Industrial Type Turbine Flowmeter NT

Hygienic Type Turbine Flowmeter BNO

Low Flow Pelton Wheel Flowmeter NS

INSTALLATION AND OPERATION

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PRINCIPLE OF OPERATION

The Nixon turbine flowmeter consists of a helically cut turbine rotor supported in two plain bush bearings, the rotor being machined from solid ferritic stainless steel of a grade compatible with the metered fluid, all contained within a housing of non-magnetic stainless steel. A pick off coil having permanent magnet core is mounted in the housing adjacent to the rotor blade tips such that a magnetic circuit is set up via the rotor blades.

Rotation of the rotor varies the reluctance of this magnetic circuit, and the flux changes induce a small voltage in the coil, the frequency of which is directly proportional to the rotor speed and therefore proportional to the volumetric flowrate.

For very low flowrates the Nixon Pelton Wheel flowmeter whilst having the same signal generation principal relies upon a calibrated jet of fluid impinging upon a star shaped paddle rotor provided with bearing bush rotating around a fixed spindle.

2. PERFORMANCE

Referring to the typical performance curve it will be seen that pulses per unit volume are almost constant over a wide range of flowrates, and it is thus possible to establish a meter factor of pulses per unit of volume by which the output pulses must be divided in order to register real flow units on the associated electronic integrator.

As would be expected with any device possessing a fixed cross sectional area the pressure drop across the meter varies as the square of the flowrate, a typical design figure being 0.2 Bar for maximum flowrate.

The effects of increasing viscosity are clearly shown as reducing the linear flowrate at which the pulses per unit volume are constant, and if fluids of viscosity above approx. 7 cstks are to be handled it is advisable to request a calibration at a simulated viscosity from the manufacturers.

Linearity figures vary according to the size of meter and the operating fluid conditions but are generally within O.5% of average meter factor with point repeatability of 0.1% of reading.

3. INSTALLATION REOUIREMENTS

The flowmeter may be installed in any attitude in the pipeline, but in the case of vertical installations, it is preferable for fluid to flow in an upward direction. Unless otherwise requested, factory calibration takes place in a horizontal plane, and vertical operation may be expected to result in a slight calibration shift of less than 0.1%

Flowmeters should preferably be installed with ten diameters of straight pipe upstream and five diameters downstream, with a cruciform or alternative type of flow straightening vane section being fitted at the upstream end of the flow straightener. Reducers where necessary should be of the concentric type with included angle of 22-30 degrees.

Inlet pipe bore should be matched as closely as possible to that of the meter, but where it is impossible to select the exact diameter, a smaller inlet diameter should be used in order to avoid sharp step at the meter inlet which could cause swirl.

The straight pipe requirements do not however apply to the Pelton Wheel flowmeter, swirl and turbulence do not affect the overall performance.

Whilst most plants requiring the precision of turbine flow measurements will usually be protected by adequate filters or strainers, the recommended mesh sizes for protection of Nixon Turbine Meters are:

Up to 9mm bore size	0.1 mm
Between 9 and 50mm	0.3 mm
Above 50mm bore size	0.5 mm

Any turbine flowmeter will register the total amount of fluid passing whether this be all liquid or a mixture of liquid and gases, and it is therefore essential to ensure that the pipeline at the meter point is completely filled with liquid.

A good general rule is to ensure that the downstream static pressure is at least equal to twice the pressure drop across the meter plus the vapour pressure of the fluid in order to prevent cavitation at the rotor.

If the meter is to be used with open ended pipe then the metering installation should be located at the lowest possible level in the system with a good positive head on the meter outlet.

4. ELECTRICAL INSTALLATION

The generated voltage output from Nixon Turbine meters varies according to size, a minimum figure of approximately 10 millivolts at lowest flow on the smaller meter sizes up to approximately 1.5 volts for large meters at maximum flow.

A twin core screened signal cable should always be used for connection to the pick off coil recommended size being 14/.0076 inch the outer screen under PVC covering,

A solid steel earth connection should be made at the receiving instrument end and signal

cables where possible should be kept well away from heavy current devices or strong magnetic fields.

Signal transmission distance using the recommended cable is approximately 1000 feet without special amplification. This is a good general rule for all flowmeter sizes, but in the case of meters of 2" bore and upwards no difficulties have so far been experienced with cable runs of 1500 Metres.

