum head as it developed between that same head and minimum head.

9.6 Horizontal Generator — A generator with its axis of rotation in the horizontal plane.

9.7 Horizontal Shaft Machine — Setting of a turbine in which the runner of the turbine is in a vertical plane so that the connecting shaft to the generator is horizontal.

9.8 Open Pit Setting — Setting in which the turbine is installed in an open pit, horizontally or vertically, and the turbine shaft passes from the pit into the machine room, if necessary, by means of a stuffing box (*see* Fig. 6).

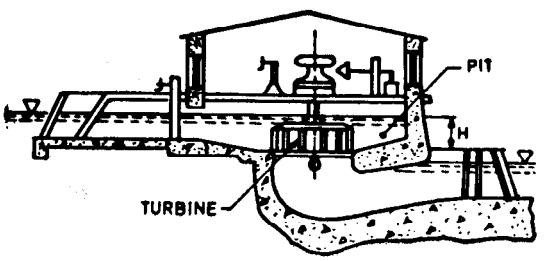

FIG. 6 OPEN PIT SETTING

9.9 Speed

9.9.1 *Runaway Speed* — Steady speed attained by the unit with wicket gates or nozzles fully open and with no external load.

9.9.2 *Specific Speed* — The speed of a homologous 1 hp turbine under 1 metre head and is given by:

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

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9.5 Guide Vanes — Moveable gates controlling the discharge from the scroll case into the turbine runner. Also called 'Wicket Gates'.

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9.6 Horizontal Generator — A generator with its axis of rotation in the horizontal plane.

9.7 Horizontal Shaft Machine — Setting of a turbine in which the runner of the turbine is in a vertical plane so that the connecting shaft to the generator is horizontal.

9.8 Open Pit Setting — Setting in which the turbine is installed in an open pit, horizontally or vertically, and the turbine shaft passes from the pit into the machine room, if necessary, by means of a stuffing box (*see* Fig. 6).

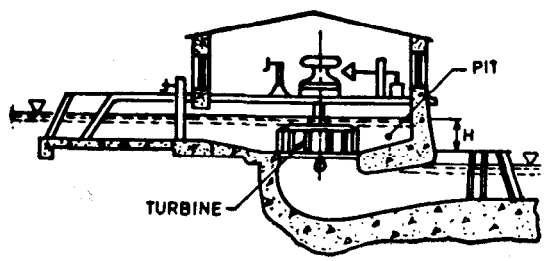

FIG. 6 OPEN PIT SETTING

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9.9.1 *Runaway Speed* — Steady speed attained by the unit with wicket gates or nozzles fully open and with no external load.

9.9.2 *Specific Speed* — The speed of a homologous 1 hp turbine under 1 metre head and is given by:

$$N_S = \frac{N\sqrt{P}}{H^{5/4}}$$

where

N = speed in rev/min,

H = design net head in metres, and

P = metric horse power at full gate opening.

9.9.3 *Unit Speed* — It is the speed under one metre head and with one metre diameter of runner.

9.9.4 *Synchronous* — The speed at which an alternating-current generator runs corresponding to a particular frequency.

9.10 Syphon Setting — A type of turbine setting where the water passes through the turbine under syphonic action (*see* Fig. 7).

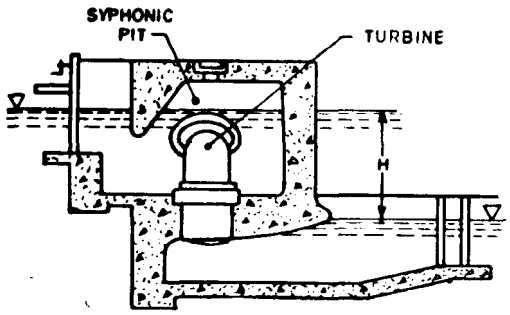

FIG. 7 SYPHON SETTING

9.11 Spiral Casing — The fixed c ircumferential casing of a reaction turbine of gradually contracting cross-section so designed as to impart to the incoming water an initial whirl component and to feed the water uniformly to the turbine runner.

9.12 Stay Ring/Speed Ring — Component of turbine consisting of fixed vanes fitted to the inner periphery of the scroll case. It transmits the load of turbine pit, the weight of the hydro-generator parts and the axial water load of the fundations. It is also called 'Speed Ring'.

9.13 Turbine — A rotary prime mover operated by the reaction or impulse, or both, of a current of flowing fluid acting on a series of vanes or buckets.

9.13.1 *Bulk Unit* — It is a horizontal or inclined shaft kaplan turbine with its directly coupled generator (placed inside a bulk shaped casing) located in a straight water passage.

9.13.2 *Cased* — A turbine in which the water is conducted to the runner through a casing.

9.13.3 *Deriaz* — A mixed flow reaction type turbine (akin to Francis turbine) with moveable (feathering) runner blades.

9.13.4 *Francis* — A radial axial flow reaction turbine having fixed runner blades.

9.13.5 *Impulse* — A turbine in which all the potential energy of water is converted to kinetic energy before it acts on the runner.

9.13.6 *Pelton/Pelton Wheel* — An impulse turbine comprising a set of double cup-shaped buckets fitted on to the rim of a disc attached to a shaft, and operated by impact of one or more jets of water on the buckets from water nozzle. The flow of jet or jets is tangential to the wheel.

9.13.7 *Propeller* — A propeller turbine is an axial flow reaction turbine and is of two types— fixed blade or adjustable blade (kaplan).

9.13.8 *Reaction* — A type of turbine in which only a part of the available energy is converted into kinetic energy at entry into the runner, a substantial part remaining as pressure energy which varies during the passage of the water through the runner.

9.14 Unit — Term describing the set of combination of turbine and generator.

9.15 Wicket Gates — *See* **9.5.**

10. SHAFTS

10.1 Drop Shaft — A shaft vertical or inclined through which the water from the source of supply is dropped into the head race tunnel.

10.2 Air-Entrainment — The air which enters into the head race tunnel along with the water while droping through the drop shaft.

10.3 Anti Air-Entrainment Chamber — A chamber made at downstream end of the drop shaft to release the air entrained in water during its fall in the drop shaft so that air free water goes into the head race tunnel.

10.4 Desilting Chamber — It is a chamber in which the sediment particles up to a specified grain size and above would settle (by slowing down their velocity) thereby allowing relatively silt-free water to flow into the head race tunnel.

10.5 Silt Ejector/Extractor — A structure provided in a canal/tunnel for setting and ejecting/flushing of finer sand particles (generally in the range of 0·1 to 1 mm).

10.6 Silt Excluder — A structure provided in the barrage at the mouth of offtake channel for intercepting coarser particles (generally above 4·75 mm).

10.7 Spiral Spillway — A spiral type of spillway through which the water enters into the drop shaft.

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