5. INTRINSIC SAFETY

For hazardous locations, flowmeters may be provided with intrinsically safe pick off coils having a BASEEFA certification the signal cable in such cases maybe run through barrier devices to the control room instrumentation.

6. START UP PROCEDURE

a. Remove flowmeter from packing case, and examine for presence of packaging materials, or other foreign matter which may have been introduced during shipment. Carefully blow down meter bore to ensure freedom of rotation - there may be some amount of stiction present to flowmeters having been stored otherwise drying out during shipment. This need not cause any concern since complete freedom of rotation will be restored once the flowmeter is immersed in its metered fluid.

b. Ensure that flange gaskets or joints are clean edged, of the correct bore and located centrally. A little light adhesive used to locate the gasket on the meter flange should prevent any misalignment.

c. Ensure that the arrow stamped on the meter housing is in line with direction of flow. Whilst conventional turbine meters will operate satisfactorily in both directions accuracy may suffer if flow is inadvertently reversed. The Pelton Wheel flowmeters are however unidirectional.

d. Ensure that pick off coil is screwed down onto sleeve using finger pressure only. Flowmeters are provided with a collar fitting underneath the pick off coil to prevent over tightening.

e. Make signal cable connections to pins A and B only, and tighten down Amphenol connector ensuring that cable screen is separated from any earth point.

f. If any air is still present in the system valves should open slowly until flowmeter is completed filled with liquid in order to prevent overspeeding.

7. MAINTENANCE

Once installed, the Turbine Meters will require no regular running maintenance other than a periodic check on the pick off coil and connector, but it is recommended that each 5000 running hours the flowmeter should be removed from the line and inspected for signs of bearing wear or presence of dirt or foreign bodies in the internal parts.

Dismantling is carried out as follows, NT and BNO series meters utilise circlips to retain the internal parts. BNO 500, 1000, 1500, 2000 and 36 meters have complete internal assemblies which can be withdrawn from one end of the meter body. All other variants have two circlips and the hangers must be withdrawing from each end. In the case of NS series meters the metering plug is held in place by a single retaining screw.

Upon dismantling it is advisable to mark internal parts with arrows indicating direction of flow to ensure correct reassembly.

Bearing wear may be detected by mounting the meter horizontally and using a soft implement under the rotor to check for vertical movement which should be not greater than 0.25 mm on meters of 30mm bore and above, 0.130mm on meters down to l2mm bore and 0.075 mm on smaller units.

In the event of bearing wear having taken place, re-bushing of the bearing hangers is a comparatively simple process and maybe undertaken by a skilled machinist. Details of bearing replacement procedures will be provided on request.

8. CALIBRATION

Calibration details for your turbine flowmeter are enclosed and the setting up of the associated electronic flow integrator or indicator are dealt with in the appropriate instruction manuals for electronic equipment.

Works calibrations are made over ten points throughout the working flow range unless otherwise specified. The average meter factor is given on the assumption that flowrate will vary over the operating range. Closer accuracy can be obtained by checking from the calibration chart the flowrate closest to your plant figure and using the pulse per unit volume calibration figure appropriate to that of flowrate.

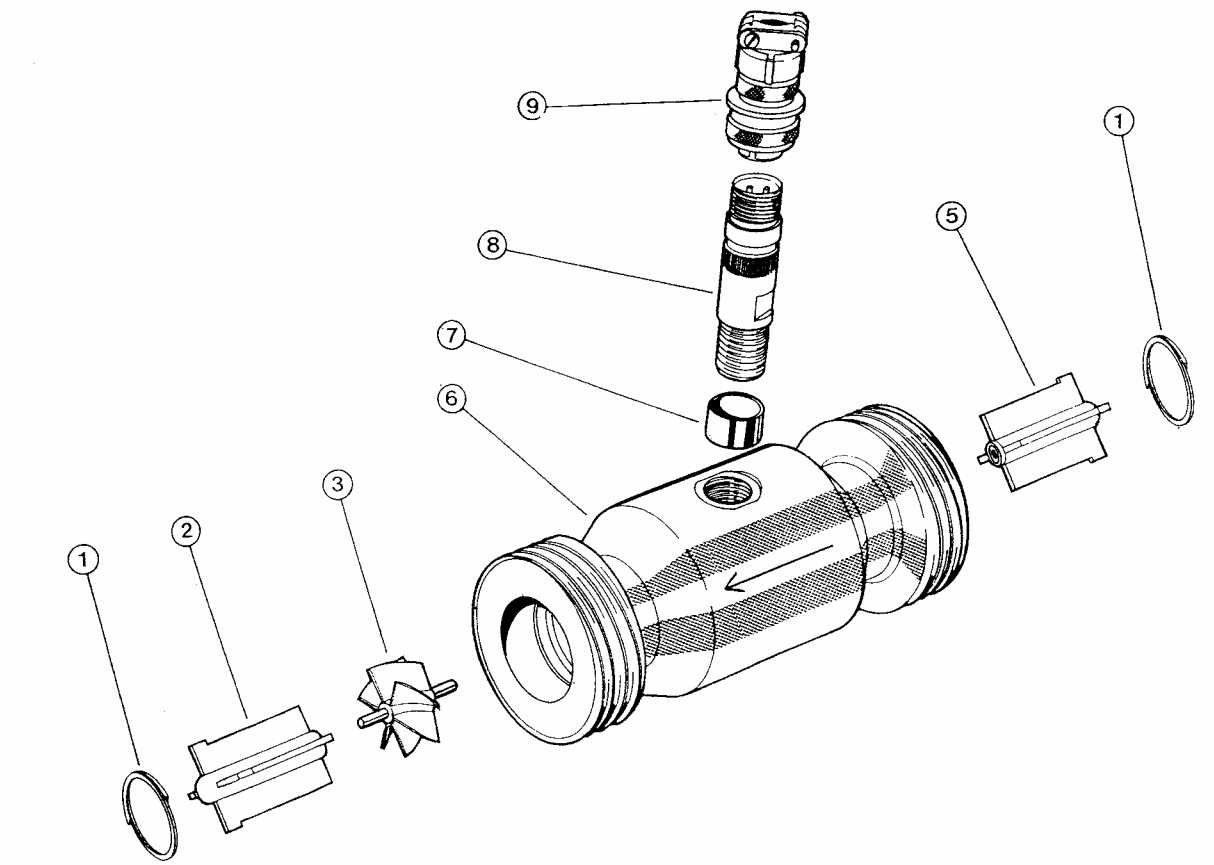
After long periods of use any turbine meter will slightly change its calibration factor, and a re-calibration is recommended at least each 20,000 running hours. Nixon Flowmeters provide a calibration service for most retail sizes.

9 SPARES

Spare parts for most standard sizes of flowmeter are normally held short delivery ex Cheltenham but major overhauls and repairs can be carried out at our factory.

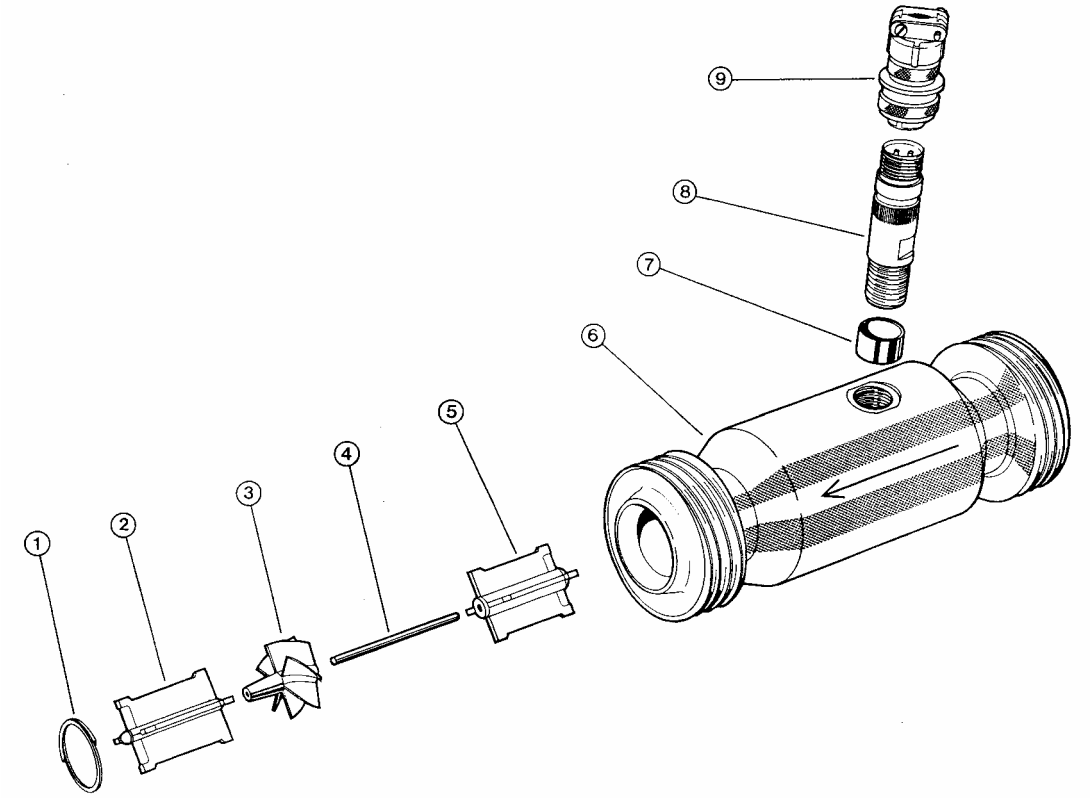
When requesting spares or service it is important that the full meter serial number is given. This is normally a seven digit serial number, the first five referring to the sales order, the last two digits indicating the number of flowmeters manufactured on that specific order.

Internal Parts list All NT Series Flowmeters



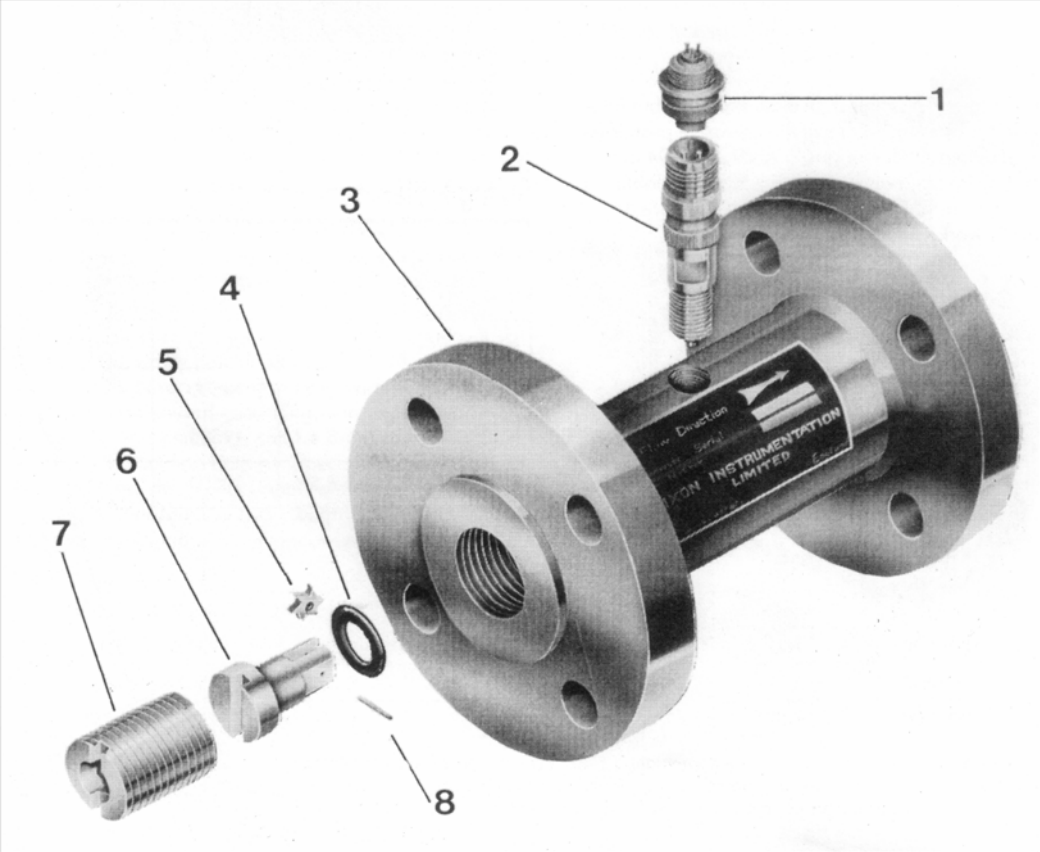
1	Circlip	316 St/stl
2	Bearing Hanger	316 St/stl
3	Rotor	431 St/stl
4	Circlip	316 St/stl
5	Bearing Hanger	316 St/stl
6	Housing	316 St/stl
7	Collar	316 St/stl
8	Pick Off Coil	316 St/stl
9	Connector	Aluminium

Internal Parts List All BNO Series Flowmeters



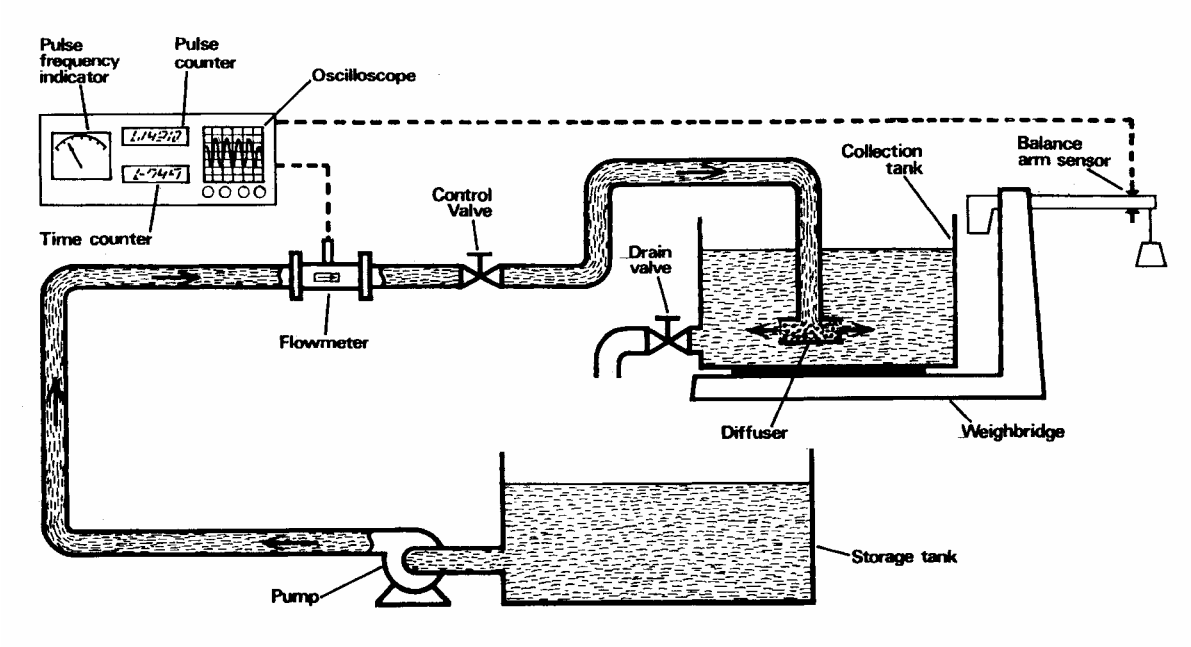
1	Circlip	316 St/stl
2	Downstream Hanger	316 St/stl
3	Rotor	431 St/stl
4	Spindle	316 St/stl
5	Upstream Hanger	316 St/stl
6	Housing	316St/Stl
7	Collar	316 St/stl
8	Pick off Coil	316 St/stl
9	Connector	Aluminium

Internal Parts List NS 500 Pelton Wheel Flowmeter



1	Connector	Aluminium
2	Pick off Coil	Stainless Steel
3	Housing	316 St/stl
4	Seal	Butyl Rubber
5	Rotor	431 St/stl
6	Metering Plug	316 St/Stl
7	Retaining Screw	316 St/stl
8	Spindle	Tungsten Carbide

Calibration Method



Water is pumped from storage through the test meter, through a manual control valve into a collecting tank mounted upon a standard weighbridge, the vessel having a drain valve for return to storage.At the commencement of a calibration, water iscirculated through the system and allowed to drain whilst the operator regulates the control valve to set up the approximate desired flowrate.

Next, a small weight, equal to about 10% of tank capacity is attached to the weighbridge arm, which when the arm is displaced is arranged by means of microswitches or an optical system, to switch on a high resolution pulse counter and a microsecond timer. The drain valve is closed, and when the level reaches the preset value, the balance arm starts the counting procedure. The operator now re-sets the balance arm, and attaches weights equal to the desired calibration volume whilst the collecting tank is filling. When the second level is reached, the balance arm again deflects and closes the gating circuit of the counters.

thus for one given flowrate, we can calculate pulses per unit of volume, and also the exact flowrate at which the calibration took place. This procedure is then repeated at ten points over the operating range of the meter. Readings of pressure loss and output voltage are taken and the a.c. waveform is examined on an oscilloscope to detect any abnormalities in the rotor blades etc.